

EXAMINING THE CURRENT & POTENTIAL IMPACTS OF THE PAMPLIN COLLEGE OF BUSINESS

Expanding Pamplin's impact through the
development of a four-building Global Business and
Analytics Complex



Pamplin College
of Business

EXECUTIVE SUMMARY

Since 1961, Virginia Tech's Pamplin College of Business has provided education in finance, accounting, business administration, hospitality and tourism, management, marketing, and business information technology. Annual enrollment averages 4,500 undergraduates and 900 graduates. *U.S. News and World Report* ranks the Pamplin College of Business #45 among business schools, #7 among evening MBA programs, #16 among part-time MBA programs, and #2 among online degree programs.

A 2014 strategic plan outlined Pamplin's focus on building excellence in business analytics, innovation through entrepreneurship, and global sustainable prosperity. While Pamplin currently encourages student learning, faculty research, and interdisciplinary collaboration in these core areas, opportunities exist for greater growth through a new **Global Business and Analytics Complex**. This Complex will allow for the co-location of existing VT programs including those from the colleges of Business, Science, and Engineering, and Virginia Tech's Division of Outreach and International Affairs. With two academic buildings and two residence halls, the Complex will create a synergistic space that supports the development and expansion of partnerships, business innovations, and a highly formidable workforce.

This report reviews the existing economic contributions of Pamplin and its potential for expansion due to the Complex. The Virginia Tech Office of Economic Development conducted a seven-month study comprising interviews with Pamplin faculty, surveys of Pamplin industry partners, examinations of over 140 schools websites to understand how they measure their economic outcomes and perceive the impact of their new or renovated buildings, and interviews with eight peer schools. We found that the Global Business and Analytics Complex would likely impact Virginia in three different ways:

- 1. More and better-prepared Pamplin alumni.** Thanks to Pamplin's programming, alumni represent the most significant impact on Virginia's industries. Not only do companies benefit through skilled labor, but Pamplin hires contribute to the overall productivity and efficiency of these businesses. With the new Complex, Pamplin will experience a 20% increase in new graduates, offering a greater value-added contribution to Virginia industries, at least \$12 million annually, compared to contributions brought by typical Virginia business school graduates. More alumni with data analytics skill sets will also increase industry revenue by as much as 12% or \$8 million annually. Enhanced entrepreneurial programming with the new living learning center will also ensure more startups in Virginia, and a greater global perspective will prepare students to assist in connecting Commonwealth companies to international markets.
- 2. Increased Pamplin operational and out-of-state student spending in Virginia.** In FY2017, Pamplin spent almost \$13 million originating from outside the state, primarily on faculty and staff salaries. With the indirect and induced effects of that money circulated through the Commonwealth's economy, total economic output due to Pamplin spending was \$23.1 million. Out-of-state and international students also serve as conduits for new money flow into the state. Their spending can result in \$5.18 million for the state annually. With the new Complex, these impacts would increase to \$31.4 million and \$6.75 million respectfully.
- 3. Greater student and faculty engagement with industry.** Students and faculty engage with industry in many ways. Faculty and student research, for instance, is growing in the college and

shows promise for greater industry outcomes. The Center for Business Information and Analytics has a particularly effective framework for industry collaboration through its industrial affiliates program. Without additional data, it is difficult to quantify this impact. However, half of industry survey respondents stated their engagement resulted in new products and marketing; increased productivity and efficiencies; and more opportunities to recruit top students.

Not including the significant work done by students and faculty in collaboration with industry and the potential for even greater work and impacts not quantified in this report, Pamplin’s economic impact on the Commonwealth is estimated to be more than \$35.5 million annually. With the \$250 million Global Business and Analytics Complex, that annual impact would increase by more than \$17.5 million. Separately, the construction of the new Complex would offer an estimated, one-time \$201 million impact on the Roanoke-Blacksburg region.

The annual economic impact of the Pamplin College of Business on Virginia		
	Current Impacts (millions)	Future Impacts with Complex (millions)
Value-Added to Industry by Pamplin Alumni	\$7.35	\$12.32
Industry Revenue Increases due to Alumni with Data Analytics	\$5.08	\$7.97
Pamplin Operational Spending	\$23.1	\$31.4
Out-of-State Student Spending	\$5.18	\$6.75
Total Annual Impact	\$35.52	\$53.06
One-time Construction of New Complex (in Roanoke-Blacksburg)	--	\$201

The economic impact number reported also does not include certain impacts, which OED could not quantify at this time. These include dollar impacts from data analytics training of non-Pamplin students, the innovation and entrepreneurship skills and new startups developed through the entrepreneurial living-learning center, and the international relationships and knowledge generated with greater global business programming.

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INTRODUCTION

Virginia Tech's Pamplin College of Business educates over 4,500 undergraduates and 900 graduates annually in the academic fields of finance, accounting, business administration, hospitality and tourism, management, marketing, and business information technology. Its 2014 strategic plan outlined Pamplin's focus on excellence in business analytics, innovation through entrepreneurship, and global sustainable prosperity. In these areas, Pamplin encourages student learning, faculty research, and collaboration across the university.

Through this work, the college positively affects Virginia's economy. Traditional economic impact is produced through Pamplin's direct purchasing and student tuition, while broader effects include the value brought to the economy from Pamplin's graduates and research. Meanwhile, Pamplin foresees its work expanding and evolving with the new space, technology and partnerships offered with the development of the **Global Business and Analytics Complex (the Complex)**. This initiative will bring together students and faculty from across Virginia Tech with research interests in the Data Analytics and Decision Sciences Destination Area by creating two new academic buildings and two residential living-learning communities. With this new venture, Pamplin will be able to train more students, engage more businesses, and collaborate more closely with other colleges. As a result, Pamplin's current economic contribution to the local economy and to Virginia will increase. For instance, Pamplin will: have more graduates supporting existing industry, encourage greater entrepreneurship (startups and spinouts), and facilitate industry growth through more data analytics research and more alumni with that expertise.

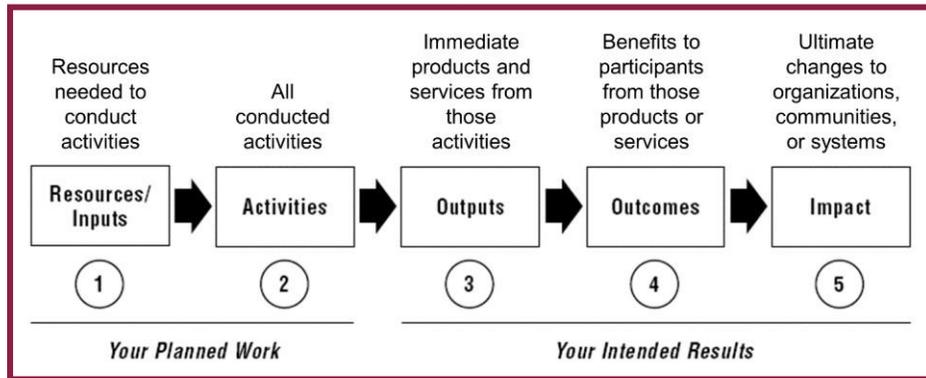
The Virginia Tech Office of Economic Development (OED) completed a seven-month study to estimate the current economic impact of Pamplin College of Business on the Commonwealth of Virginia and to illustrate how the Complex may increase Pamplin's impact in the future. Most of this analysis focuses on effects on industry: Pamplin's dollar expenditures, assessing the effects of Pamplin alumni on industry, and capturing student, faculty and programmatic engagement with industry.

This report begins with a brief analysis of economic impact studies performed for other universities and business schools. We then discuss our own approach to this research and examine the current impacts of Pamplin through its various forms of engagement with industry and through its in-state spending. Finally, we assess how the new Global and Business Analytics Complex will affect the programming in Pamplin and indirectly influence Pamplin's spending and engagement with industry.

MEASURING UNIVERSITY ECONOMIC IMPACT

When reviewing the economic impact of higher education institutions, studies tend to use very narrow definitions. Traditional economic impact analyses measure operational and visitor spending effects on a region. Many organizations and higher education institutions advocating for stronger evaluation have begun to turn to logic models to visualize the broader relationship between organizational activity and ultimate social and economic outcomes.

Figure 1: Sample Logic Model Framework¹



Historically and today, most higher education institutions use impact metrics stemming from policies of the 1980s and 90s that emphasized technology transfer, patents, start-ups, capital inputs and revenues generated from research. These metrics tend to be first and second generation approaches, which focus on resource inputs and outputs.² Very few (e.g. employment and salary outcomes) fit into the outcomes category, and none really connected to the broader effects on communities, industries and economies. They also reflect the industrial era more so than the current knowledge economy, which can be difficult to measure using a single or handful of random metrics.³ Hence, emphasizing a logic model approach as well as both quantitative and qualitative analyses can provide a more holistic picture of impact.

