



KENAN INSTITUTE

ENGINEERING, TECHNOLOGY & SCIENCE

NC STATE UNIVERSITY



KENAN INSTITUTE GOALS AND ACCOMPLISHMENTS FISCAL YEAR 2017-2018

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Technology & Science
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A MESSAGE FROM THE DIRECTOR

With the resources so generously provided by the William R. Kenan, Jr. Fund for Engineering, Technology & Science, NC State University, and our corporate, government, and philanthropic partners, in 2017-2018 the Kenan Institute continues to support and advance innovation in science and technology as a vehicle for our economic development and growth as a state and nation.



The Kenan Institute for Engineering, Technology & Science focuses its intellectual, human and financial resources in support of innovative individuals and programs involved in science, mathematics and engineering driven enterprises with demonstrated potential for high impact educational, economical and other benefits to society. Specifically, the Institute continues to support and enable core competencies in four strategic areas: high technology research; science, technology, engineering, and math K-12 education; technology commercialization and entrepreneurship; and science and technology policy.

We remain committed to encouraging multidisciplinary, multi-institutional teams involving government, university, and corporate partners to solve scientific and societal problems, generate technology-based economic development, and bring together the public and private resources necessary to tackle successfully the emerging issues of our time. We will do this while maximizing the leverage from the significant strengths of NC State University students, faculty, and staff while focusing on programs that are consistent with the university's strategic goals in research, education, and engagement.

Our Institute support and leadership will enable individuals and programs at NC State and at other institutions to continue to produce world-class research and scholarship which will enhance knowledge and learning, produce and support new innovative companies, and inform sustainable practices and effective public policies that will have lasting impacts.

We really appreciate your interest in the Kenan Institute and welcome your comments and questions on our work and our programs.

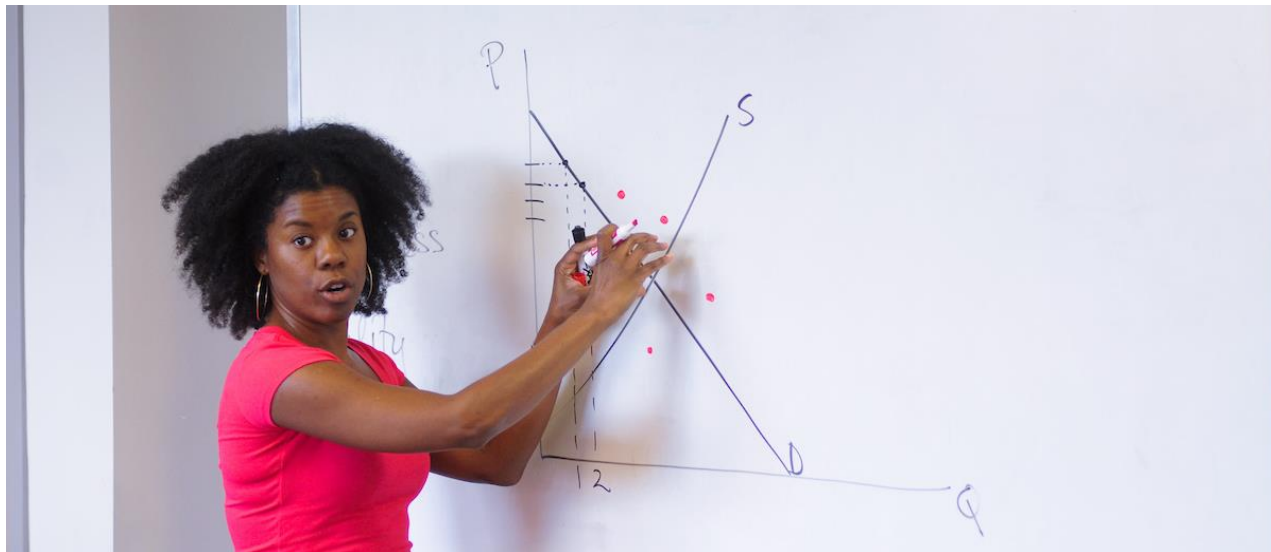
Sincerely,

A handwritten signature in black ink, appearing to read 'Ruben G. Carbonell'. The signature is fluid and cursive, with a large, stylized 'R' at the beginning.

Ruben G. Carbonell

OVERVIEW OF GOALS

The Kenan Institute for Engineering, Technology & Science (KIETS) aligns its goals with NC State University strategic plan goals and UNC System-wide strategic initiatives. KIETS also has focus areas of its own. Those goals and how KIETS has accomplished them through its varied programs and initiatives are outlined in this document.



GOAL 1: Enhance Student Success

- **UNC System Strategic Initiative on Student Success:** Increase degree attainment and ensure value and relevance for students.
- **UNC System Strategic Initiative on Access:** The UNC system must continue its proud heritage of access and student diversity.
- **NC State Strategic Plan:** Enhance the Success of Our Students through Educational Innovation.

KIETS Goal: Identify and support NC State student led initiatives and novel educational approaches to enhance undergraduate and graduate education.

