I am happy to report that in its first seven years the Hagler Institute for Advanced Study has grown from infancy to maturity. But maturity does not mean that the Institute has reached its potential.

By maturity, I mean that the Institute is now a permanent game-changing feature of Texas A&M University—thanks to the foresight and initial funding of Chancellor John Sharp, the promise of current and continued A&M support by President Michael K. Young, and the significant endowment by Distinguished Alumnus Jon Hagler ’58. By maturity, I mean that the University faculty, led by the deans of all colleges and schools, Vice President for Research Mark Bartoe, and Provost Carol Fierke have converged to a conviction that this Institute is central to our quest to significantly elevate the quality of academics. By maturity, I mean that the guidelines and administrative structure under which the Institute operates, overseen by the Administrative Council and a prestigious External Advisory Board, have been fully validated. By maturity, I mean that the Institute has proven to be a magnet for endowment; in addition to the naming endowment by Jon Hagler and significant endowments from several other former students, five sitting faculty have committed their life savings through estate gifts. In the past seven years, the Institute has received endowment commitments in excess of $36 million. Most important, by maturity I mean that the Institute is now a proven vehicle for attracting some of the world’s greatest talent and finest scholars—Faculty Fellows—to reside for up to twelve months at Texas A&M to collaborate with faculty and students. So, thanks to an enormous investment of effort and resources, we have established a unique institute that will continue to elevate Texas A&M by replenishing its academic talent pool—forever.
The Institute, though mature, is just now well positioned to help us realize a truly transformative impact on the quality and reputation of Texas A&M. Here is my vision for the future.

Our near-term outlook is to expand the number of Faculty Fellows from our historical annual average of nine to the midteens over the coming five years. That growth is possible because of the generosity of the Institute’s supporters. My long-term vision is for the Institute to attract up to twenty Faculty Fellows per year—enabling every college to anticipate at least one Faculty Fellow per year. That growth will be made possible through Hagler Institute College Chair endowments.

A Hagler College Chair is unique. It will be filled by a Faculty Fellow during that Fellow’s active twelve-month participation in the Institute. A Hagler College Chair is named after the donor and could be occupied by a new stellar scholar each year. Although Hagler Chairs can be earmarked for use at the discretion of the Institute, the Hagler College Chairs can be filled only by scholars in the college of the donor’s choice.

Hagler College Chairs, from which only two of our colleges (Science and the Mays Business School) now benefit, help elevate the already outstanding quality of Texas A&M’s faculty and students—a major goal of Vision 2020. For Texas A&M to be viewed as a top-ten public university, a broad set of its colleges and schools must be considered top ten. A Hagler College Chair established in each of our colleges and schools will help elevate all to national prominence. By regularly attracting the finest scholars in every field, Texas A&M will be a beacon of academic excellence for the state and nation. By strengthening its colleges and schools, Texas A&M will produce significant discoveries and an enhanced education for its students. Doing so will elevate the University’s impact, influence, and reputation around the world.

Hagler College Chair earnings will ensure that a college nominates an outstanding scholar frequently to collaborate and interact with faculty and students. Regular participation by each college in the Institute will have a dramatic and positive effect. That same chair removes the college’s possible constraints on resource allocation by paying the expenses of the scholar’s time in residence, including research support. Some colleges that now have difficulty affording their share (30 percent) of Faculty Fellow stipends will then be able to participate fully.

Endowments for graduate student fellowships also are key to achieving the Institute’s potential. To date, we have offered two fellowships per Faculty Fellow for top graduate students to engage with those outstanding scholars. As we increase the number of Faculty Fellows, we will need more endowments to support a proportional increase in the number of graduate students who work with them. As with a Hagler Chair, a named graduate student endowment can be unrestricted to the Institute or specified for a particular college.

My vision for the future also includes an endowment for a Director Chair to ensure that future directors of the Institute have the resources to maintain their research programs. The directors must be of the same stature as the Faculty Fellows with whom they will associate. That Director Chair will serve as an enticement to attract a strong pool of candidates to serve as the second director.

The quantitative impact of Faculty Fellows’ collaborations is easy to observe—journal articles and conference presentations co-written with our faculty and students, grant participation, lectures to students, and additional national and international exposure for Texas A&M, among other things. Although the dollar value of new grants resulting from Faculty Fellow appointments totals far in excess of the Institute’s costs to date, we must recognize that the most important facet of those Faculty Fellow appointments is qualitative: Those remarkable individuals inspire everyone who works with them. Almost all successful people will credit their accomplishments to a mentor who inspired and motivated them. Some of the most important, long-lasting influences of those Faculty Fellows will result from their inspiration and mentoring of our students and faculty.

We are justifiably proud of the many outstanding achievements by former students and faculty over the history of this great University. The Hagler Institute for Advanced Study opens the door to a new era for cultivating the highest levels of academic excellence, in perpetuity, at Texas A&M University.

John L. Jenkins
Our goal: Bolster Texas A&M's standing as a world academic leader

The Hagler Institute for Advanced Study is founded on the idea that the world's finest universities have access to the world's finest minds. The Hagler Institute brings world-class scholars—Faculty Fellows—to take residence at Texas A&M University for up to twelve months. Those scholars collaborate with A&M faculty and top graduate students on research projects designed to solve some of the world's toughest problems and challenges. The results may lead to important insights presented in joint peer-reviewed publications, grant applications, college and departmental lectures, and public lectures.

For a land-grant university, with an obligation to serve the broad educational objectives of the state and its citizens, achieving stature as a national and international leader in research and scholarship is an aggressive goal. However, that goal can be achieved with a multifaceted approach that takes full advantage of the Hagler Institute's proven ability to attract world-class talent.