Table 1: Timeline of Different Approaches to Measuring Higher Education Impact

1 st Generation Input Indicators (1950s-60s)	2 nd Generation Output Indicators (1970s-80s)	3 rd Generation Innovation Indicators (1990s)	4 th Generation Process Indicators (2000s)
R&D expenditures S&T personnel Capital Tech intensity	Patents Publications Products Quality Change	Innovation surveys Indexes Benchmarking Innovation and capacity	Intangibles (Knowledge) Networks Demand Clusters Management techniques Risk/Return Systems Dynamics

The following summarizes prevalent metrics used by business schools and, in parentheses, number of schools out of 31 using each metric:

- **Current Student Metrics:** Number of students in program (15), graduation rates or degrees conferred (7), increase in students enrolled (2), number of student internships/coops (2), number of students studying abroad (2)

¹ The Pell Institute for the Study of Opportunity in Higher Education (2017). Evaluation Toolkit. Retrieved from: <http://toolkit.pellinstitute.org/evaluation-guide/plan-budget/using-a-logic-model/>.

² Milbergs, E. & Vonortas, N. (n.d.). "Innovation metrics: Measurement to insight". White Paper prepared for the National Innovation Initiative 21st Century Innovation Working Group. Retrieved from: <http://innovationmanagement.se/wp-content/uploads/pdf/Innovation-Metrics-NII.pdf>

³ Ibid.

- [Business School Rankings](#): US News (15), Business Week (11), Financial Times (7), Forbes (5), The Economist (5)
- [Research and Donations](#): Number of corporate partners (6), donations by corporations, student and alumni donations including capital and IT investment (4), dollars in research awards (2)
- [Business School Programming](#): Number of faculty (11), number and type of programs offered (10), number of researchers/centers (4), affiliated programs (3), number of companies represented at events, trade floors and extracurricular programming (3), number of people attending conferences (2)
- [Outcomes/Student Profiles](#): Number of alumni (18), employment outcomes/job offers upon graduation or within 3 months (13), number of foreign or minority students (12), salaries (4)
- [Stanford Innovation and Entrepreneurship Study](#): Number of companies with Stanford roots (+employment and revenue), number of firms created by students/alumni/research, number and type of entrepreneurial resources (e.g. incubators, angel and VC investments), industries of companies, program participation by Stanford students and alumni.

The broadest study reviewed was the Stanford Innovation and Entrepreneurship Study, which analyzed the impacts of a university or business school in terms of the industries affected by alumni, or student and faculty engagement. The majority of schools limit their analysis to university spending. With its even broader analytic parameters, the Pamplin study is a unique, more comprehensive approach to understanding the larger impacts of a business school.

METHODOLOGY

OED divided this research into three phases. Phase One defined current Pamplin activities and, with college faculty and staff, explored possible new or expanded activities that would occur with the development of the Global Business and Analytics Complex. This phase identified what metrics to examine using quantitative and qualitative data. OED interviewed leaders of eleven Pamplin departments or centers and reviewed approaches to measuring economic impact (see above).

Phase Two assessed the current economic impacts of Pamplin on Virginia. OED faculty gathered available secondary data about alumni and industries affiliated with the business college. Pamplin leadership and faculty sent industry surveys to over 276 companies, non-profits and government entities, which engage with Pamplin faculty and students in one or more ways. OED received 74 responses to the industry survey. Finally, OED worked with Pamplin faculty to estimate the dollar effects of Pamplin operational and out-of-state student spending.

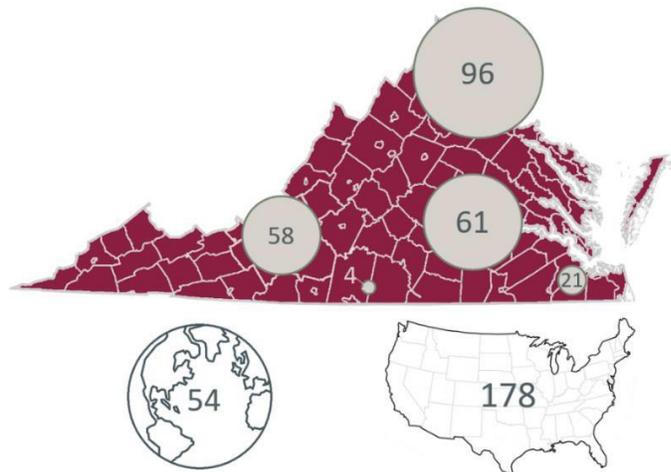
In Phase Three, OED and Pamplin leadership determined how the Complex would enhance Pamplin's programming and spending. OED estimated economic outcomes of Complex construction on the Roanoke-Blacksburg region as well as the ensuing increased Pamplin spending that would occur. Furthermore, OED reviewed websites of 131 business schools with facilities built or renovated after 2014 to see what architectural features they highlight and how those features affected the schools' economic contribution. Finally, faculty interviewed eight business schools to hear their perspectives on how their buildings affected their programming and overall impact on industry and their regions.

CURRENT IMPACTS OF PAMPLIN COLLEGE OF BUSINESS

Pamplin offers a variety of majors and graduate degree programs that attract students, donations, and research dollars. In FY2017, the college received over \$3.9 million in donations through the Virginia Tech Foundation and \$2.5 million in research dollars through Virginia Tech’s Office of Sponsored Research.⁴ This funding includes work done by the Center for Business Intelligence and Analytics (CBIA), which contracts with businesses. CBIA’s Quality Analytics Consortium is an industrial affiliates program in which companies benefit from informal and formal research by CBIA faculty and students. The departments of Hospitality and Tourism, and Business Information Technology also play significant roles in acquiring research funding through government and private entities.

Although Pamplin ranks among the top 100 business schools, opportunities exist to increase its ranking. *U.S. News and World Report* ranks the Pamplin College of Business #45 among business schools, #7 among evening MBA programs, #16 among part-time MBA programs, and #2 among online degree programs (Master of Information Technology program). In 2014, Pamplin’s undergraduate program

Figure 2. As many as 240 Virginia companies benefit from their relationship with Pamplin



ranked #23 among public undergraduate programs.⁵ The college also has one of the best placement rates at Virginia Tech.⁶

Pamplin-affiliated businesses or organizations are those that hire Pamplin alumni, work with Pamplin students and/or faculty, or visit/host Pamplin students. Pamplin works regularly with as many as 276 affiliates, 240 of which have offices in Virginia (87%). About 24% of these companies are in the consulting services, or companies that contract for marketing, management, accounting, and/or IT services. Approximately 20% of Pamplin-

affiliated companies are in the finance and insurance industry. The hospitality-related sector and the wholesale and retail trade sector each comprise 10% of companies engaging with Pamplin. Other prominent industries include manufacturing (5%); mining, utilities, and construction (5%); government (5%); and real estate (4%).

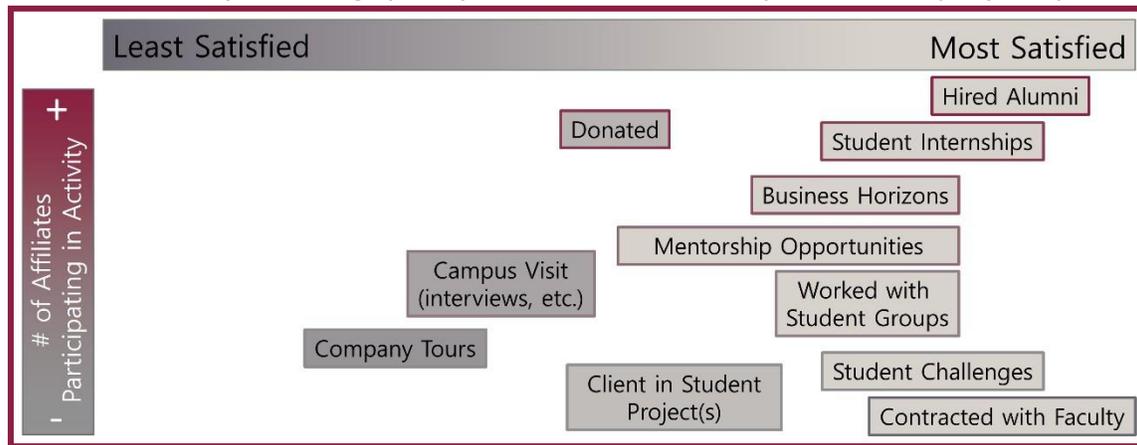
⁴ Virginia Tech Office of Sponsored Programs (2017). “Awards.” Retrieved from: <https://www.research.vt.edu/era/awards/home>.

⁵ Virginia Tech (2017). “Rankings.” Retrieved from: <https://vt.edu/about/rankings.html>.

⁶ Virginia Tech Pamplin College of Business (2017). “Just the Facts.” Retrieved from: <http://www.pamplin.vt.edu/just-the-facts-info-sheet/>.