ACCOMPLISHMENTS

Entrepreneurs Living and Learning Village

KIETS supported *The Entrepreneurs Living and Learning Village*, a program of the NC State Entrepreneurship Initiative (EI). The 2017-18 cohort in the Albright Entrepreneurs Village (AEV) has shown continued growth, with 68 living and learning village residents (an 84% increase year-over-year) with a diverse population that represents the Colleges of Engineering, Humanities and Social Sciences, Textiles, Agriculture and Life Sciences, Poole College of Management and the Graduate School. Albright Entrepreneurs Village residents received scholarships to attend the annual EI trip to New York City, the annual EI trip to Silicon Valley and the annual NC State Village Alternative Service Break. In addition to the Albright Entrepreneurs Village, Kenan Institute resources have also helped support the continued efforts of the EI Fellows Program. KIETS Associate Director Raj Narayan continued to collaborate with and advise former EI Fellow Leigh Kathryn Bonner, CEO and Founder of *Bee Downtown*.

TEC Program

KIETS actively engaged and advised *TEC program* graduate students regarding their potential initiation and launch of high-tech companies based on technology developed at NC State and other university, government, and industry partners. One of the TEC teams *MitraMag* placed third winning \$2K in the Lulu EGames

competition Design and Prototype category. In addition, TEC Student David Majeski placed first winning \$10K for his startup *Tueri* in the New Venture category. KIETS Associate Director Raj Narayan served as an executive mentor and advisor to TEC teams and as an advisor to David Majeski regarding *Tueri*.

NC State Social Entrepreneurship Initiative

KIETS collaborated with the *NC State Social Entrepreneurship* initiative led by the NC State Institute for Nonprofits to provide students with opportunities to engage and learn from social entrepreneurs in North Carolina, nationally, and internationally. The NC Social Innovation Fellows program launched in October 2017 with Kenan Institute support to engage students in cross-disciplinary teams in developing social impact ventures. KIETS Associate Director Raj Narayan served as an advisor for the *FreshSpire* team, which placed first winning \$5K in the Lulu EGames Social and Environmental Impact category.

Goodnight Scholars Annual Interviews

KIETS supported the Goodnight Scholars annual interviews providing space and organizational support. KIETS University Program Associate Tara Spivey helped organize and support the annual interviews, which were held at the Kenan Institute offices in February and April 2018.



GOAL 2: Enhance Scholarship and Research

- **NC State Strategic Plan:** Enhance Scholarship and Research by Investing in Faculty and Infrastructure

KIETS Goal: Identify programs that support faculty research efforts, promote career development and help enhance the research infrastructure at the university.

ACCOMPLISHMENTS

KIETS is supporting several research programs involving NC State faculty and students:

Modular Liquid Fuel and Power Co-Generation System for Shale Gas Upgrading

The Modular Liquid Fuel and Power Co-Generation System for Shale Gas Upgrading led by Prof. Fanxing Li has secured \$2.04 million external funding support from the US Department of Energy and a UNC General Administration Research Opportunities Initiative (ROI) grant in the amount of \$800K.

Bioseparations/Bioprocessing Development Center (BBDC)

KIETS enabled the *Bioseparations/Bioprocessing Development Center* (BBDC) initiative led by KIETS Director Dr. Ruben Carbonell in partnership with BTEC. In 2017-2018, BTEC completed approximately 30 bioprocess and analytical services projects totaling over \$300,000. In addition, BTEC is on the second year of a grant for \$350,000 from a textile company to develop novel nonwoven membranes for separations and a one-year grant from a resin company to develop new ligands for purification of proteins from plasma for \$125,000. A European producer of chromatographic resins is expanding their testing and services agreement with BTEC for an additional year with a grant of \$70,000 for one year. Dr. Carbonell is pursuing a large opportunity from the Novo Nordisk Foundation to expand BTEC and develop curriculum and training tools for Novo Nordisk employees assigned to the Novo Nordisk insulin plant being constructed in Clayton, NC. The capabilities provided by the BBDC also enabled BTEC to succeed in getting three major grants from the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL).

NASA Use of Satellite Measurements to Validate and Improve Air Quality Predictions of Ammonia and Fine Particulate Matter

KIETS supported the *NASA Use of Satellite Measurements to Validate and Improve Air Quality Predictions of Ammonia and Fine Particulate Matter* led by Professor Viney Aneja. Dr. Aneja and his colleagues presented on their research at the March 2018 NC BREATHE Conference held in Raleigh, NC on Reactive Nitrogen Emissions from Biomass Burning in the US.

Dynamic Model Downscaling of Climate Change and Its Impacts on Marine Environmental Conditions off North Carolina

KIETS supported NC State Professor Roy He's project on *Dynamic Model Downscaling of Climate Change and Its Impacts on Marine Environmental Conditions off North Carolina*. Kenan Institute support for this project leverages a \$5 million, 4-year (2016-2020) NSF Award to study physical processes driving exchange between the shelf and deep ocean at Cape Hatteras. Dr. He and his colleagues were also awarded a Chancellor's Innovation Fund (CIF) grant in 2017 to investigate the commercial applications for their research and have launched a startup company called Fathom Science LLC.

Visiting Scholar Chemical Engineering Professor Moti Herskowitz

KIETS supported visiting scholar Professor Moti Herskowitz, Director of the Blechner Center for Industrial Catalysis and Process Development and Israel Cohen Chair in Chemical Engineering at Ben-Gurion University of the Negev in Israel on a sabbatical to NC State University in Fall 2017 to collaborate with Professor Fanxing Li in NC State's Department of Chemical and Biomolecular Engineering. The collaboration resulted in \$12K support from the UNC General Administration's Research Opportunity Initiative (ROI) program to enable additional collaborations between Prof. Li and Prof. Herskowitz. In addition, Prof. Li and Prof. Herskowitz jointly submitted a proposal (\$300,000 over three years) under the NSF-BSF bilateral program in October 2018.