Now a permanent feature at Texas A&M, the Hagler Institute is a key component of the University's strategy to advance its academic evolution and to emerge as one of the ten universities that are generally regarded as the best in the United States. The University's Vision 2020 report identified specific areas of focus to achieve this goal. The Hagler Institute provides support for several of these areas. For example, the Institute elevates Texas A&M faculty by establishing personal connections with some of the most recognized scholars in their fields. Moreover, the Institute strives to ensure that the results of those collaborations are known to the global community. The Institute also strengthens A&M's graduate programs and enriches the undergraduate academic experience by bringing students at all levels into direct contact and collaboration with Hagler Faculty Fellows. That connection has a long-term impact on the quality of the students who choose to attend Texas A&M. Because the finest students want the finest education, their choice of schools may be influenced by the objectives and proven success of the Hagler Institute.

The Institute serves every college and school at Texas A&M, including the Galveston campus and the School of Law in Fort Worth, as well as several key institutes. The affiliations between the Faculty Fellows and the University's colleges and
schools are determined by nominations, which originate with our faculty and college deans. Those nominations are strictly confidential. Nominees are evaluated by a revolving panel of University Distinguished Professors. To be approved for recruitment, nominees must meet the highest standards of accomplishment in their professions, hold national academy or equivalent stature, and produce top-quality work as scholars and mentors. The time in residence at Texas A&M is flexible, with many Faculty Fellows choosing to spread their work at Texas A&M over multiple years, ensuring long-term collaboration.

Great universities such as Texas A&M require the constant renewal and integration of exceptional scholars and researchers with an extraordinary existing faculty. The Hagler Institute is designed with that premise clearly in mind. The Institute’s world-class scholars have an immeasurable impact on our faculty, students, and reputation. In addition, the Faculty Fellows are energized by the flexible structure of the Institute and by their ability to team with enthusiastic faculty and exceptional students. The Hagler Institute has demonstrated a proven, affordable formula for advancing Texas A&M, as expressed in Vision 2020.

About Jon L. Hagler ’58

A 1958 graduate of Texas A&M University, Jon L. Hagler is recognized nationally as a leader in investment management as well as philanthropy. In 1984, he and wife Jo Ann founded the Jon L. Hagler Foundation, a private, independent foundation that has served as a financial supporter of Texas A&M as well as multiple philanthropic efforts across the nation.

Hagler has shown an interest in supporting overarching initiatives to elevate Texas A&M’s academic stature and long-term success. He is highly regarded and respected at the University for both his leadership and his contributions that have spanned decades.

Texas A&M recognized Hagler with an honorary doctorate in 2015 and with the 2005 Sterling C. Evans Medal for his dedication to philanthropy in supporting Texas A&M. He was named a Texas A&M Distinguished Alumnus in 1999 and is a past member of the Board of Directors of The Association of Former Students.

His many contributions include serving as a chair of the executive committee of the “One Spirit, One Vision Campaign” from 2000 to 2006; co-chairing the University’s 1999 strategic planning initiative, “Vision 2020: Creating a Culture of Excellence”; serving as past chairman and trustee emeritus of the Texas A&M Foundation Board of Trustees; and being the lead donor of the Texas A&M Foundation’s campus headquarters named in his honor.

Hagler has provided valuable leadership as a member of the Institute’s External Advisory Board since its formation and has—through his generosity—helped ensure that the Institute will forever be a part of Texas A&M.

Hagler received his bachelor’s degree in agricultural economics in 1958 from Texas A&M. He was Corps of Cadets commander during his senior year and served as a Ross Volunteer. He earned an MBA from Harvard University in 1963.
One hallmark of a great university is to offer its students opportunities to work with the world’s finest academic minds and for its faculty to conduct transformational research to benefit humankind.

Faculty Fellows collaborate with Texas A&M’s own stellar faculty–researchers and with rising stars among the University’s junior faculty and graduate students. Those collaborations offer participants opportunities that could fundamentally enhance their career options.

During their time on campus, Faculty Fellows engage in intense research. They set goals with faculty members, interact with students, and present public lectures in the Hagler Institute’s Distinguished Department Lecture Series. In addition, one Faculty Fellow is chosen each semester to present the Eminent Scholar Lecture. The annual influx of talent enriches our intellectual atmosphere, enhances the quality of our programs, accelerates solutions to difficult research problems, and enhances Texas A&M’s reputation as a top-tier research university.

The Hagler Institute for Advanced Study serves as a standard of excellence for our academic and research community.
Although the Institute is not designed to recruit permanent faculty, the time in residence gives Faculty Fellows a valuable look at the opportunities and research facilities of this great institution.

9 of 61

Scholars in the first seven classes have chosen to join Texas A&M’s permanent faculty:

1. Harold Adams  
   RKTL International
2. Leif Andersson  
   Uppsala University, Sweden
3. the late Christodoulos Floudas  
   Princeton University
4. the late Karl Hedrick  
   University of California, Berkley
5. Roger Howe  
   Yale University
6. James E. Hubbard  
   University of Maryland
7. Robert Kennicutt, Jr.  
   University of Cambridge, England
8. Alan Needleman  
   University of North Texas
9. Robert Skelton  
   University of California, San Diego

Select memberships and accolades

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In its first seven years, the Hagler Institute for Advanced Study has brought sixty-one Faculty Fellows to Texas A&M University.

The chart on the right shows the number of nominees the Institute received from each college or school in its first seven years, the number of those nominees approved for recruiting, and the number of those approved who were then recruited.

Each college or school’s participation in the Hagler Institute’s mission is best measured by the number of its nominations of Faculty Fellows. Each college and school may submit 2.5 nominations per call for nominations (the half arising when two colleges share a nominee’s time on campus). That system favors smaller colleges because the number of nominating slots is not linked to college size.

The chart clearly shows that the College of Science and the College of Engineering have attracted the most Faculty Fellows. That outcome is a result of those colleges’ significantly greater number of nominations. The nominations with respect to faculty size in the colleges are not measured in this chart.

A revolving panel of nine A&M University Distinguished Professors—the Institute’s Faculty Advisory Board—can evaluate Faculty Fellow recruiting eligibility only from nominations received. The composition of the Faculty Fellows mirrors the composition of nominees from the colleges.