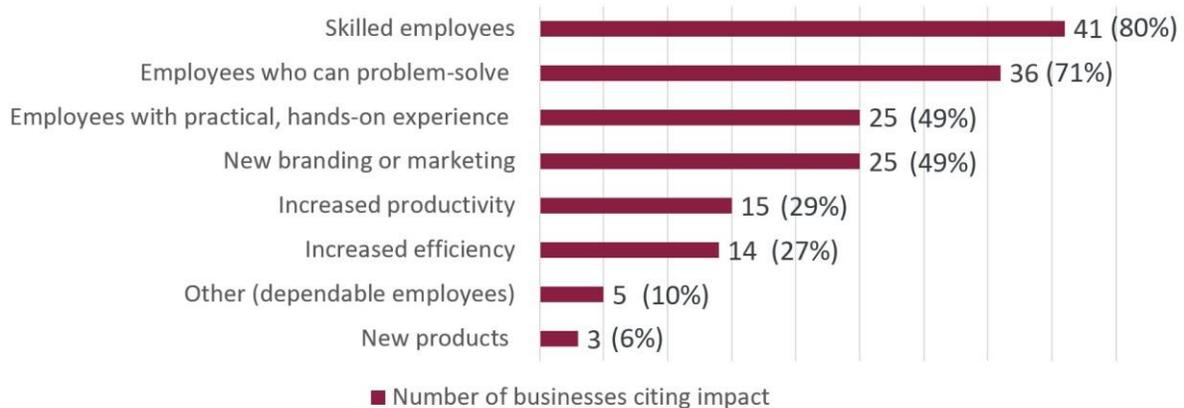
Through OED’s industry survey, 74 organizations reported engaging with Pamplin in three or more ways, and the respondents were overall satisfied with Pamplin’s services. Figure 3 shows activities in which Pamplin-affiliated organizations engaged and their satisfaction with the outcomes of these activities.

Figure 3: The majority of survey respondents were most satisfied with hired alumni and student interns. A small handful were highly satisfied with the research they did with Pamplin faculty.



Finally, survey responses highlighted the areas where Pamplin has the most impact on businesses. Respondents agreed that they benefited most from Pamplin alumni—the employees coming out of Pamplin excel at problem-solving and demonstrate their practical, hands-on experience. Almost half of respondents cited new branding or marketing. Many of these were local companies, which illustrates the benefits of Pamplin’s work to the surrounding Roanoke-Blacksburg region. Other organizations saw increased productivity and efficiency, and new products thanks to their partnership with the college.

Figure 4: Top cited industry impacts from Pamplin-industry engagement were skilled Pamplin alumni.

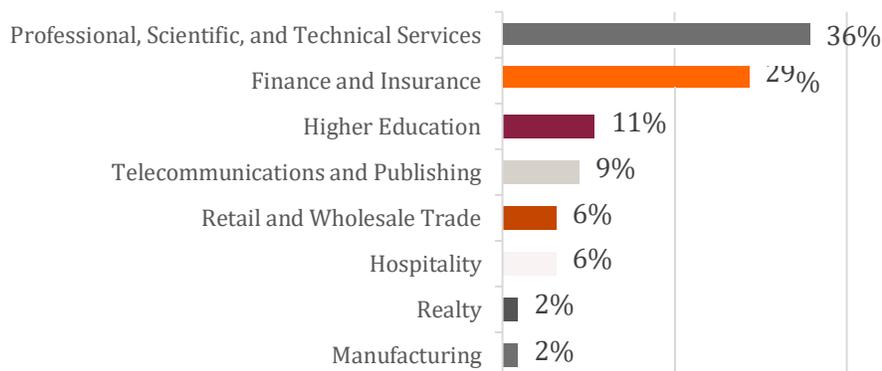


Through Phase One, OED identified three activity areas in which Pamplin’s College of Business could affect industries, communities, and economies. These impacts were: 1) Pamplin alum working in industry, 2) Pamplin student and faculty engagement with industry, and 3) Pamplin spending.

1. Pamplin Alumni

Alumni contribute to several industries in Virginia and worldwide. Industries benefiting most from Pamplin alumni reflect somewhat the list of 276 Pamplin-affiliated businesses: contracting services, finance and insurance, telecommunications (marketing), retail and wholesale trade, and hospitality industries. From this data, OED estimates that about 42.5% of Pamplin alumni reside in Virginia.⁷

Figure 5. Pamplin alumni tend to gravitate towards the consulting and finance industries.⁹



The 44 survey respondents who hired Pamplin alumni came from different industries such as Finance (18), IT (4), Construction (4), Transportation (3), Hotels and Marketing (2 each), Manufacturing, Government and Non-profit (1 each). Of these, 98% were satisfied with these employees: 79.5% were highly satisfied and 18% were somewhat satisfied. Only 2% were extremely dissatisfied.

Pamplin hires contribute to the overall productivity and efficiency of these businesses. Pamplin alumni can optimize business processes, design new branding or products that increase sales and contribute to the overall growth of companies. Among survey respondents who extolled the benefits these alumni bring to their business, one said Pamplin alumni are "some of the best and brightest professionals that we have hired. [They have] affected our organization very positively."

As a possible representative estimate of this contribution, the median starting salary of a Pamplin undergraduate alumnus is over \$17,000 higher than that of a typical business graduate in Virginia. Including benefits, a cohort of Pamplin graduates that remain in Virginia and take full-time positions may contribute as much as \$7.35 million annually.⁸

⁷ This data is from Economic Modeling Specialists Inc (EMSI), an economic and workforce tool. Its Insight tool scrapes data from over 30 online databases including CareerBuilder and Linked-In to identify alumni, sometimes from specific programs. It gives individual and company data, but also aggregates data such as top alumni locations, occupations, companies and industries. However, EMSI has a poor sample size (293) for Pamplin. EMSI can match universities' alumni data to online profiles to increase its sample size and provide the most up-to-date information on where alumni are working, their jobs titles, an analysis of their career progression, etc. EMSI's current match rate is 30-50% and guarantees 98% accuracy.

⁸ In this calculation, we take the 2016 graduate count (1109), account for 42.5% who stay in VA (471), and reduce by a 70% placement rate within the first year. This also accounts for 30% benefits, or \$22,276. Source of original data: Virginia Tech

2. Pamplin Spending

Pamplin brings new money into Virginia through tuition dollars, donations, and other program activities. To estimate the economic impact of Pamplin’s operational spending, we account for “new money” that would not be in the state without Pamplin, and we assess how that money is spent in the state by reviewing Pamplin’s FY2017 budget. These estimates are considered the direct effect of Pamplin, or all spending within the designated study area due to the study subject (i.e. Pamplin). OED used IMPLAN input-output software, used widely in academic and professional research, to provide estimates of the indirect and induced impacts of Pamplin spending.

- Indirect effects: when direct suppliers purchase inputs from other firms who themselves purchase further inputs and so on
- Induced effects: arise when the beneficiaries (households) of the direct and indirect expenditures spend their increased incomes on consumer goods and services.⁹

The largest amount of spending was on households (i.e. faculty and staff). As Pamplin pays faculty and staff, they then spend a portion of that money in state on household needs. This spending results in indirect and induced effects. The table below shows Pamplin’s FY2017 budget and estimates how much “new money” enters Virginia because of the college.¹⁰

BUDGET ITEM (IMPLAN Industry)	TOTAL EXPENDITURES	NEW DOLLARS SPENT IN VIRGINIA
Personnel (households)	\$30,455,741	\$6,380,891
Operating (retail/wholesale)	\$2,315,240	\$31,511
Student Support (univ tuition)	\$1,665,841	-
Programs (85% to households)	\$7,083,953	\$4,821,118
Research (households)	\$601,700	\$1,701,571
TOTAL	\$42,122,475	\$12,935,090

In FY2017, Pamplin spent almost \$13 million originating from outside the state. With the indirect and induced effects of that money circulated through the regional economy, total economic output due to Pamplin was \$23.1 million, which also includes as many as 970 full-time equivalent jobs in the region.¹¹

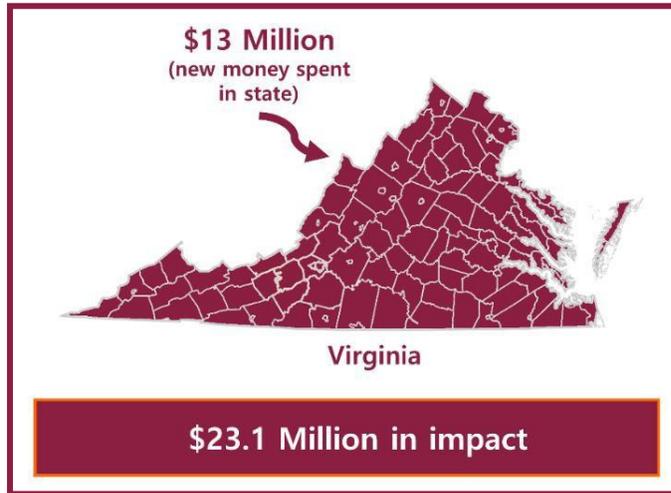
Career and Professional Development. This is a very rough calculation that could be significantly more refined and accurate with EMSI data (see above).