International Workshop on Soft Matter Interfaces

KIETS supported an international workshop on Soft Matter Interfaces. This workshop, hosted by NC State, was part of a U.S.-Germany research cooperation program with NC State, the Technical University of Berlin (TUB), Humboldt University and the Max Planck Institute for Colloid & Interface Science. The conference took place on October 6-9, 2017 at the NC State College of Textiles and was attended by 54 participants (21 faculty and 33 Ph.D. students), 26 of whom were from Germany. There were 26 technical presentations, all but two of which were delivered by the U.S. and German graduate students.

Mapping the Environmental Genome of Industrial Products

KIETS supported the *Mapping the Environmental Genome of Industrial Products* (EGIP): *A Workshop on Vision, Value, and Impact* in August 2017. The Workshop and the projected impact of the wider Environmental Genome concept has led to a grant from the National Science Foundation to focus on specific areas of improvement in the mapping effort to lower cost of mapping and expand the interfaces with other users.



GOAL 3: Enhance Interdisciplinary Scholarship

- **NC State Strategic Plan:** Enhance Interdisciplinary Scholarship to Address the Grand Challenges of Society

KIETS Goal: Identify, develop and foster new interdisciplinary approaches in research, education, outreach that address the Grand Challenges of Society.

ACCOMPLISHMENTS

National Institute for Innovation in Manufacturing Biopharmaceuticals

KIETS supported the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), a \$70M collaborative agreement over five years from the National Institute for Standards and Technology (NIST). KIETS Director Ruben Carbonell, NIIMBL CTO, is one of the lead investigators that led to the establishment of NIIMBL, an institute that will become part of the Manufacturing USA Network to enhance the nation's manufacturing-based economy. The first year of Institute activity saw a large number of accomplishments, including identification of Institute leadership, attraction of a diverse membership of academic institutions, non-profits and industry (current members include four Tier 1 companies, 29 academic institutions, 30 Tier 3 companies, and 16 non-profits and community colleges), development of technical and workforce roadmaps, and three calls for proposals from Institute members. Each of these accomplishments have led to substantive benefits to academic and corporate interests in the State that are anticipated to have a major impact on biopharmaceutical manufacturing in North Carolina. The total value of all grants from NIIMBL involving North Carolina institutions comes to \$5.95 million.

Research Innovation Seed Funding

KIETS provided support for the *Research Innovation Seed Funding (RISF)* program. RISF projects selected for support in 2018 include the following:

- Dr. Karen Chen, College of Engineering, *Development and Evaluation of a Multimodal Feedback Virtual Reality System for Rehabilitation*
- Dr. Colleen Doherty, College of Agriculture and Life Sciences, *Predicting the Impacts of a Changing Climate on Crop Resilience: Testing the Impacts of Warmer Night Temperatures on Plant and Pathogen Interactions Using Lettuce as a Model System*
- Dr. Tiegang Fang, College of Engineering, *Fluid Dynamics of Droplet Impact on Textiles*
- Dr. Dean Hesterberg, College of Agriculture and Life Sciences, *Nanoscale Dynamics of Phosphate and Arsenate Reactions Affecting Soil Regulation of Plant Nutrition and Environmental Toxicity*
- Dr. Albert Keung, College of Engineering, *Breaking the Limiting Paradigm of Standard DNA Technologies in Extreme-Scale Information Storage Systems*

- Dr. Wayne Place, College of Design, *Assess and Optimize Advanced Building Glazing Technologies for Lighting, Energy, and Health Outcomes*
- Dr. Xu Xu, College of Engineering, *Tracking the Body, Tracking the Mind: Inferring Driver's Mental States from In-Car Body Motion*
- Dr. Shu Yang, College of Sciences, *Statistical Methods for Oral Anticoagulation Therapy in Patients with Atrial Fibrillation*

Since 2013, the RISF program has received 258 proposals and awarded 48 projects. During the same time, RISF projects have generated approximately 85 follow on proposals to external organizations of which 24 were awarded with awards totaling \$11,805,112 that represents a 10.13 leverage ratio when compared to the total ORIED/KIETS awards of \$1,061,924 during the corresponding period. In addition, 46 students were supported, 167 publications or presentations made and 17 workshops/symposia held. KIETS Director Ruben Carbonell serves on the RISF selection and steering committee.

FREEDM Systems Center and the Statistical and Applied Mathematical Sciences Institute

KIETS is helping to support several large NC State Centers including the *FREEDM Systems Center* and the *Statistical and Applied Mathematical Sciences Institute (SAMS-I)*. The FREEDM Center supported 2017-18 Kenan Fellow David Sander with Wake Forest High School (Wake County Schools) on his project titled *Fueling the Future of Renewable Energy*. SAMS-I supported 2017-18 Kenan Fellow Bill Worley of Johnston County Early College Academy (Johnston County Schools) on his project titled *Is U.S. Air Pollution Getting Better or Worse?*

Field-Portable Thermoplasmonic Plant DNA Extraction Device for Emerging Plant Disease Diagnosis

KIETS supported Dr. Qingshan Wei from the Department of Chemical and Biomolecular Engineering and Dr. Jean Ristaino from the Department of Entomology and Plant Biology, on their *Field-Portable Thermoplasmonic Plant DNA Extraction Device for Emerging Plant Disease Diagnosis* project. The PIs reported 6 undergraduates and 1 graduate student supported by this project. Alyssa Williams, a Chemical Engineering junior working on this project, is the recipient of the 2017 College of Engineering Research Experience for Undergraduate (REU) Award. Drs. Wei and Ristaino are involved with NC State's Emerging Plant Disease and Global Food Security Cluster.