Nominees must hold the equivalent of at least national academy-level stature in their discipline. Not all fields have such academies, of course, so the Faculty Advisory Board always conducts “apples versus oranges” comparisons across disciplines. The chart, however, shows that the Hagler Institute has developed a rigorous process to evaluate nominees that does not discriminate against disciplines that lack national academies. The chart shows that most colleges, even those without academies, are submitting high-quality nominations as measured by the high proportion of nominees approved for recruitment.

For example, the Faculty Advisory Committee has approved every nominee for recruitment to the Mays Business School. The College of Liberal Arts has had eight of nine nominees approved. Approval does not guarantee recruitment, which is always challenging and depends on many factors.
“The easily observable impact of bringing Faculty Fellows to campus are journal articles and conference presentations co-written with our faculty and students, grant participation, lectures to students, additional national and international exposure to Texas A&M, among others. But the most important facet of their interactions on the A&M campus is inspiration.”

– John L. Junkins
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4. Amanda Scott
   Assistant Director

“I HONESTLY BELIEVE FROM AN ACADEMIC STANDPOINT THIS INSTITUTE WILL DO MORE FOR A&M THAN ANY PROGRAM IN HISTORY.”

– Bill E. Carter
Hagler Institute Advocate
Distinguished Former Student
seats on the Faculty Advisory Board are chosen by the University’s provost and the vice president for research. The remaining six seats are chosen by the Electorate from among its members.

Each year, the Faculty Advisory Board reviews all Faculty Fellow nominations submitted.

Board Members terms expire on November 30.

The Board ensures that the nominees:

1. have obtained prominence in their chosen fields
2. have made major contributions to those fields
3. possess outstanding mentorship qualities.

2019
R. Duane Ireland
University Distinguished Professor
Mays Business School

Olga Kocharovskaya
University Distinguished Professor
College of Science

J. N. Reddy
University Distinguished Professor
College of Engineering

2020
Ronald DeVore
University Distinguished Professor
College of Science

Marcia Ory
University Distinguished Professor
School of Public Health

Ignacio Rodriguez-Iturbe
University Distinguished Professor Emeritus
College of Engineering

2021
Joe Feagin
University Distinguished Professor
College of Liberal Arts

Marlan O. Scully
University Distinguished Professor
College of Science

James E. Womack
University Distinguished Professor, Emeritus
College of Veterinary Medicine & Biomedical Sciences
As each Faculty Fellow is inducted they are presented with Rodin’s statue of “The Thinker.”

– Mark A. Barteau, Vice President for Research
Texas A&M University

2012–2018 FACULTY FELLOWS

BY YEAR

- 2012–2013
- 2013–2014
- 2014–2015
- 2015–2017
- 2016–2017
- 2017–2018
- 2018–2019

Vanderlei S. Bagnato
University of Sao Paulo

William G. Unruh
University of British Columbia

Yonggang Huang
Northwestern University

Michael J. Duff
Imperial College London

Robert D. Putnam
Harvard University

Vincent Poor
Princeton University
"IDEAS ARE GLOBAL, TALENT IS GLOBAL, AND THE CHANCE TO BRING SOME OF THE FINEST MINDS IN THE WORLD TO TEXAS A&M, AS ENABLED BY THE INSTITUTE, ELEVATES THE LEVEL OF DIALOGUE AND THE INTELLECTUAL ACTIVITY AND EXCITEMENT OF THE ENTIRE CAMPUS."

– Mark A. Barteau, Vice President for Research
Texas A&M University
2012-2018
FACULTY FELLOWS

2017-2018

Vijay K. Dhir
University of California, Los Angeles
National Academy of Engineering
Lifetime Achievement Award
International Conference on Computational and Experimental Engineering
RESEARCH: Fundamental and applied sciences involving boiling

Richard A. Dixon
University of North Texas
National Academy of Sciences
GP Scientific Prize
Groupe Polyphenols
RESEARCH: Metabolic engineering of plants

Richard A. Epstein
New York University School of Law
American Academy of Arts and Sciences
Bradley Prize
Lynde and Harry Bradley Foundation
RESEARCH: Legal theory property, torts, and employment

Tom Ginsburg
University of Chicago
American Academy of Arts and Sciences
Tribece Disruptive Innovation Award
RESEARCH: Multidisciplinary social scientific analysis to comparative constitutional law

James E. Hubbard Jr.
University of Maryland
National Academy of Engineering
Lifetime Achievement Award
Society of Photonics and Instrumentation Engineers
RESEARCH: Designs, develops, and defines the state of the art in robotic platforms

Thomas J. Stipanowich
Pepperdine University
American College of Commercial Arbitrators (founding fellow)
D’Alembert-Raven Award and Lawyer as a Problem Solver Award
American Bar Association
RESEARCH: Commercial arbitration and dispute resolution

Jerry Tessendorf
Clemson University
Academy Award for Technical Achievement
Academy of Motion Picture Arts and Sciences
Thirty-nine Feature Film Credits
RESEARCH: Fluid simulations in computer graphics for motion pictures

2016-2017

Christopher C. Cummins
Massachusetts Institute of Technology
Ludwig Mond Award, Royal Society of Chemistry
American Academy of Arts and Sciences
RESEARCH: Synthetic chemistry, inorganic synthesis methodology

Ingrid Daubechies
Duke University
National Academy of Engineering
National Academy of Sciences
RESEARCH: Wavelets, mathematical methods

Gerald Galloway
University of Maryland
National Academy of Public Administration
National Academy of Engineering
RESEARCH: Civil engineering, flood plain management

Huajian Gao
Brown University
National Academy of Engineering
William Prager Medal, Society of Engineering Science
RESEARCH: Mechanical and biological engineering

Maryellen Giger
The University of Chicago
National Academy of Engineering
Academic Career Achievement Award, Engineering in Medicine and Biology Society
RESEARCH: Computer-aided diagnosis, digital signal and image processing

Robert Kennicutt Jr.
University of Cambridge
National Academy of Sciences
American Academy of Arts and Sciences
RESEARCH: Astronomy, star formation and galaxies

Charles E. Kolb
Aerodyne Research Inc.
National Academy of Engineering
American Association for the Advancement of Science
RESEARCH: Atmospheric chemistry, air quality, and climate

V. Kumar
Georgia State University
Don Lehmann Awards (4), American Marketing Association
Paul H. Root Awards (3), Marketing Science Institute
RESEARCH: Marketing research methods, customer relationship management

William M. Sage
The University of Texas at Austin
National Academy of Medicine
The Academy of Medicine, Engineering and Science of Texas
RESEARCH: Law, national health care reform

Thomas S. Ulen
University of Illinois at Urbana-Champaign
Honorary Doctorate, Katholieke Universiteit Leuven, Belgium
Board of Directors (Founding Member), American Law and Economics Association
RESEARCH: Law, economics, legal, scholarship, and legal education
Faculty Fellows are recruited for visiting appointments that will last from three to twelve months, and may be spread over multiple years.
2012–2018 Faculty Fellows

CONT.