⁹ Lee, M. (2006) “Analytical Reflections on the Economic Impact Assessment of Conventions and Special Events.” *Journal of Convention & Event Tourism* 8(3): 71-85.

¹⁰ Note that OED did account for origins of Pamplin’s revenue. The money spent in Roanoke-Blacksburg and Virginia fall within the limits of what Pamplin can consider to be “new money” or money from outside the two regions.

¹¹ We label this number as “full-time equivalent” jobs because the Implan input-output model only accounts for full-time (2080 hours/year) jobs and not part-time jobs. In many instances, particularly when dealing with tourism or the service sector, one job counted in Implan may actually equate to two or three part-time jobs in reality.

Figure 6. Economic Impact of Pamplin Spending in Virginia



In addition to this spending, Pamplin successfully retains, if not attracts, 24% of its students from out-of-state.¹² A portion of these students derived all of their spending money from outside the state. They essentially serve as a conduit attracting new money to the Virginia economy. On average, approximately 520 Pamplin students come from outside of Virginia annually. Accounting for those receiving possible revenue via scholarships or work-study and some money spent outside the state, these students could spend as much as \$3.87 million annually. As that money circulates through the state, economic output due to Pamplin students is \$5.18 million annually.

3. Student and Faculty Engagement with Industry

Phase One interviews revealed that Pamplin students and faculty engage with companies in many different ways throughout the year, including “challenge” events, class projects/capstone projects, student clubs and groups, student internships, company visits to campus, student trips to companies, and faculty research. Each activity is described with corresponding examples in the Appendix. Through these interactions, companies identify possible recruits post-graduation; receive technical and research

“Our experience in working with CBIA has allowed my defense, health, and international healthcare businesses at Leidos to address highly complex problems with very big data sets.”
– Leidos Senior Vice President

assistance from students and faculty at below-average private consulting costs; and interact with relatively nascent knowledge, technology and research that could significantly affect the industry in the future. These interactions result in several benefits to industry including: new marketing, branding, and products; new knowledge and research that results in better decision-making for companies; and increased productivity and overall revenue to companies over the long-term.

While it is difficult to quantify these engagement impacts on Virginia, we can calculate the impacts of visitor spending to the Roanoke-Blacksburg region due to Pamplin programming and engagement activities. Impacts on the Roanoke-Blacksburg region can be seen on page 18 of this report.¹³

¹² Virginia Tech Institutional Research and Evaluation. Retrieved from: <https://www.ir.vt.edu/data/cds.html>

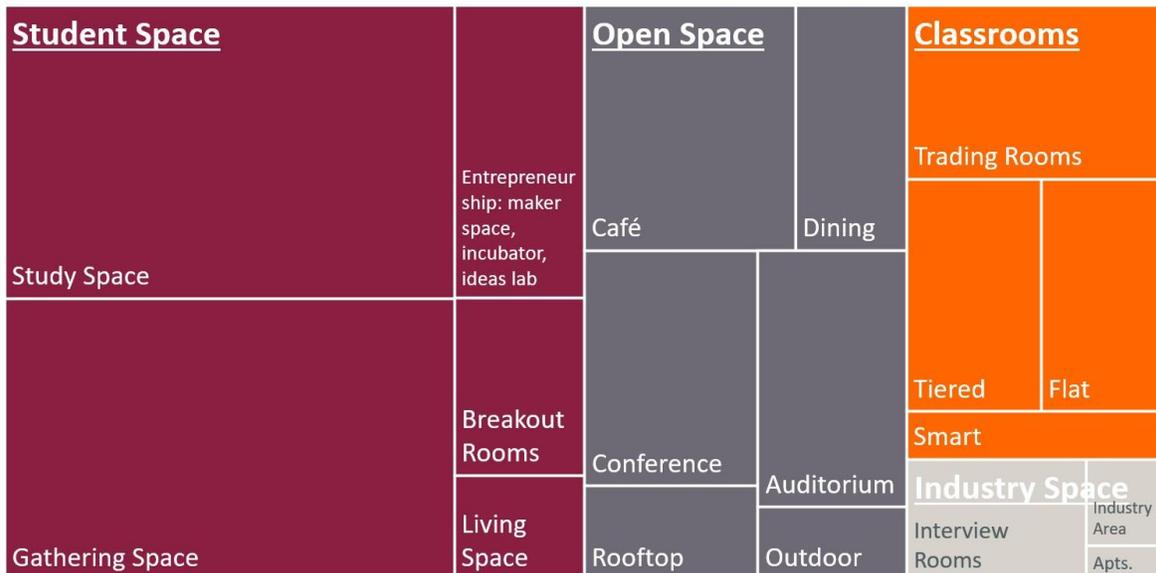
¹³ To estimate this impact, OED used Virginia Tourism Corporation (VTC) tourist surveys estimate how much tourists spend in a particularly region of Virginia or by their purpose for travel (e.g. leisure or business). OED used two VTC spending estimates to develop a reasonable range for business spending in the Roanoke-Blacksburg region: tourist spending for Southwest Virginia and business traveler spending in Virginia. Retrieved from: <https://www.vatc.org/research/travel-data-and-profiles/>.

EXPERIENCES OF OTHER BUSINESS SCHOOLS

The 131 business school websites reviewed by OED highlight student space, open space, classroom types and amenities, and industry space as key assets that enhanced their programming and may influence their economic impact. About 108 or 82% have designated space where students can work in groups or study. Another popular space mentioned by 17 schools were breakout rooms for students during class time. Only about 8% of business schools have space designated for living within their new buildings. About 21% of schools have designated space for student entrepreneurship.

Open space was another key architectural component mentioned. About 44% of the schools reviewed have space for food and dining, 66% of these were cafés; 22% of schools have conference space, the majority of which are large lecture halls; and 9% specified that they have outdoor space such as rooftop gardens or terraces. Figure 10 shows a breakdown of key architectural features from other schools.

Figure 7. Among the top amenities for business school facilities are flexible and diverse student spaces.



Note: The size of each box corresponds with the frequency of citations by schools

Interviews with eight other business schools¹⁴ also emphasized these kinds of spaces and their relationship to program quality. Several schools touted their large open spaces for student and faculty meetings outside the classroom. University of Michigan explained how its Winter Garden has become the heart of the business school: “During the academic year, it is always full, and there is a buzz in the building that originates from that space.” Pennsylvania State University lauds its atrium as a key feature of its building, where students build a sense of community in the college and hold events.

¹⁴ OED interviewed Arizona State (McCord Hall), Cornell Tech (NYC Campus), Eastern Carolina University (Business Living-Learning Center), MIT (Building E62, E52, and Martin Trust Center for MIT Entrepreneurship), Penn State (Main Campus Business Building), Radford University (Business Building), University of Michigan (Ross Hall, Blow Hall, Kresge Library Building, Executive Residence, and Wiley Hall), and University of Utah (Lassonde Studios).

Stressing the importance of study and breakout rooms, Arizona State and MIT said their schools could not have enough of these spaces. Arizona State has breakout rooms just outside of classrooms for students to go to during class time. When asked what they would do differently, several schools called for more study and breakout space, even “nooks” for students and faculty to work. These rooms should have whiteboards or write-on walls, projector capabilities, and other tools for group work.

While new buildings can significantly support growth and change, OED’s eight business school interviewees agreed that business school **programming** is the catalyst of overall community and economic impact. In designing a new building, they emphasized the need to align the building’s features with the desired programmatic goals.

Finally, interviewees emphasized the need for flexible space: acoustic quality large classrooms that could be broken into smaller classrooms; tiered classrooms that could transition into flat-classrooms as the teaching trends change; portable white boards and tables in flat-classrooms; write-on walls for action-based learning activities; and state of the art technology or “smart classrooms”.