Game Changing Research Incentive Program (GRIP)

KIETS collaborated with the Vice-Chancellor for Research, Innovation, and Economic Development to support the *Game Changing Research Incentive Program (GRIP)*. KIETS Director Ruben Carbonell serves on the GRIP selection and steering committee. GRIP projects in progress are as follows:

- Water Sustainability through Nanotechnology: Nanoscale Science and Engineering at the Solid-Water Interface; Collaborators: Jacob Jones, David Berube, Douglas Call, Jan Genzer, Detlef Knappe, Yaroslava Yingling, Mohammed Zikry (NCSU); Young Chul Choi, Khara Grieger (RTI); Susan White (WRRRI); and many other participants at NC State, RTI, UNC, and Duke;
- Computer Science for All K-12 Students; Collaborators: Glenn Kleiman, Eric Wiebe, James Lester, Tiffany Barnes (NCSU); Kimberly O'Mally (RTI);
- 3D Printing of Fibrous Tissue Engineered Medical Products: A New Paradigm for Tissue Biofabrication and Therapeutics; Collaborators: Behnam Pourdeyhimi, Frances S. Ligler, Benoit Maze, Matthew B. Fisher, Rohan A. Shirwaiker, Kyle G. Mathews (NCSU); Shawn D. Hintgen, Jeffrey T. Spang, Bruce Cairnes (UNC-Chapel Hill);
- The NCSU/RTI Program In Genetic Discovery and Prediction (PGDP); Collaborators: Fred Wright, Alison Motsinger, Jung-Ying Tzeng, Zhao-Bang Zeng, Yi-Hui Zhou, Marie Davidian, Spencer Muse, Siddhartha Thakur (NCSU); Carol Hamilton, Wayne Huggins, Rebecca Boyles, James Balhoff, Stephen Hwang, Michelle Krzyzanowski.



GOAL 4: Enhance Organizational Excellence

- **UNC System Strategic Initiative on Excellent & Diverse Institutions:** Help institutions achieve excellence within individual missions.
- **UNC System Strategic Initiative Affordability & Efficiency:** Ensure a UNC education is within the financial means of all in the state.
- **NC State Strategic Plan:** Enhance Organizational Excellence by Creating a Culture of Constant Improvement

KIETS Goal: Seek opportunities for professional training, to save costs, maximize efficiency and enhance resources for KIETS operations and improve services to our stakeholders.

ACCOMPLISHMENTS

Leveraging Partnerships

In 2017-18, KIETS core operating and program investments of \$1,441,868 were leveraged by approximately \$20,951,261 in complementary funding from NC State University and external partners. While only a portion of these funds flows directly through KIETS, the resulting impact of the Institute's ability to enable leveraged support for its programs is significant and continues to grow annually. KIETS continued to maintain a healthy and active portfolio of 30 supported projects representing a 77% turnover ratio and 38% new projects at the start of fiscal year 2017-18.

Collaborating on Initiatives

KIETS is working collaboratively with the NC State Advancement on the NC State Campaign to identify and develop resources for priority initiative such as the Kenan Fellows Program. KIETS Board member John Atkins is serving as the Chair of the KIETS Campaign cabinet in collaboration with KIETS Director Ruben Carbonell and Kenan Fellows Program Assistant Director of Development Kelly Vogel. The KIETS Board of Trustees pledged approximately \$19,150 for fiscal year 2017-18 and \$52,500 over the next four years representing 78% board participation. With this support, Anthony Nesbit of Craven County was selected as a 2018 KIETS BOT Kenan Fellow.

Improving Administrative Structure

In response to staff transitions, KIETS made improvements to its administrative structure that enabled more efficient and effective use of Institute resources and operational expenditures.

Improving Program Effectiveness, Outcomes and Impact

The Kenan Fellows Program for Teacher Leadership continues refine its processes and adapt novel strategies for improved program effectiveness, outcomes, and impact while implementing strategies for long-term

sustainability. The Kenan Fellows Program implemented collaborations with school districts in NC including the Charlotte-Mecklenburg school system and is developing similar collaborations with the Wilson and Johnston County School systems in 2018 to further leverage complementary resources.

Improving Branding

KIETS continued to update its website (kenan.ncsu.edu) and identity materials to better align with the branding of NC State, provide easier website and social media management, and enhance the overall website visitor experience.



GOAL 5: Enhance Local and Global Engagement

- **UNC System Strategic Initiative on Economic Impact & Community Engagement:** Deepening partnerships that strengthen local communities and the state's economy.
- **NC State Strategic Plan:** Enhance Local and Global Engagement Through Focused Strategic Partnerships

KIETS Goal: Seek and support efforts that will inform public policy and engagement for the benefit of North Carolina and the Nation.