Robert Skelton
University of California, San Diego
National Academy of Engineering
Institute of Electrical and Electronics Engineers
RESEARCH: Systems and aerospace engineering

2013–2014

Leif Andersson
Uppsala University, Sweden
Wolf Prize in Agriculture
Foreign Associate Member, National Academy of Sciences (US)
RESEARCH: Animal genetics

Satya Atluri
University of California, Irvine
National Academy of Engineering
European Academy of Sciences
RESEARCH: Mechanical and aerospace engineering

Claude Bouchard
Louisiana State University
American Association for the Advancement of Science
Member, Order of Canada
RESEARCH: Genetics and nutrition

Christodoulos Floudas
Princeton University
National Academy of Engineering
RESEARCH: Chemical and biological engineering

Roy Glauber
Harvard University
Nobel Prize in Physics
National Academy of Sciences
RESEARCH: Quantum physics

Roger Howe
Yale University
National Academy of Sciences
American Academy of Arts and Sciences
RESEARCH: Mathematics

Robert Levine
University of Maryland
Jay B. Hubbell Medal for Lifetime Achievement in American Literary Scholarship
Outstanding Book Award, Choice Magazine
RESEARCH: Literary and comparative studies

Wolfgang Schleich
Ulm University, Germany
Academia Europaea
Austrian Academy of Sciences
RESEARCH: Theoretical and quantum physics

Peter Stang
University of Utah
National Academy of Sciences
American Academy of Arts and Sciences
National Medal of Science
RESEARCH: Organic chemistry

Aleda Roth
Clemson University
Distinguished Fellow, Manufacturing and Service Operations Management Society Fellow, Decision Sciences Institute Fellow, Production and Operations Management Society
RESEARCH: Global supply chain management

Vernon Smith
Chapman University
Nobel Prize in Economics
National Academy of Sciences
American Academy of Arts and Sciences
RESEARCH: Experimental economics

Katepalli Sreenivasan
New York University
National Academy of Sciences
National Academy of Engineering
American Academy of Arts and Sciences
RESEARCH: Mechanical engineering

2012–2013

Jay Dunlap
Dartmouth College
National Academy of Sciences
American Association for the Advancement of Science
RESEARCH: Genetics, biochemistry

Peter Liss
University of East Anglia, UK
Fellow, Royal Society
Academia Europaea
Commander of the Order of the British Empire
RESEARCH: Environmental sciences

Alan Needleman
University of North Texas
National Academy of Engineering
American Academy of Arts and Sciences
Timoshenko Medal, American Society of Mechanical Engineers
RESEARCH: Materials science and engineering
SELECTED ARTICLES

“THE HAGLER INSTITUTE ENRICHES AND ENHANCES OUR QUEST FOR EXCELLENCE IN LEARNING, DISCOVERY, AND INNOVATION.”
– Michael K. Young, President, Texas A&M University

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NATIONAL ACADEMY OF ENGINEERING
FELLOW OF THE AAAS, ACM, IEEE, AND SIAM
FOREIGN MEMBER, RUSSIAN ACADEMY OF SCIENCE

Dongarra at his Eminent Scholar lecture in March of 2017 entitled, “Current Trends in High-Performance Computing and Future Challenges.”
About two decades ago, the idea was introduced that computational modeling and simulation represent a new branch of scientific methodology, sitting alongside theory and experimentation. That idea has since come to symbolize the enthusiasm and sense of importance that people in our community feel for the work we are doing.

But when we try to assess how much progress we have made and where things stand along the developmental path for this new “third pillar of science,” recalling the development of the other such pillars can help keep things in perspective. For example, we can trace the systematic use of experiment back to Galileo in the early seventeenth century. Yet, for all the incredible successes the experimental method enjoyed over its first three centuries, the method arguably did not fully mature until the elements of good experimental design and practice were finally analyzed and described by British statistician and geneticist R. A. Fisher and others in the first half of the twentieth century. In that light, it seems clear that—although computational science has had many remarkable, youthful successes—it is still at a very early stage in its growth.

Many of us today who want to hasten that growth believe that doing so will require more community focus on the core of computational science: software and the mathematical models and algorithms it encodes. Of course, the widespread obsession with hardware is understandable, especially given exponential increases in processor performance, the constant evolution of processor architectures and supercomputer designs, and the natural fascination that people have for big, fast machines. I am not exactly immune. But to advance computational modeling and simulation as a new part of the scientific method, the complex software “ecosystem” that requires must take center stage.

At the application level, the science has to be captured in mathematical models, which are expressed as algorithms and encoded as software. On typical projects, most of the funding goes to support this translation process that starts with scientific ideas and ends with executable software. Over its course, that process requires intimate collaboration among domain scientists, computer scientists, and applied mathematicians. It also relies on a large infrastructure of mathematical librar-
ies, protocols, and system software. That infrastructure takes years to build up and must be maintained, ported, and enhanced for many years to come if we are to preserve and extend the value of the application codes that depend on it. The resulting software routinely outlasts—usually by years and sometimes by decades—the hardware on which it was originally designed to run, as well as the individuals who designed and developed it.