In sum, new or renovated buildings can facilitate the following outcomes:

1. **Growth of the student body:** Schools with a goal of increasing student enrollment state that this growth would not have occurred without the new building. The added space allows for student population growth and attracts existing students to the business program. Lassonde Studios at University of Utah, for example, tripled their student engagement on campus.
2. **Collisions and a sense of community among students and faculty:** New buildings with features that encourage students and faculty to stay and interact tend to become community hubs. Collisions, or chance encounters among faculty and students, increase. Arizona State explained, “We see our students and faculty take a sense of pride in our buildings. You really know you’re on the business school campus.” Interviewees emphasized the need for a large open space for collisions, other smaller spaces for group work, and possible entrepreneurial-style spaces with flexible hours for students to experiment. For buildings that house different disciplines, open spaces can serve as a catalyst for faculty collaboration and research. For MIT, “The rehabbed buildings have helped to generate greater collaboration among faculty, leading to improved interdisciplinary research, and resulting in more corporate engagement.”
3. **Action-based learning in and outside the classroom:** A growing trend among business colleges is experiential or action-based learning, in which students work in groups to solve real world problems. Flexible classrooms with space for team activities, breakout or study rooms, and other spaces with tools for group work encourage action-based learning. This learning prepares students for work within industry by helping them think more critically, collaborate with team members from different backgrounds, and effectively communicate to solve problems.
4. **Visitations by industry:** A beautiful new building and new spaces for industry/faculty/student engagement tend to increase industry visitations to campus and subsequent collaborations. For example, Cornell Tech in New York City stated, “connectivity with business is happening even more with co-locations and the high-profile nature of our campus.” Lassonde said with the new

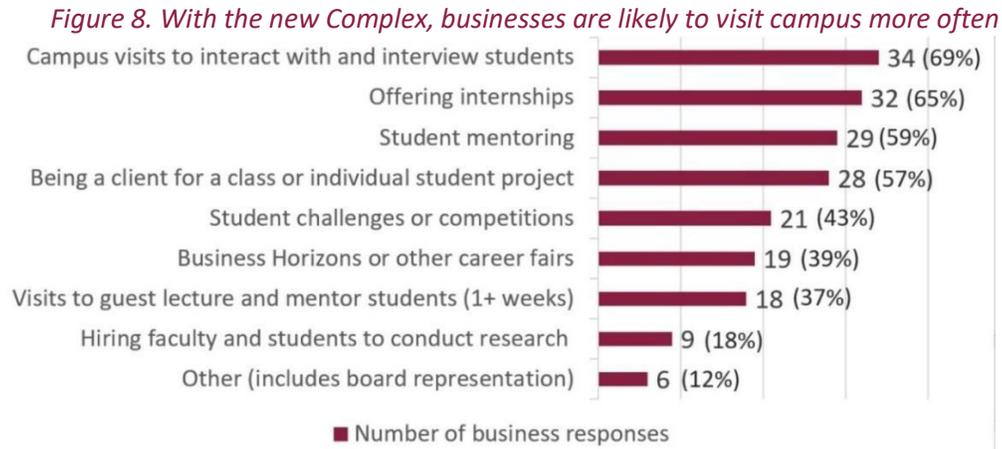
building, “we have more companies getting involved in programming (workshops)... Close to 400 people coming to mentor, judge in competitions, and more.” With its beautiful large atrium, Penn State indicated that recruiters loved coming to the building. With more visitations, companies will be able to expand their recruitment of Pamplin students for internships and hiring upon graduation, work more collaboratively with students and faculty, and increase the benefits received through these relationships.

THE GLOBAL & BUSINESS ANALYTICS COMPLEX

The Global Business and Analytics Complex will comprise two new academic buildings and two residential halls for living-learning communities, bringing together entities from across Virginia Tech that have research interests in the Data Analytics and Decision Sciences Destination Area. There will be space for the colleges of Business, Science, and Engineering, and for Outreach and International Affairs (OIA). For Pamplin, the Complex means growth of the college’s business analytics and entrepreneurial programming, more interdisciplinary collaboration, and a greater emphasis on international business in partnership with OIA. New or enhanced activities that could result from the new Complex, the direct outputs of these activities, and the ultimate increased impacts of Pamplin are represented in Table 3.

Table 3: Global Business And Analytics Complex Impact Model			
Inputs →	Expected Activities →	Direct Outputs →	Impacts
New Global Business And Analytics Complex building offers more space for programmatic growth and new activities	Growth in number of Pamplin students, particularly those: <ul style="list-style-type: none"> • Focusing on business analytics and global business • Already in workforce (part-time students) 	Increased number of Pamplin alum per year Increased number of companies affiliated with Pamplin through alum	<ul style="list-style-type: none"> • Increased Pamplin spending and dollar impact due to research, international student and business revenue • Increased estimated percent of workforce contributing to particular industries • Increased number and types of industries benefiting from Pamplin engagement in 2 or more ways • More companies citing beneficial effects due to work with Pamplin <ul style="list-style-type: none"> - new products - new branding - increased efficiency - increased productivity - skilled workforce - other • Improved business school rankings
	More opportunity for student engagement with industry: <ul style="list-style-type: none"> • Sandbox • Individual and small group discussions • Larger space for events and recruitment • Apartments for visiting professionals and faculty 	Increased number of companies Pamplin has engaged through students and faculty (annually and by type) Students feel more prepared for workforce due to experiential learning	
	Increased collisions among Colleges of Science and Engineering, Outreach and International Affairs, and others in the building	Increased interdisciplinary research (number and dollars)	
	Greater focus on global business engagement through research, consulting, student study abroad, and international student recruitment	Increased revenue from abroad – FDI, international business engagement and international student recruitment	

With the construction of the new Complex, industry engagement will increase, leading to enhanced economic benefits for Virginia companies. In OED’s industry survey, respondents explained how their engagement with Pamplin might change with the new Complex. Thirteen respondents also noted that the Complex would have to be accompanied by programmatic changes such as expanded approaches to industry engagement, updated curriculum that matches the needs of industry, and broader skill sets of student (e.g. business presentation skills, marketing and sales, technical writing, business etiquette, and interdisciplinary communication skills). Figure 12 shows the top activities that Pamplin-affiliated companies and organizations may increase with the construction of the new Complex.



Specifically, the Global Business and Analytics Complex will expand upon the three key areas of impact highlighted in Pamplin’s current economic impact section: 1) Pamplin alumni, 2) student and faculty engagement, 3) Pamplin spending. The enhanced impact of these three areas will be particularly apparent in Pamplin’s three strategic foci: data analytics, entrepreneurship, and global business.

1. Growth of Pamplin Alumni

Pamplin expects to grow its student body by 20% with the new Complex. If enrollment were to increase equally across programs that would mean greater workforce contributions to contractor services, finance and insurance, hospitality, wholesale and retail trade, and manufacturing industries to name a few. If the current industry contribution by alumni is represented by the value-added brought by a Pamplin degree—currently \$7.35 million annually—then the contribution brought by additional Pamplin graduates with bachelor’s degrees would be \$1.47 million more annually.

With a greater emphasis on global business, entrepreneurship, and data analytics, most of the workforce impacts may be in related occupations. Already, Virginia stakeholders (e.g. Virginia Economic Development Partnership) have highlighted three workforce areas where the state could improve drastically: greater connections to international trade, strategic industry growth using tools like data analytics, and start-up growth. A stronger workforce with more skills in these areas would optimize Virginia’s success.

Data Analytics Contributes to Greater State GDP and Industry Revenue.

Growing Pamplin’s data analytics programming through the new Complex could impact industry in two ways. First, Pamplin alumni could increase their overall contribution to industry as illustrated by the overall increase in the median salary of Pamplin graduates. Those implementing business analytics systems may have higher competitive advantage and may generate more positive stock market reactions from shareholders.¹⁵ Early adopters of data analytics are twice as likely to have top-quartile financial performance, five times more likely to make decisions faster than competition, and three times more likely to execute decisions as intended.¹⁶ In May 2017, IBM predicted that data jobs would increase by 364,000 openings or 28% by 2020.¹⁷ Table 5 shows top occupations held by recent alumni with data analytics skill sets. Note the average annual openings indicate high demand.¹⁸

Description	2016 Jobs (VA)	Median Annual Salary (VA)	Work Experience Required	VA Annual Openings (2016-2021)
General and Operations Managers	53,802	\$119,725	5+ years	4,905
Marketing Managers	4,366	\$153,338	5+ years	457
Sales Managers	5,959	\$155,792	< 5 years	620
Financial Managers	14,370	\$136,427	5+ years	1,257
Management Analysts	52,996	\$95,326	< 5 years	5,168
Market Research Analysts and Marketing Specialists	19,422	\$66,893	None	2,338
Business Operations Specialists	31,669	\$79,726	None	3,009
Accountants and Auditors	44,558	\$74,610	None	4,735
Financial Analysts	8,820	\$86,923	None	830
Computer Systems Analysts	27,283	\$94,515	None	2,307

The current median starting salary for Pamplin alumni (\$58 thousand¹⁹) could increase as much as \$20 thousand²⁰ with as many as 175 additional alumni seeking Virginia jobs reliant on data analytics skill sets. Considering the increased demand and higher overall salaries, the value brought by these graduates could be an additional \$3.5 million annually.

¹⁵ Teo et al (2016). “Do shareholders favor business analytics announcements?” *Journal of Strategic Information Systems* 25: 259-276. Retrieved from: <http://www.sciencedirect.com/science/article/pii/S096386871630083X>.