ACCOMPLISHMENTS

Gordon-Kenan Graduate Research Seminars

KIETS continued its partnership with the Gordon Research Conferences, helping young scientists and engineers throughout the world to be exposed to state of the art research through the *Gordon-Kenan Graduate Research Seminars*. Since 2001, Kenan Institute support has provided seed funding for over 167 new Gordon-Kenan Research Seminars, helped leverage over \$8,255,763 from private & federal sources, and helped provide registration and travel support for over 3,392 GKRS registrants, roughly 45% of all participants. From 2001 to 2017, GKRS/GRC Chairs have raised \$3,133,563 from federal funding and \$5,122,200 million from private industry partners. 16,830 North Carolina scientists representing 1,046 organizations attended GRC and GKRS programs during that time. In addition, 26 GRC chairs and 194 GRC speakers were from NC State University. The GRC invited KIETS leadership to attend their 2018 Board meeting on April 13, 2018. Among the items discussed were the possibility of evolving the KIETS/GRC relationship to investigate the potential for GRCs in Engineering, a focus on underrepresented groups in particular women, and the potential to revisit siting GRCs in North Carolina.

IEI Faculty Fellows for Public Policy Engagement

KIETS supported and advised the *IEI Faculty Fellows for Public Policy Engagement* program to help enable faculty engagement in significant research and outreach activities associated with recent IEI Forum topics. In

fiscal 2017-18 year, IEI has used Kenan funding to collaborate purposefully with faculty members and students on the following projects: *Emerging Issues Commons*; *Text, Talk, Future*; *Reconnect NC*; and *KidsReadyNC*.

Innovate NC 2.0 initiative

KIETS continued to support and advise the *Innovate NC 2.0 initiative*. Innovate NC has developed an Asset Map for community-led innovation mapping. KIETS Associate Director Raj Narayan presented a brief talk on the Asset Map at the NSF Sloan Workshop for Land Grant Universities and Data Sciences held on June 5, 2018. The five community local innovation councils for Wilson, Wilmington, Pembroke, Asheville, and Greensboro are continuing to develop and implement their strategic plans in 2018. The Innovate NC 2.0 initiative has also led to the development of a proposal for a North Carolina Community Innovation Impact Fund led by the NC Office of Science and Technology that would help accelerate entrepreneurial activity in select communities. This proposal and budget was included in the Governor's budget proposal for fiscal year 2017-18.

NC Sea Grant Community Collaborative Research Grant Program

KIETS supported the NC Sea Grant Community Collaborative Research Grant Program. KIETS Associate Director Raj Narayan serves on the CCRG review and steering committee. As a result of KIETS support, four successful proposals were awarded in 2017-18 including the following:

- Dr. Scott Belcher, NC State University, *Assessment of Novel and Legacy Poly and Perfluorinated Alkyl Substances (PFASs) in Alligator and Fish of the Cape Fear River*
- Dr. Stan Riggs, NC-LOW, *Night-scape Resources of a Sustainable Ecotourism Trail System on the Outer Albemarle Peninsula (OAP): Tyrrell, Washington, and Mainland Hyde-Dare Counties, NC* (dual funding, \$10K from Sea Grant, \$15K from Space Grant)
- Dr. Joanne Halls, UNC-Wilmington, *Assessment of Flood Risk and Simulations of Wetland Change in Pender County, NC*

Developing a Shellfish Mariculture Strategic Plan for North Carolina Initiative

KIETS supported a partnership with the NC Coastal Federation and NC Sea Grant regarding their *Developing a Shellfish Mariculture Strategic Plan for North Carolina Initiative*. In 2017-18, a steering committee (Shellfish Mariculture Advisory Committee, or SMAC) has been assembled and has been meeting almost monthly. Individual workgroups within this team of stakeholders are developing different elements of the Shellfish Mariculture Plan for N.C. focusing on industry leadership, removing barriers to entry into the industry, research, water quality, and how best to site new operations. The project's SMAC has members that a scientists from UNC-W, UNC-Chapel Hill, N.C. State University, East Carolina University, and Carteret Community College. The project team is working with the SMAC to devise a strategic plan to grow the shellfish mariculture industry from the current dockside value of about \$2 million, to \$33 million by 2030. This would result in an industry for the coast that has a total economic value of more than \$100 million each year. This plan, which has been requested by the N.C. General Assembly by December 2018, will include findings, recommendations and detailed legislative, appropriations and regulatory proposals for its implementation.

NC State Outreach and Engagement Incentive Grant Program

KIETS supported the *NC State Outreach and Engagement Incentive Grant Program*. The fiscal year 2017-18 incentive grants awarded proposals will receive \$10,000 each to support work through June 2019 and are as follows:

- Dr. Lisa Bass, *NC State / Wake County Public Schools Affinity Support Network*;
- Dr. Tiffany Barnes, *Bridge to Computing*;
- Marshall Brain, *Creating a New \$60 Million Economic Food Driver for Kinston, NC*;
- Dr. Willa Casstevens, *The Role of Navigators in Community Reentry from the Judicial System*;
- Dr. Richard Clerkin, *Enhancing Leadership Capacities for Social Innovation in Wake County Wake County, as well as seek funding partners to grow the project in other targeting counties*;
- Dr. Marc Grimmett, *Assessing the Community Counseling, Education and Research Model for Multicultural and Social Justice Counselor Education*;
- Dr. Whitney Knollenberg, *Modeling the Craft Beverage Tourism Product in Wake County*.