High-performance computing (HPC) today, which encompasses what most people call “supercomputing,” requires hundreds of petaFLOP/s. That’s $100 \times 10^{15}$ floating-point operations per second (FLOP/s). We are nearing the next big milestone in HPC, known as the exascale computing era, in which HPC systems will run at 1018 FLOP/s or more. Exascale computing will benefit a variety of industries, including energy, pharmaceutical, aircraft, automobile, and entertainment. That improvement in computing capability will enable those diverse industries to more quickly engineer superior new products that could improve a nation’s competitiveness. Therefore, HPC will directly contribute to advancements in:

- weather and climate forecasting;
- oil exploration;
- biomedical research;
- high-end equipment development;
- new energy research;
- animation design;
- new material research;
- engineering design, simulation, and analysis;
- remote sensing data processing; and
- financial risk analysis.

In addition, considerable benefits will result from meeting the hardware and software challenges posed by HPC. Those benefits include enhancements to smaller computer systems and many types of consumer electronics—such as smartphones and cameras—as devices become smaller, faster, more fault tolerant, and more energy efficient.

Supercomputers used for computational science enable researchers to conduct simulations that can accelerate the pace of innovation while producing better designs. For instance, simulation already has enabled Goodyear to design safer tires much more quickly, Boeing to build more fuel-efficient aircraft, Cummins to build better diesel engines faster and less expensively, and Procter & Gamble to create better materials for home products. Simulation also accelerates the progress of technologies from laboratory to application.

Better computers produce better simulations and more confident predictions. The best machines today are 10,000 times faster than those of fifteen years ago (Figure 1) and the techniques of simulation for science and national security have improved.

In the future, exascale systems will be an entirely new breed. Not only will they be fast, they will also handle big data in new ways. They will open avenues for techniques in artificial intelligence (AI), data science, and simulations that can tease out new insights. The coming exascale era, in which an HPC system can perform a billion billion calculations per second, will be twenty to forty times more capable than what we are talking about today.
The design and operation of those immense resources are important and will lead to overcoming the most daunting scientific challenges the world has to offer:

Reducing pollution. More than 85 percent of the world’s energy is generated by burning fossil fuels. We can minimize pollution and optimize efficiency by understanding and controlling the chemical process of combustion. Through HPC, it should be possible to increase the efficiency of combustion systems in engines and gas turbines for transportation and power generation by potentially 25 to 50 percent while also lowering emissions.

Advances in materials science. To create certain new technologies and inventions, we need to discover new materials with specific properties. One crucial way is to use complex calculations to simulate how materials behave in nature. Doing so requires massive databases of known compounds to identify combinations that have the desired properties. Exascale computing will enable faster and more complex designs. For example, much more efficient, less expensive, and longer-lived batteries will be developed through the discovery of new materials. Batteries are important, not only for portable consumer electronics and electric automobiles but also for storing energy from variable energy sources, such as wind and solar, to ensure consistent power delivery.

New energy solutions. Solar energy will also be made more cost-effective through the discovery of materials that can more efficiently convert the sun’s rays to electricity. Wind turbines can be made more efficient and quieter through computer-based design of their blades. Simulations can also optimize the locations of individual wind turbines in wind farms to yield substantially more energy from the same number of turbines. Another challenge is to manage the electric power grid—such as when the wind dies down in the area of a wind farm. The electric power grid is complex and adjustments, such as firing up a fossil fuel generator, have to be made quickly to avert problems. Accurately predicting such events far in advance is not possible. Computationally intensive optimization methods can provide the needed guidance, but getting the results in time for them to be useful requires fast computers.

Advances in health care. Exascale computing will accelerate cancer research by helping scientists understand the molecular basis of key protein interactions and by automating the analysis of information from millions of cancer patient records to determine optimal treatment strategies. It also will enable doctors to predict and prescribe the best treatments for the patient by modeling drug responses. Those tasks are daunting. For example, predicting responses to drug combinations might require searching one trillion drug combinations.

Advanced biology. Exascale computing applications in biology might enable the prediction of feasible parameter values for dynamic models of metabolism. That ability would enable scientists to design organisms to perform a variety of tasks. Those models could contribute to the development of treatments for emerging types of infections.

Predicting severe weather. Weather models will be able to predict the timing and path of severe weather events, such as hurricanes, more rapidly and more accurately by using much higher spatial resolution, incorporating more physics, and assimilating more observational data (Figure 2).
Improving quality of life. The use of exascale computing in urban science promises to mitigate health hazards, reduce crime, and improve the quality of life in cities by optimizing how people choose to access and use infrastructure, such as transportation, energy, housing, and health care. Such optimization requires gathering and analyzing many types of data from sensors, existing databases, and simulation results, and then conducting thousands of potential simulations. The resulting analyses will be useful for planning new cities or neighborhoods as well as restructuring the infrastructure in existing large urban areas.

Advances in industry. Exascale computing also will provide capability benefits to a diverse array of industries, such as energy production, pharmaceutical research and development, and aircraft and automobile design. That will allow many industries to more quickly engineer superior products that could improve a nation’s competitiveness.

Currently, the Department of Energy has the most powerful supercomputer. In the summer of 2018, the department’s Oak Ridge National Laboratory unveiled Summit (Figure 3) as the world’s most powerful and smartest scientific supercomputer. With a peak performance of 200,000 trillion calculations per second—or 200 petaFLOP/s—Summit is eight times more powerful than Oak Ridge’s previous top-ranked system, Titan. Summit will provide unprecedented computing power for research in energy, advanced materials, and AI, among other domains, enabling scientific discoveries that were previously impractical or impossible.

A closer look at Summit (Figure 3):

- Summit’s file system can store 250 petabytes of data, or seventy-four years of high-definition video.
- More than 4,000 gallons of water pump through Summit’s cooling system every minute, carrying away about thirteen megawatts of heat.
- For some AI applications, researchers can use less precise calculations than FLOP/s, potentially quadrupling Summit’s performance to exascale levels, or more than a billion billion calculations per second.