¹⁶ Bain & Company (2013). “The who, why and how of big data”. Insights Infographic. Retrieved from: <http://www.bain.com/infographics/big-data/>

¹⁷ Columbus, L. (May 2017). “IBM predicts demand for data scientists will soar 28% by 2020.” *Forbes*. Retrieved from: <https://www.forbes.com/sites/louiscolombus/2017/05/13/ibm-predicts-demand-for-data-scientists-will-soar-28-by-2020/#1844f3c07e3b>.

¹⁸ Top Occupations were determined using EMSI Insight’s alumni tool, which scrapes data from over 30 online sources to develop a list of Pamplin Alumni, their occupations, industries, and locations. Table data was then pulled from EMSI’s Developer tool (2017.3 Dataset), which provides industry and occupations data. Note that the weighted average of these median salaries aligns with the average salary for a business analyst in Virginia.

¹⁹ Virginia Tech Career and Professional Development. Retrieved from: <https://career.vt.edu/about/postgrad-survey/single-year-reports.html>.

²⁰ With the new Complex, enhanced data analytics programming, and more students pursuing data analytics position, many (not all) Pamplin alumni would increase their salaries to approximately \$95K, the average salary for a business analyst in Virginia. Thus, we assume median starting salary for all Pamplin graduates combined could reasonably increase by \$20,000.

Second, the greater data analytics expertise brought to companies could actually help them to increase their overall revenues, inevitably increasing overall GDP of the larger industries. Groups such as IBM and Experian Data Quality have examined the costs of bad data for companies, estimating that poor data quality leads to time lost for workers and overall bad decision-making. With better data analytics, the average U.S. business could experience a 12% gain in annual revenue.²¹ Workers with data analytics skills are more capable of gathering good quality data, easily detecting poor quality data, and offering business recommendations based on good data. Therefore, they can increase productivity and revenue.

Pamplin alumni can contribute to these gains. Pamplin awarded an average of 1,100 undergraduate degrees annually between 2011 and 2016, and about 314 have some level of data analytics skill sets and work in Virginia.²² With the new Complex, annual graduations will increase by more than 200 graduates annually, contributing more than 60 new Pamplin graduates annually with data analytics skill sets to the state's economy. In addition, the new Analytics living-learning center will house 250 students, only half of which will be Pamplin students. If just half of those non-Pamplin students gain data analytics skills because of their residency in the new living-learning center (in other words, they would not have gained those business analytics related skills without the presence of the residency dorm), then an additional

With the Global Business and Analytics Center, Pamplin will contribute over 400 new data-analytics informed alumni to the Virginia economy every year. These graduates may contribute as much as \$8.0 million annually in additional revenue to Virginia businesses, or 6-12% more in industry GDP.

27 graduates will have data analytics skills to contribute to Virginia's industries annually. With the new Complex, Pamplin will contribute at least 97 more Pamplin graduates with data analytics skill sets annually to Virginia businesses, or more than 400 graduates in all total.

The average Pamplin alumnus with data analytics skill sets may contribute as much as \$32,343 to industry GDP growth (assuming 12% revenue increases).²³ Even if Pamplin alumni increase industry revenues by just 6%, current contribution would be more than \$5.1 million annually. With the new complex, alumni's contribution could grow by \$1.4-\$2.9 million.²⁴ This impact does not include the 500 or more students that may take data analytics classes through Pamplin but are not affiliated with the college or its Analytics living-learning center.

Much of this estimate depends on the rate of adoption of data analytics and hiring by companies. Moreover, as the majority of businesses begin to rely on these skill sets and improve their data quality and analysis for decision-making, the impact of data analytics efficiencies on industry revenue and GDP

²¹ Singh, A. (2017). "The hidden costs of bad data." *InsideBIGDATA: your source for machine learning*. Retrieved from: <https://insidebigdata.com/2017/05/05/hidden-costs-bad-data/>

²² Office of Institutional Research & Effectiveness (2016). "Degrees". Virginia Tech. Retrieved from: <https://www.ir.vt.edu/data/student/degrees.html>.

²³ Basing calculations on contribution of median salaries to industry across all occupations, OED calculated the weighted average of a Pamplin alumni's contribution to industry GDP using the occupations listed in Table 5.

²⁴ OED assumes that the capacity of Pamplin alumni will be greater, improving revenues more than 6%. This analysis is based on a narrowed set of industries that are affiliated with Pamplin and are more likely to utilize data analytics skillsets.

will experience diminishing returns. For instance, adding one more data analyst to a team of twenty (assuming they all have the same skill sets and shrewdness) will not equate to the same increased productivity or revenue growth.

More entrepreneurial activity will foster Virginia start-ups and an entrepreneurial workforce.

The Complex will house a second living learning center (LLC) for entrepreneurship on campus. This LLC will expand the current work of the Apex Center for Innovation and Entrepreneurship (CIE) and its Innovate LLC to encourage more entrepreneurial activity among students at Virginia Tech. The need for more entrepreneurship and startups in the state and region has continued to grow. While Virginia excels in many industries, it lags behind the national average for the growth of new startups. Nationally, there exists 5.21 startup firms for every 1,000 people, compared to Virginia's 4.97 firms per 1,000 people. The Roanoke-Blacksburg region only has 3.38 startup firms for every 1,000 people.²⁵

Of the 131 business schools reviewed, 21% had entrepreneurial space (e.g. innovation lab, maker space, incubator, or ideas lab). One model on which Pamplin could base its LLC is University of Utah's Lassonde Studio. The Lassonde Entrepreneur Institute began in 2001, with programming that encouraged interdisciplinary collaboration, particularly amongst business, engineering and science students. Similar to CIE, this program is student-focused and grounded in the real world to develop scalable companies.

Figure 9. Lassonde Studio Living-Learning Center



With the success of the initial program, the university built a 160,000 sq. ft. building, which opened in Fall 2016. It offers dorm space for 400 students, welcoming both undergraduates and graduate students to enhance collaboration. The main floor is open 24/7 and serves as a space for 30 student companies, a prototyping space open to any student, a working space with open desks for students, and a restaurant and café area.

Within the first year of the new facility, student participation in entrepreneurial programming increased 135%. The number of startup teams formed more than doubled (97 to 290 teams). The Studio's director equated these outcomes to students and faculty now knowing where to go to tinker, collaborate, and commercialize their business ideas. He also explained, "The building increased the speed at which students are getting things done. It has facilitated their connections with resources. Students are helping each other more. Bad ideas are stopping sooner, and good ideas are getting accelerated."

While the building was not the sole cause of the Lassonde Entrepreneur Institute's ultimate impacts, it contributed to University of Utah's increased standing among ranking groups, increased interdisciplinary

²⁵ Census Business Dynamics Statistics (2014). Longitudinal Business Database 1977-2014. Retrieved from: <https://www.census.gov/ces/dataproducts/datasets/lbd.html>; we define start-up as a firm that is 5yrs old or less.

work, enhanced action-based learning, and increased business relationships. The Engineering and Medical colleges as well as Football use this space as a recruitment tool. Moreover, this growing entrepreneurial mindset on-campus has contributed to an increase in faculty commercialization. With similar programming and space, Pamplin may have similar benefits with its entrepreneurial LLC. While the *Innovate LLC* focuses on Virginia Tech freshmen, this new living learning community will focus on nascent entrepreneurs, no matter what their year in school. As such, the center will have a strengthened ability to move the needle on commercialization and start-ups in Virginia.

A greater global perspective will better prepare future Virginia workers to engage international markets.

With a new Complex that also houses Virginia Tech’s Outreach and International Affairs (OIA), Pamplin may grow its international activities exponentially. The potential partnerships with OIA will lead to new opportunities. Faculty foresee growth in possible international business research and study abroad programs to increase students’ exposure to different cultures and business climates. NAFSA, the world’s largest international education nonprofit, explains that skills gained while studying abroad are often the same skills valued by employers.²⁶ As business becomes more globalized, cross-cultural experiences become ever more pertinent to business students’ learning. To that effect, Pamplin will also reach out to and include a greater proportion of international students. With a new building and more opportunities to engage with industry and improve national rankings, the recruitment of international students to Pamplin may be easier. The Institute of International Education maintains that this presence of international students in American schools “provides U.S. students with exposure to different cultures and ideas, enlivening classroom discussions with their perspectives and experiences. This exposure also has practical value, especially when only a fraction of American college students study abroad. [It may be] the only opportunity to develop skills critical to a globalized workforce.”²⁷

In the past, Pamplin did not strategically engage international students; only 2-2.5% of Pamplin students are international. The new Complex will expand programming and convene numerous international experts and resources to offer an attractive opportunity for foreign students and experiential learning abroad. Students working in Virginia companies may be more adept at helping those companies reach and interact with global markets. Moreover, strong connections with international graduates and businesses can strengthen Virginia’s connection to multinational corporations, resulting in greater opportunities for trade amongst Virginia industries.