Catalysts for Innovation

KIETS collaborated with the Research Triangle Park (RTP) Foundation and TUCASI to launch the *Catalysts for Innovation* initiative. The purpose of the initiative is to support university activities that would benefit from a partnership leveraging the RTP, Triangle universities, and the private sector. Two projects supported through the Catalysts for Innovation include the following:

- *Biomedical Innovation Collaborative for Veteran Entrepreneurs at the Frontier*. In 2017-18, in partnership with UNC neonatologists, MEDIC worked to develop a simulator for chest tube insertions in neonatal patients. With this simulator, clinicians will be able to be trained on this procedure prior to a live patient scenario. In partnership with the Triangle Global Health Consortium, the PIs have also started a 5 month long innovation boot camp focusing on 2 problem areas: Clinic-in-a-Box and Disease Vectors. 15 faculty members, 30 undergraduates, 6 graduate students, 10 companies are engaged in the MEDIC projects. KIETS BOT member Rob Tyler is serving on the MEDIC Advisory Board and his firm Williams Mullen Provides in-kind support.
- *EcoPRT Automated Transit in Research Triangle Park* – In 2017-18, the PIs have built and tested an autonomous vehicle and are in the process of building a second vehicle. The PIs reported 8 faculty members are involved, 20 undergraduate students, 20 graduate students, 3 corporate partners engaged, 1 invention disclosure submitted, and 1 startup company. The Eco-PRT team also reported receiving a \$149,000 feasibility grant from the NC Department of Transportation and have applied for a NSF Connected and Smart Communities grant.



KIETS GOAL: Enhance K-12 STEM Education

KIETS Goal: Support strategic partnership among industry, state government, federal agencies, and state school districts to enhance STEM education in our schools.

ACCOMPLISHMENTS

Kenan Fellows Program for Teacher Leadership

KIETS continued to support the growth of the *Kenan Fellows Program for Teacher Leadership*, engaging a large number of industrial partners, non-profits, federal agencies such as the NSF, the DPI, and numerous communities and individuals throughout NC. The Class of 2017-18 was chosen through a competitive application process from 122 applications submitted from 36 school districts. The 27 Fellows selected from this group represent 10 North Carolina counties, one of which (Wilson) is new to the program. These Fellows had an impact on 1329 students, 1101 community members, and 735 teachers or administrators. In addition to classroom instruction, these activities include presentations at conferences, professional development sessions,

field trips, and other public venues. The Kenan Fellows Program published the third edition of the *Journal of Interdisciplinary Teacher Leadership* (JoITL) online July 31, 2017. With support from the Biogen Foundation, the Kenan Fellows Program for Teacher Leadership held its inaugural North Carolina Teacher Leadership Symposium on Tuesday, Aug. 1, 2017 in Greenville, NC led by Kenan Fellows Alumni. Other kudos for Kenan Fellows include the following:

- Linda Dion was named the 2017-18 Holly Springs High School Teacher of the Year.
- Paul Cancellieri, Jasmine Frantz & Dail Midgette were named 2018-19 Teacher of the Year Finalists for Wake County Public Schools.
- Tomika Altman-Lewis is part of the 100Kin10 2018-19 Teacher Forum. She was one of 46 STEM teachers from across the country who was selected to participate.
- Kathy Brintle was named 2017-18 Teacher of the Year for Gentry Middle School.
- Michelle McElhiney was named a STEM Superstar Teacher by Piedmont Natural Gas.
- Tomika Altman-Lewis, Tasha Martinez, Brad Rhew, Kimberly Sanderlin and Mark Townley were named to the Governor's Teacher Advisory Committee.
- Ashley Thompson was named as the Southwestern Area Superintendent for Wake County Public School System.
- Mary Samuels is the winner of the Distinguished (Beginning) Teaching Award in STEM Education presented at Bridging the Gap Conference and winner of the Outstanding Science Teacher Award (District 3) presented at the NC Science Teachers Association Fall Professional Development Institute.

EngineerGirl

In 2017-18, KIETS collaborated with the National Academy of Engineering to support the *EngineerGirl* initiative. *EngineerGirl* served as a resource to over 483,000 users, and over 180 individuals received answers to their engineering-related questions via the Ask an Engineer program. Much of 2017 was spent on developing new outreach vehicles that are being launched in 2018 including a newsletter, a design challenge, and an EngineerGirl Ambassadors program. The 2018 essay contest theme was focused on "Engineering for Your Community" and explores issues regarding community infrastructure needs. 547 students from 34 US states and territories and 10 countries in grades 3-12 prepared and submitted written essays on how engineers can help to improve the infrastructure in their own communities. Kenan Fellow Christy Wilson has served for the past three years on the program's steering committee and has provided guidance in developing the essay contest topics, dissemination and outreach to teachers, and plans for future programs such as the EngineerGirl Ambassadors. EngineerGirl received a \$2 million grant from John McDonnell, former Chairman of the board of McDonnell-Douglas.