Summit and Titan before it are a result of a twenty-year effort to maintain the U.S. nuclear weapons stockpile without actually detonating a nuclear weapon for testing. That effort drove the Department of Energy to develop computers that could model nuclear processes down to tiny fractions of a second. Achieving that goal meant raising the processing speed of the world’s best computers by a factor of 10,000. The windfall of other scientific discovery and innovation from those vast re-
sources, however, are what will push HPC and computational science to exascale.

Beyond exascale is the promise of quantum computing. Large-scale quantum computers could theoretically solve certain problems much more quickly than any classical computers using even the best currently known algorithms. Integer factorization, which underpins the security of public key cryptographic systems, is believed to be computationally infeasible with an ordinary computer for large integers if they are the product of few prime numbers. By comparison, a quantum computer could efficiently solve that problem to find its factors. However, many challenges must be overcome before quantum computers are a reality for practical computations.

In any case, every time computing power increases by large factors, new benefits open before us. The benefits of exascale computing—as diverse as creating novel, more efficient combustion engines and new energy solutions and making advances in health care, biology, and storm prediction—will flow not just from classical simulations but also from large-scale data analysis, deep-machine learning, and often the integration of all three methods. This third pillar has become indispensable in modern science and, with the ongoing efforts of computational scientists and engineers, will continue to scale. Future generations will reap the windfall.

**ABOUT DONGARRA:**

As an internationally recognized scholar in numerical algorithms for linear algebra, parallel computing, the use of advanced-computer architectures, programming methodology, and tools for parallel computers, Jack Dongarra conducts research in the development, testing, and documentation of high quality mathematical software. Dongarra is known for his work in the development of the LINPACK and LAPACK libraries, which have provided the benchmark for the world’s 500 fastest computers since 1993.

Dongarra is a member of the National Academy of Engineering and is a fellow of the American Association for the Advancement of Science (AAAS), the Association for Computing Machinery (ACM), Institute of Electrical and Electronics Engineers (IEEE), and the Society for Industrial and Applied Mathematics (SIAM). His research has strongly influenced software packages that efficiently and effectively solve many complex equations that support applications within high performance computing. He also established standards and methods in parallel processing and programming that proved critical in the advancement of high performance computing systems.

Dongarra directs the Innovative Computing Laboratory and is also the director of the Center for Information Technology Research at the University of Tennessee. He is a member of the Distinguished Research Staff Oak Ridge National Laboratory, a Turing Fellow at Manchester University in England, and an adjunct professor in computer science at Rice University.

Dongarra earned his doctorate in applied mathematics from the University of New Mexico. He worked at the Argonne National Laboratory before joining Tennessee.

He has published an estimated 200 articles, papers, reports, and technical memoranda and has co-authored several books.

*Dongarra collaborated with faculty and students in the College of Engineering’s Department of Computer Science and Engineering.*
We are privileged to live in an era of unprecedented discovery in astronomy—one that includes the birth of a new cosmological paradigm, the discovery of thousands of planets around stars other than our own, and the return of astounding spacecraft images from planets, moons, asteroids, and comets in our solar system.

Although some of those breakthroughs are marked by singular, instantly recognized events, others build only gradually, through a series of smaller but no less profound discoveries. Chief among those are the “origins” questions in astronomy: How did our universe come into being? How were galaxies formed, and how have they evolved over cosmic time? How did our Sun, planets, and exoplanetary systems form and evolve? Do life and intelligence exist elsewhere in the universe?

Those last questions about life await the work of future generations, but over the past two decades we have made enormous progress in answering the others. Even more remarkably, a single theoretical framework has emerged to link all those life cycles, galaxies, stars, and the universe itself. Much of my research and that of my Texas A&M University colleagues is devoted to that problem, and here I share a glimpse at what we have learned.

### RECONSTRUCTING THE HISTORIES OF GALAXIES AND THE UNIVERSE

Piecing together life histories of galaxies and the universe poses an enormous challenge because the distances (billions of trillions of miles) and time scales (13 billion years) involved are so far removed from human experience. Despite those handicaps, we have followed several trails of observational evidence to build the broad outlines of this picture.

One set of clues comes from studying individual stars and stellar aggregates in the Milky Way, using their ages, chemical makeup, and orbits to reconstruct a kind of fossil record of our galaxy. The Milky Way is a typical flattened spiral galaxy, and we have identified two distinct age components. In the main spiral, disk

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**FIGURE 1. HUBBLE SEQUENCE**

(as illustrated) (as photographed)
stars have been forming almost continuously from the Milky Way’s formation more than 10 billion years ago. Our own solar system formed at roughly the midpoint of that history. That star formation is ongoing today, in gas-rich regions such as the Orion Nebula. The history is different when we observe stars in the central bulge of our galaxy or in its thin outer halo. The stars appear to be almost uniformly old, with typical ages of 10 billion–13 billion years, sometimes nearly as old as the universe itself (about 13.5 billion years).

At one time those patterns were thought to result from a single monotonic formation sequence in which the stars in the halo and bulge traced the initial collapse and formation of the Milky Way. The disk formed afterward from the remaining gas and has generated stars ever since. Recent evidence however, suggests a more complicated formation scenario. When examined in more detail, the halo of the Milky Way breaks up into discrete streams of stars, which are the tidal debris of other dwarf galaxies that have fallen into the Milky Way and been incorporated into its halo. That buildup of galaxies from the accretion and mergers of smaller bodies will be a recurring theme in this story.

Much of my own research has been directed at building the tools to measure the properties of star formation in other galaxies, both nearby and at cosmological distances. The results show that the “Hubble sequence” of spheroidal, spiral, and irregular galaxies forms an evolutionary sequence (Figure 1). Nearly all galaxies seem to have formed their first stars soon after the Big Bang. But whereas the spheroidal, massive elliptical galaxies tend to be composed of nearly all old stars, like the central bulge and halo of the Milky Way, the spiral and irregular galaxies form a sequence of systems where star formation continues today, with rates tightly correlated with their masses and gas contents.