²⁶ NAFSA: Association of International Educators (2017). Independent Research Measuring the Impact of Study Abroad. Retrieved from:

http://www.nafsa.org/Policy_and_Advocacy/Policy_Resources/Policy_Trends_and_Data/Independent_Research_Measuring_the_Impact_of_Study_Abroad/.

²⁷ McKenna, L (Nov 2015). “The Globalization of America’s Colleges”. *The Atlantic*. Retrieved from:

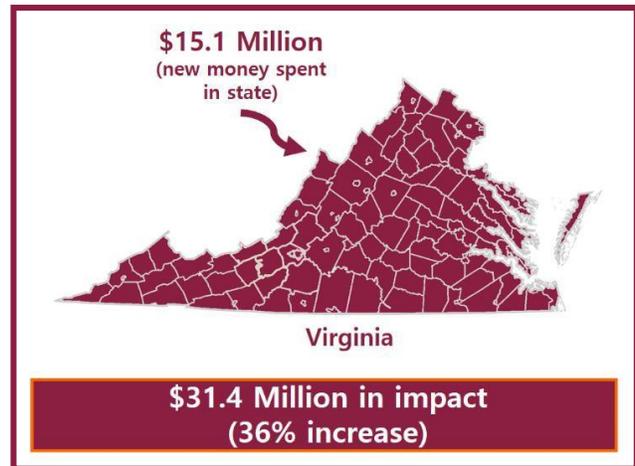
<https://www.theatlantic.com/education/archive/2015/11/globalization-american-higher-ed/416502/>.

2. Enhanced Pamplin Spending Impacts

With the 20% increase in students, Pamplin spending in Virginia will also increase. Annual Pamplin spending could increase as much as \$2.1 million, which increases the total economic impact on Virginia by \$8.3 million and 350 full-time equivalent jobs.

The expanded global business focus will also extend the possibilities for Pamplin’s direct and indirect economic impact. With more Pamplin international students, the state will receive an in-flow of new money. Pamplin estimates out-of-state students will increase to at least 30%, compared to 24% currently. Not all will be international students. As a result, almost \$1 million of additional spending will flow into the Virginia economy due to the new Complex. Total economic output could increase by \$1.3 million or be as much as \$6.75 million annually.

Figure 10. 2024 Spending Impacts, Post-Global Business and Analytics Complex (in 2017 dollars)



3. Increased Student and Faculty Engagement

As the examples from peer universities illustrate, the design of new buildings can result in increased collisions and interdisciplinary collaboration among students and faculty. Fellow business schools and almost 70% of industry survey respondents also agreed that businesses visit campus more with the development of a new building with added space for engagement with students and faculty. Considering these points and the opportunities for more action-based learning through expanded data analytics, entrepreneurial, and global business programming, overall industry engagement with students and faculty will likely increase.

As a result, participating companies may experience increased productivity and efficiency. CBIA is a good model for industry partnerships and talent preparation that encourage this sort of industry impact. With the Complex, CBIA and related data analytics work is expected to increase, providing more talent and research useful for sustainably growing businesses in Virginia. Other business schools have also noted that increased interdisciplinary research, more entrepreneurial activity, and expanded collaborations with industry can result in new products for existing companies, new patents coming out of the university, and new student or faculty spinouts. Increased visitor spending to the Roanoke-Blacksburg region will also be evident with the new Complex, as illustrate on page 18 of this report.

Construction and Visitor Impacts on the Roanoke-Blacksburg Region

While it is difficult to make an argument for significant impact on the state due to construction and visitor spending—neither would necessarily be new money in the state directly resulting from Pamplin—these two areas of impact will greatly affect the Roanoke-Blacksburg region, home of Virginia Tech.

The current construction cost estimate for the Global Business and Analytics Complex is \$250 million. It is unlikely that the entire \$250 million will be spent in the Roanoke-Blacksburg region. A portion will go to the architectural firm and contractors outside the region. Some of the in-region spending on construction workers will also experience leakage: due to the rural nature of this region, large-scale construction jobs often overtax existing labor markets, and more laborers are hired from outside of the region. While they live in the region temporarily and spend money, some of their income will likely go to family elsewhere. Finally, not all construction materials will come from the region, resulting in additional external spending. Without a more itemized budget, it is difficult to estimate accurately what the impact of the Complex's construction might be. With these assumptions, a conservative estimate is \$201 million and as many as 1,600 jobs for the duration of the construction.

Pamplin student and faculty engagement activities attract industry representatives to the Roanoke-Blacksburg region, thereby attracting new money to the region that would not be there otherwise. Pamplin estimates over 1,300 people visit Roanoke-Blacksburg to participate in one or more Pamplin activities including the Business Horizons career fair, individual recruitment visits, classroom and capstone activities, and Pamplin board meetings. Using Virginia Tourism Corporation spending estimates, these visitors spend about \$563,000-\$784,000 annually. That money circulates within the Roanoke-Blacksburg economy and generates induced and indirect effect, i.e. additional money in the region. Total economic impact due to the Pamplin visitors is between \$793,000 and \$1.1 million. With the new Complex, visitation may increase as much as 20%, or an additional \$262,300 spent in the region annually. Total economic impact due visitation would then be \$1-\$1.4 million.

Note that these two significant economic impacts on the region run parallel with those of Virginia; however, they are separate from the total economic impact on Virginia.

CONCLUSION

The Virginia Tech Pamplin College of Business already significantly influences Virginia's economy. With over 5,000 students, about \$3.9 million in donations, and approximately \$2.5 million in research dollars annually, the college is among the top one hundred business schools in the nation and is among the top ten among evening MBA programs and online degree programs. Pamplin oversees an assortment of activities that translate into benefits for the Commonwealth of Virginia, particularly through engagement with different industries. Activities that translate into improved economic impacts for these industries and Virginia include preparing Pamplin students for the workforce, student and faculty engagement with industry, and Pamplin operational spending.

Pamplin has the opportunity to expand its impact in Virginia by pursuing the development of a four-building Global Business and Analytics Complex. With this Complex, Pamplin expects to increase its student body by 20%; expand its entrepreneurial, data analytics, and international programming; and increase interdisciplinary and industry collaboration. Similar business schools have seen many benefits from new or renovated buildings, including more students, more engagement with industry, and improved programming. While industry partners emphasized the importance of focusing on improving Pamplin's programming regardless of the new Complex, many said they would increase their engagement with Pamplin with the development of the new Complex. This report captures several of the possible changes in impact due to the Global Business and Analytics Complex:

- 1. Pamplin alumni.** Thanks to Pamplin's programming, alumni represent the most significant impact on Virginia's industries. Not only do companies benefit through skilled labor, but Pamplin hires contribute to the overall productivity and efficiency of these businesses. Through an expanded focus on problem-solving, Pamplin alumni may help to find more optimal ways of doing business, designing new branding or developing new products that will increase sales and contribute to the overall growth of companies. Enhanced entrepreneurial programming with the new living learning center will ensure more startups in Virginia and a workforce with a greater entrepreneurial mindset. A greater global perspective will prepare students to assist in connecting Commonwealth companies to international markets.

Already one cohort of recent Pamplin graduates contributes \$7.35 million in value-added in their first year compared to the average Virginia business graduate. With 20% more students due to the new Complex, that contribution will increase by \$1.47 million. In addition, expanding data analytics programming will provide an additional \$3.5 million annually, not including the \$8.0 million in company revenue growth that Pamplin graduates with data analytics skillsets could help foster. Total economic impact from these recent alumni activities could be as much as \$20.3 million annually, with the new Complex contributing \$7.86 million or 39% of that total.

- 2. Pamplin operational spending and out-of-state student spending in Virginia.** In FY2017, Pamplin spent almost \$13 million originating from outside the state, primarily on faculty and staff salaries. With the indirect and induced effects of that money circulated through the Commonwealth's economy, total economic output due to Pamplin spending was \$23.1 million. Out-of-state and international students also serve as conduits for new money flow into the state. Their spending can result in \$5.18 million for the state annually. With the new Complex, these impacts would increase to \$31.4 million and \$6.75 million respectfully, a difference of \$9.87 million.
- 3. Student and faculty engagement with industry.** Students and faculty engage with industry in many ways. Faculty and student research, for instance, is growing in the college and shows promise for more industry outcomes in the future. The Center for Business Information and Analytics has a particularly effective framework for industry collaboration through its industrial affiliates program. Without additional data, it is difficult to quantify this impact. However, half of industry survey respondents stated they benefited through new products and marketing; increased productivity and efficiencies; and more opportunities to recruit top students.