Applied Synergies Partnership (ASaP) Entrepreneurship Leadership Program

Apex Friendship High School teacher Dan Jackson has been collaborating with KIETS Associate Director Raj Narayan to develop the *Applied Synergies Partnership (ASaP) Entrepreneurship Leadership Program* focused on enabling entrepreneurial analytical skills in his high school students. ASaP engaged over 40 professional partners throughout the 2017 fall semester from diverse companies such as SAS, Biogen, Citrix and others. Local industry executives and advisors including Narayan and Kenan Fellow LaTanya Pattillo mentored 57 students to help them develop business plans that were submitted for competition in the NC DECA Career Development Conference. The Kenan Institute also hosted students to visit NC State University including the Hunt Library, Poole College of Management, HQ Raleigh, Albright Village and Entrepreneurship Garage, and NC State Entrepreneurship Clinic. Of the 24 teams that participated in fiscal year 2017-18, 18 teams competed at the state competition and 13 teams were invited to the international competition in Atlanta, GA. Moreover, 100% of the students who participated in the program in 2017 and took the state-mandated end-of-course-assessment met or exceeded the test proficiency levels with an average score of 90 in contrast to the state average of 74% scoring proficiency for all test takers. The Kenan Institute also hosted a meeting in March 2018 sharing program results with stakeholders including the NC Department of Public Instruction, TIE Carolinas, NC Real Entrepreneurship, Wake County Schools, Sequoyah Fund, Kenan Fellows Program, and the Rural Center to investigate the potential for a similar program in rural areas. KIETS BOT member Charles Coble served as a judge for the teams in preparation for their state competition. AFHS DECA club president Jessica Hong was

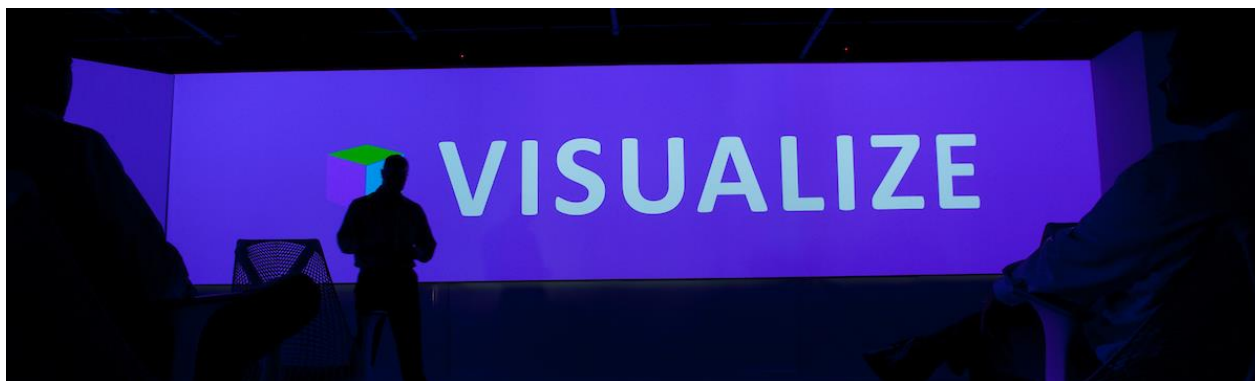
featured in an interview with Leslie Boney Director of the Institute for Emerging Issues in the *First In Future* Program.

Ingenuitas

KIETS supported *Ingenuitas*, a 501(c) (3) not-for-profit organization led by Kenan Institute Trustee Dr. Juan Luis Torres, to develop pragmatic solutions to health problems in the developing world, particularly in areas with significant deficiencies in infrastructure, such as lack of electricity, adequate water supply, or clean environment. For 2017-18, *Ingenuitas* focused on completing the design and build of the Biomimetic Mosquito Trap prototype. Over fifty STEM HS students have been involved with *Ingenuitas* and the attendance has averaged between 30-40 students five days a week during after-school hours. Currently, the principal project is the construction of a prototype mosquito trap of low cost and high efficiency. Additionally, the group spent nearly 600 hours focusing on community service and engagement. This included time spent with Habitat for Humanity, Wake STEM Early College High School, Packapalooza, Raleigh Mini Maker Faire, as well as robotics demonstrations for local industries.

STEAM Pilot Program

KIETS supported NC State College of Management Professor Fay Payton and Marian Fragola, Director of Outreach of the NC State Libraries to implement a STEAM pilot program series of workshops in Fall 2017 that parents attended with their children in order to engage them in both STEM activities as well as activities that highlight the arts.



KIETS GOAL: Support Launch of High-Tech Start-Ups

KIETS Goal: Support the launch of high technology start-ups based on NC State innovations and support technology commercialization programs at NCSU, the State and the Nation.

ACCOMPLISHMENTS

Richard and Marlene Daugherty Centennial Campus Entrepreneurism Endowment

KIETS provided matching funds for the *Richard and Marlene Daugherty Centennial Campus Entrepreneurism Endowment* that support start-up firms initiated with university intellectual property. The Daugherty Initiative continued its collaboration with the NC State Entrepreneurship Initiative to feature the selection of the Daugherty Initiative recipients as part of the Lulu eGames. 2018 award winners include VitalFlo, Sentinel Biomedical, and NExS. Since 2008, the Daugherty Initiative has invested \$258,847 in 33 companies and two research projects with 22 of the companies (67%) still in business. 2017 Daugherty Initiative awardees BreStem and Lumeova reported approximately \$2.1 million in additional support through angel investments and strategic partnerships. KIETS Director Ruben Carbonell and Associate Director Raj Narayan served on the Daugherty Initiative Selection Committee.

Wolfpack Investor Network (WIN)

In 2017-18, KIETS continued to work collaboratively with the NC State Office of Technology Commercialization and New Ventures, NC State Entrepreneurship Initiative, and NC State Poole College of Management to

support the *Wolfpack Investor Network (WIN)* initiative focused on connecting alumni investors with promising NC State-affiliated startup companies to facilitate angel investments. Although only in its second year, WIN membership has exceeded its fourth-year membership target with 134 members to date. Membership renewals are currently at a 97% renewal rate. Over 12 NC State MBA students and MS/PhD students have served on the diligence teams. Approximately 15 faculty members have aided in the WIN screening processes. WIN members have made 13 Investments to date with approximately \$5.3 million invested. The WIN initiative is currently being housed in the Kenan Institute offices and Kenan Institute Associate Director Raj Narayan serves as a member of the WIN Steering committee and works closely with the WIN team.