The observations also reveal a tiny minority (1–2 percent) of galaxies that do not fit at all into the patterns along the Hubble sequence. Instead, they are undergoing extraordinarily active bursts of star formation—often hundreds of times higher than that in the most massive normal galaxies—concentrated into tiny regions around their centers. Those “starburst” galaxies invariably prove to be the results of collisions or mergers between massive gas-rich galaxies. Their bursts are so violent that the energies released by their thousands of nearly simultaneous supernova explosions are expelling most of the remaining gas away, effectively switching off future star formation (Figure 2).
Other clues come from the most distant observable galaxies in the universe. Light has a finite speed, so if we observe successively more distant galaxies we are seeing objects as they were further in the past. Over the past twenty years, the Hubble Space Telescope has been pushing that observational horizon further back. We now have measurements of thousands of galaxies ranging in observed age from a few hundred million years after the Big Bang to the present epoch. The data reveal a fascinating picture. Galaxies such as those we see today can be traced back several billion years, but star formation in those galaxies was far more intense in the past, growing to a broad peak of activity 5 billion–10 billion years ago, when galaxies were growing and building stars at least ten times faster than today. If we probe even further into the past, the levels of galaxy building and star formation decline again and galaxies like those in the universe gradually disappear, being replaced by smaller, distorted fragments of gas and stars (Figure 3). Those fragments represent early building blocks that condensed and merged to form today’s Hubble sequence of galaxies. We have yet to observe the first galaxies or stars, simply because the Hubble Space Telescope cannot see that far into the past.

Connecting the Pieces with Theory and Numerical Simulations

By now it should be apparent that galaxies are such varied and complex systems that it is not yet possible to construct a theory that fully describes their formation and evolution. The physics is simply too complicated. Even so, the physics governing the dominant constituent of galaxies—dark matter—is relatively simple. Dark matter particles appear to follow the laws of gravity and are unaffected by the other forces of nature, so their behavior can be simulated computationally by using large N-body codes. Such simulations provide a remarkably accurate description of the large-scale structure of the universe as well as the foundation for more sophisticated simulations of galaxies themselves.

In this picture, all the structure seen in the universe arose originally from tiny quantum fluctuations in the primordial soup of particles in the first instants of the Big Bang itself. As the universe expanded and cooled, first through a rapid cosmic inflation and then the slower expansion we see today, those fluctuations grew under gravity, and by a few hundred thousand years after the Big Bang they had grown to a level of a few parts per million. We observe the manifestations of those fluctuations today through the fine structure in the cosmic microwave background radiation, a highly redshifted flash of radiation emitted when the universe was about 1/1,000 of its present age. As the universe continued to expand and cool, those tiny fluctuations grew further, first into filaments of dark matter (with gaseous ordinary matter following along). Where filaments intersected, the seeds of galaxies began to form. Over the past 13 billion years, that process of coalescence, condensation of protogalaxies, and the accretion and mergers of small galaxies into larger objects has continued.
How did our universe come into being? How were galaxies formed, and how have they evolved over cosmic time? How did our Sun, planets, and exoplanetary systems form and evolve? Do life and intelligence exist elsewhere in the universe?
FIGURE 4. GALAXIES SIMILAR TO THE MILKY WAY

Figures showing galaxies at different billions of years ago.

FIGURE 5. BLUE VS. RED GALAXIES

Figures showing blue and red galaxies.
cold dark matter predict a structure that shows stunning agreement with the observed cosmic structure.

Simulating the formation and growth of galaxies is far more challenging, requiring higher resolution and methods to incorporate nongravitational processes such as gas cooling, star formation, and feedback of energy from star formation. Those last processes are too complicated to model or simulate directly, so the modelers feed the simulations with data from observed relations (such as star formation).

Perhaps the best known of those is a tight relationship between the rate at which stars form and the density of cold gas in the galaxies, a relation that appears to hold uniformly over the full range of galaxies and cosmic epochs (Figure 4), known as the Kennicutt–Schmidt law (I didn’t name it!). The outputs from those models are often stunning, producing simulated galaxies that only a trained expert can distinguish from real objects (Figure 5). The models all have limitations and cannot reproduce every observed property or scaling law. They bring powerful new tools. For example, those tools make it possible to trace the evolution of a present-day object backward in time and to reveal the history of accretion and merger events that led to its formation and growth.

The future of that embryonic subject is bright. As the successor to the Hubble Space Telescope, the James Webb Space Telescope will obtain deep images and spectra of the sky at infrared wavelengths and is designed to detect the first stars and galaxies. Other large radio telescopes and arrays on the ground will trace the histories of gas accretion and star formation. More powerful simulations will help refine the theoretical picture. Perhaps the most important lesson already has been learned—namely, that the processes linking the formation of stars, galaxies, and our universe are intimately linked in what can truly be regarded as a cosmic ecosystem.

COLLABORATIONS:
Casey Papovich, professor, Department of Physics and Astronomy, College of Science

Kim-Vy H. Tran, professor, Department of Physics and Astronomy, College of Science

Benjamin Forrest, Hagler Institute for Advanced Study Heep Fellowship, Department of Physics and Astronomy, College of Science

Vincent Estrada-Carpenter, Hagler Institute for Advanced Study Heep Fellowship, Department of Physics and Astronomy, College of Science

The Department of Physics and Astronomy, College of Science

ABOUT KENNICUTT:
Best known for his work on the Kennicutt–Schmidt law—which relates gas density to star-formation rates—Robert Kennicutt Jr. studies star formation and the chemical evolution of galaxies. He also is known for his role in constraining the value of the Hubble constant, the unit of measurement that astronomers and astrophysicists use to describe the expansion of the universe.

Kennicutt served as co-leader on a scientific team that definitively measured the expansion of the universe. His current research includes developing methods to characterize the evolution of distant galaxies as well as high-redshift galaxies (those moving away from our solar system).

He earned his doctorate in astronomy from the University of Washington and served as a Carnegie Postdoctoral Fellow at Hale Observatories.

Kennicutt has served on the faculty of the University of Minnesota, the University of Arizona, Steward Observatory, and the University of Cambridge. He received the Plumian Chair of Astronomy and Experimental Philosophy professorship at Cambridge, a Professorial Fellowship at Churchill College, and director of the Institute of Astronomy.