Not including the significant work done by students and faculty in collaboration with industry and the potential for even greater work and impacts, Pamplin’s economic impact of Virginia is estimated to be more than \$35.5 million annually. With the Global Business and Analytics Complex, that annual impact would increase by more than \$17.5 million. Separately, the construction of the new Complex would offer a one-time \$201 million impact on the Roanoke-Blacksburg region.

Table 5: The annual economic impact of the Pamplin College of Business on Virginia

	Current Impacts (millions)	Future Impacts with Complex (millions)
Value-Added to Industry by Pamplin Alumni	\$7.35	\$12.32
Industry Revenue Increases due to Alumni with Data Analytics	\$5.08	\$7.97
Pamplin Operational Spending	\$23.1	\$31.4
Out-of-State Student Spending	\$5.18	\$6.75
Total Annual Impact	\$35.52	\$53.06
One-time Construction of New Complex (in Roanoke-Blacksburg)	--	\$201

The economic impact number reported also does not include certain impacts, which OED could not quantify at this time. These include impacts from data analytics training of non-Pamplin students, the innovation and entrepreneurship skills and new startups developed through the entrepreneurial living-learning center, and the international relationships and knowledge generated with greater global business programming

APPENDIX: EXAMPLES OF STUDENT AND FACULTY ENGAGEMENT WITH INDUSTRY

Industry engages with Pamplin students and faculty in many different ways and to different extents. Below are examples of industry-Pamplin engagement.

Challenges

Challenges are events in which students individually or as a group work to solve a business problem, developing marketing, product or operational solutions. Challenges offer students quality experience with companies and individual awards, often \$10K-\$25K in scholarship funding. Pamplin hosts multiple challenges throughout the year in partnership with different companies. Pamplin's entrepreneurial center, Apex CIE, oversaw six different challenges this past year, but the center's director, Derick Maggard, estimates they could host up to 18 challenges annually with more resources. One of their most recent challenges with Electromechanical Corporation helped the company to expand its product line to Calloway golf clubs, which require the same manufacturing equipment and processes as the company's current products, power boxes and motors.

In partnership with Coca Cola, Pamplin also hosts the Barracuda Bowl. Coca Cola gives Virginia Tech students a theme around which they can create a Coca Cola marketing campaign. Virginia Tech students pitch their campaigns to an on-campus panel. Finalists then pitch to Coca Cola, who chooses one campaign to promote on campuses. This challenge helps Coca Cola develop marketing tailored to the specific youth market and identifies future employees.

Class Projects/ Capstone Projects

Companies or organizations give students an organizational problem to solve, and students have a semester to a year to assess the situation and devise possible solutions. This role allows companies to assess students' capabilities as future employees, receive affordable technical assistance, and build the skills of their industry's future workforce. The Management Consulting course is one opportunity for companies and students to play this client-consultant role. Eighty to 160 undergraduate students annually consult with businesses, mostly in the Roanoke-Blacksburg area, providing them research-based strategy recommendations about new markets/products, marketing, and other opportunities for growth and sustainability. In one semester, students worked with a video store to expand its product line, a karate school to improve its revenue, and the town of Buchanan to seek opportunities for economic development. This course not only improves students' abilities to work and problem-solve, but also serves as a form of economic outreach for the college, strengthening relationships with and impacting regional organizations and businesses.

The Center for Business Intelligence and Analytics (CBIA) also strongly advocates for a consulting approach in preparing Pamplin students to work in industry. Understanding the distinct deficit of workers in the U.S. with data analytics skillsets, CBIA's purpose is to prepare students for c-suite and research positions that take a systems analysis approach to business planning and decision-making. As part of this, CBIA master students pursue nine-month capstone projects with company partners. According to CBIA, "students work on interdisciplinary, four-to-five member teams on a corporate project that has significant strategic importance to corporations. Corporations will provide data and

a project coordinator”.¹ When describing the in-class engagement and mentorship of students, one survey respondent remarked that these opportunities “provide an outlet for me to exchange ideas and learn about how our younger alums view the work world.”

Worked with student groups (e.g. PRISM, SEED, ECLUB, Consulting Club)

Many student-led clubs also engage with business with the help of faculty advisors. For example, PRISM is a student-run ad agency that began by assisting Pamplin with its marketing but has since expanded to help many companies, primarily within the Blacksburg area. Clients include the First &

“Yes, the positive results provided by PRISM and other student-based groups have helped several of our largest clients. They have proven to be focused young minds that are looking to expand their knowledge and leadership roles when working on a vast range of promotions. Positive attitudes and confidence to take on new task and roles is one of their many features as both a group and individuals.” - Survey Respondent

Main shopping center, Click & Pledge online fundraising platform, and Stone Circle financial and investment firm. PRISM is comprised of students from Pamplin’s marketing department as well as the departments of visual arts, computer sciences, engineering, and industrial design—all of which offers companies a multi-skilled team and provides students an opportunity to work across disciplines. PRISM graduates have a 100% placement rate. The work that PRISM students do have earned the organization nationally recognized awards such as three Teles and one Muse award. Moreover, the businesses that have worked with PRISM, such as First & Main, have claimed a return on investment from PRISM’s work.

Another industry-engaged club is the Consulting Group at Virginia Tech. They explain, “The pro bono work we’ve done has been mutually beneficial to our members and clients... We offer first-hand consulting experience with our clients. In addition, CGVT provides continuous preparation and training through peer mentoring, case studies, case competitions, and mock interviews. Consequently, our analysts gain valuable insights in consulting, helping them to excel in their future careers.” CGVT students work with Excella Consulting, Edible Arrangements, Back to Nature Landscaping and Consulting, and Virginia Tech’s Office of Sustainability to name a few.

Virginia Tech’s Entrepreneur Club (ECLUB) builds the skill sets of young entrepreneurs and helps them to develop and grow their companies. ECLUB explains, “Virginia Tech has had a long history of producing great startups: Modea, Webmail.us (acquired by Rackspace in 2007), TORC Robotics, Taaluma Totes (seen on Shark Tank), Koofers, SkillCapped, Mindsense, Heyo, VirtualU, CardIsle, Follow My Vote, LawnStarter, BigScreen, and Vàs to name a few. We want this list to be longer.”

Student Internships

Internships play a large role in student experiential learning in Pamplin. For that reason, a handful of programs such as Pamplin’s MBA and MS in HTM have relocated to the Falls Church campus, where students currently have a better chance to engage with companies looking for interns. These programs have ranked higher amongst their peers because of this move. Even without these changes, however, other established internship programs also exist between companies and Pamplin. The

Master's of Accounting program has a joint partnership with KPMG, one of the top four accounting firms in the nation. About 50 Pamplin students a year intern with KPMG during the spring, take courses they missed in the summer, and return to KPMG as employees in the fall. Another company explained, "Our relationship with VT Pamplin is part of the fabric of our Tyson's Corner office culture. We have six Hokie partners... We attract great, qualified student internship and full-time candidates."

Company Visits to Campus

Companies visiting campus to recruit students come both for career fairs and individually throughout the school year. Bersin, one of Deloitte's research arm, noted in its 2016/2017 Talent Acquisition Factbook that the individualized candidate experience is one of the leading factors to successful company recruitment and retention. Because they want the best students and have the resources, larger companies like Deloitte tend to come more frequently to campus to build a rapport with Pamplin juniors and seniors as potential hires. This personalized interaction with students has become ever more important as 68 percent of human resource leaders say they struggle to find suitable candidates to fill their hiring needs.

In addition to individual visits, Pamplin's Business Horizons Job Fair hosts approximately 160 companies and 600 company representatives in fall semester, with a second smaller job fair in the spring. As one of the largest job fairs on campus, Business Horizons is held in the Squires Student Union and welcomes over 2,500 students from across campus.

Student Trips to Companies

Students go on trips to places such as New York, Northern VA and Richmond to meet companies and present work they have done through Pamplin. Company visits give students perspective on life outside of school. Trips include Hokies on Wall Street, Northern Virginia in the spring and Women in Business throughout the year.

Of all other activities listed here, companies seemed least satisfied with student trips. One reason for companies' dissatisfaction may be student's lack of knowledge of business etiquette and lack of soft skills (e.g. communication, writing and presentation skills). When asked about the areas where Pamplin students and alumni need to improve, it was primarily in these areas.

Faculty and Programmatic Engagement with Industry

Industry also engages with Pamplin faculty research and consulting. For instance, work done by BIT faculty helped the automotive and other industries react to product defects more quickly and efficiently than before. Another example is CBIA, which "serves as a conduit for connecting corporations that have business problems and opportunities with faculty and graduate students who have analytics expertise."¹ CBIA professors have worked with Carilion Health Systems to research telemedicine opportunities in Southwest Virginia.¹ All three, survey respondents who contracted with Pamplin faculty for research or consulting were extremely satisfied with the outcomes of their partnership. This positive feedback may hint at future possibilities for expanding faculty research and contracting with private companies.