Staff Leadership

KIETS staff also served in leadership and advisory roles in several initiatives at NC State and with external groups.

ACCOMPLISHMENTS

- KIETS Director Dr. Ruben Carbonell served on the RISF Selection Committee, the IEI National Advisory Board, the COE Executive Committee, the Daugherty Endowment Board, the Advisory Board for the FSU-FAMU Chemical Engineering Department, the National Academy of Engineering's Audit Committee, the Plant Sciences Initiative Leadership Committee, the Kenan Institute for Private Enterprise Advisory Board, the Executive Committee of the NC Association for Biomedical Research, and as Chief Technology Officer for the National Institute for Innovation in Manufacturing Biopharmaceuticals. In May 2018, Dr. Carbonell was presented with the O. Max Gardner Award which is the highest distinction provided to a member of the faculty across the UNC System in recognition for his research and service contributions to North Carolina.
- KIETS Associate Director Raj Narayan served on the Chancellor's Innovation Fund selection committee, as a TEC Program Executive in Residence and Faculty, as a mentor with the Apex Friendship High School Applied Synergies Entrepreneurship program, on the NC State Entrepreneurship Alliance Steering Committee, as a mentor for the NC State Social Innovation Fellows program, the NC Sea Grant CCRG Review Committee, the Wolfpack Investor Network (WIN) Steering Committee. He was also an active participant in the NC Eisenhower Fellows, Marshall Memorial Fellows, and William C. Friday Fellows alumni initiatives. He also completed the NC State Management Essentials Training Program Certification.
- KIETS Assistant Director for Grants and Finance Cordella Rashid participated served on the following committees in fiscal year 2017-18: HR Connections Committee, Business Connections Committee, African-American Faculty & Staff Organization Committee. Ms. Rashid also completed trainings in the following programs: ezFedGrants Training Program, Coordinator WolfTime Training Program Certification, Summer Salary Training Program Certification, and Management Essentials Training Program Certification.
- KIETS University Program Associate Tara Spivey served as the Hunt Library building liaison team on behalf the tenants of the tenants in our Hunt Library office suite. Ms. Spivey worked collaboratively with CHASS units (SPIA, Institute for Non-Profits) to successfully administer the needs of units located in the Hunt Library 5th floor office suite. Ms. Spivey also participated on the following committees: Chancellor's Unit Award for Excellence selection committee, NC State Event Planners Council, Hunt Library Partners Meeting Committee, TSS LanTech Meeting Committee, Facilities Liaison Briefing Meetings Committee, and African-American Faculty & Staff Organization. Ms. Spivey also received her North Carolina Notary Public Course & Certification and was recognized for 10 years of service to North Carolina at the 2017 Service Award Breakfast.
- Kenan Fellows Program Director Dr. Elaine Franklin served as the Executive Editor, Amneris Solano served as the Managing Editor, and Randy Pinion served as the Copy Editor of the Kenan Fellows Program Journal for Interdisciplinary Teacher Leadership.
- Dr. Elaine Franklin, Director of the Kenan Fellows Program was awarded the 2017 Hermann and Emma Gatling Award for Outstanding Science Education Leadership by the NC Science Leadership

Association. She was also nominated for the Chancellor's Unit Award for Excellence. She also completed the NC State Management Essentials Training Program Certification. She also served as a strategic advisor for the Triangle Learning Network and was featured in the leadership spotlight of the Public School Forum's "Education Matters."

- Ms. Lisa Hibler, Associate Director for Program Operations for the Kenan Fellows Program was nominated for the Chancellor's Unit Award for Excellence. She also served on the planning team for the Citizen Science Association conference that will be held in Raleigh in March 2019. In addition, she collaborated with the Public School Forum's Beginning Teacher Leadership Network and Lee County Schools to deliver a joint Education Policy Summit in June 2018.
- Ms. Kelly Vogel, Assistant Director of Development for the Kenan Fellows Program served as the NC State Staff Senator effective July 1, 2017, representing groups under the Chancellor's Unit.
- Ms. Amneris Solano, Kenan Fellows Communication Manager, was accepted into the NC State Master of Arts in Liberal Studies program where she will focus on social action through social media as her concentration.

Recommendations and Future Concerns

In order to build on its past successes, the Kenan Institute will require continued commitment and financial support from its partners including NC State University, the Kenan Fund for Engineering, Technology & Science, and other universities, foundations, and government partners.

In addition, it will be essential for leadership from within the University, Kenan Fund, and industry to work closely with the Institute's leadership to serve as high-level advocates on behalf of Institute programs such as the Kenan Fellows Program. This strategic advocacy will help the Institute promote the impact of its programs and build its reputation as an honest broker of best practices in research, education, entrepreneurship, and public policy. In addition to financial support, the Institute will need continued in-kind support from the University such as the office space provided in the Hunt Library and support from units such as the Office of Advancement, Office of Communications, and Office of Sponsored Programs' Integrated Support Services Center.

Ultimately, these are issues related to the sustainability of the Institute and its programs and how the Kenan Institute is regarded in terms of University fundraising priorities.