He is a member of the National Academy of Sciences, the American Astronomical Society, the International Astronomical Union, and the Astronomical Society of the Pacific and is a fellow of the Royal Society in the United Kingdom and the American Academy of Arts and Sciences.

Kennicutt is the author of four books and more than 380 articles in peer-reviewed publications, which have been cited more than 42,000 times.
V. KUMAR
2016-2017 HAGLER FELLOW
Regents Professor
Richard and Susan Lenny Distinguished Chair Professor of Marketing
J. Mack Robinson College of Business
Georgia State University
That not only presents firms with opportunities to actively shape their relationships with customers, but also enables them to explore newer ways to maximize the value from the relationships. However, value from customers reflects two key characteristics that often are of concern to firms. First, all customers do not contribute the same amount to the firm. That creates challenges for firms in allocating cross-customer resources that are in sync with customers’ value-creation potential. Second, customer contributions are not always uniform. As a result, firm profitability is exposed to volatility and vulnerability that can hamper overall firm profitability and growth. So, how can firms create value from customers, and what approach do they use to value customers?

**OF BULLS AND BEARS**

Because firms generate value from customers, they consider customers to be assets. Therefore, for managing customer assets, that approach would suggest that investing in customers may work on similar strands as investing in stocks. So on the basis of the following three similarities, one can make a case for adapting financial theories and practices to suit the marketing milieu. Specifically, as with stocks or bonds, (a) firms invest in those customers who show the highest potential for future growth, (b) a portfolio of customers can be constructed to manage risks, and (c) rebalancing the portfolio of customers can ensure maximum future gains. Such similarities could lead one to surmise that financial theories can be used to manage customer value. However, on scrutiny, the stock valuation principles differ significantly from those governing customer assets.
from those of customer valuation principles. In brief, the following differences are noteworthy:

- Unlike customers, it is possible to invest as much money into stocks and achieve a higher return indefinitely. For instance, customers’ needs are satisfied at some point. As a result, an indefinite investment in customers does not lead to higher levels of firm profitability.
- Information about how long a stock (and the firm) will exist has some certainty, but no such conclusion can be made about customers, since customers are free to move to competition at any time (except when bound by a contract).
- Unlike customers, routine buying and selling of stocks connotes an active portfolio management practice. Firms do not have the luxury of “hiring” and “firing” customers.
- The impact of investments on customers may reflect on the value of stocks and ultimately on firm value. However, investments in stocks have a limited observable impact on the value of customers.
- From a risk management standpoint, it is easier to identify, and therefore manage, the risks through diversification by reconfiguring the financial portfolios. However, although firms may be able to identify the risks from customer contributions, firms are not in a position to reconfigure customer portfolios to manage customer risks.
- The importance of investor sentiment is higher in the valuation of stocks than in the valuation of customers. That is, firms do not value their customers according to sentiments.
- Whereas speculation plays an important role in valuing investments in stocks or bonds, it does not in valuing a customer. For instance, firms do not invest in customers on the basis of a speculative outlook.
- Unlike customer management, financial management practices are passive because they accord a binary decision choice, invest or divest, regarding investments in stocks or bonds according to future discounted cash flows. For instance, in managing customers, firms require an active approach because they do not have the option of “divesting” their customers.
- Unlike customer returns, a more accurate prediction of stock returns is possible only in the long run. On the contrary, the prediction of customer value is more accurate in the short run than in the long run.

In light of those differences, financial theories and applications are unlikely to serve firms well in managing customer value, despite customers’ being assets of the firm. That is, managing customer assets and managing financial assets operate on different principles. So, how can firms manage customer value that is uniquely suited to the marketing function?

**The Future Looks Green**

One way to manage customer value is to develop an accurate approach to model the future value contribution of customers. In that regard, the following general form of customer future profitability (CFP) has been presented (Kumar 2018):

\[
\text{CFP}_{i,t} = f(\text{Transaction behavior}_{i,t}, \text{Marketing cost}_{i,t-1}, \text{Demographic/firmographic variables}_{i,t}, \text{Economic and environmental factors}_{i,t})
\]

where, \(\text{CFP}_{i,t}\) refers to customer future profitability of customer \(i\), at time \(t\). Specifically:

- The transaction behavior (i.e., exchange characteristics) broadly includes all past and current transaction variables that affect and influence the customer–firm relationship. Therefore, the customer transaction activities significantly influence CFP.
- The marketing cost can include, among others, past, current, and future promotional costs (toward customer acquisition, retention, and win-back), technology upgrades, service improvements, employee management, and quality control. All those activities significantly affect (in a nonlinear fashion) CFP.
- The demographic/firmographic variables refer to the distinguishing characteristics of the customer, whether as an end user or a business customer. Those variables can aid firms in characterizing attractive segments into identifiable and measurable groups of customers and therefore significantly influence CFP.
- The economic and environmental factors help determine the overall consumption pattern of a country and therefore significantly influence CFP.

In other words, the CFP at a given time depends on (a) the past and current transaction behaviors exhibited by
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Customer Valuation Theory: A New Way Forward

Earlier discussions on the principles of customer valuation and the CFP approach can be distilled into the customer valuation theory (CVT). CVT is a mechanism to measure the future value of customers on the basis of their direct economic value contribution, the depth of the direct economic value contribution, and the breadth of the indirect economic value contribution by accounting for volatility and vulnerability of customer cash flows. Accordingly:

1. The direct economic value contribution refers to the economic value of the customer relationship to the firm, expressed as a contribution margin or net profit.
2. The depth of the direct economic value contribution refers to the intensity and inclusiveness of customers' direct value contributions to the firm through their own purchases resulting in significant financial results for the implementing firms.
3. The breadth of the indirect economic value contribution refers to customers' indirect value contributions to the firm through their referral behavior, online influence on prospects' and other customers' purchases, and feedback on the firm offerings.

Implementing the CVT would secure improvements in marketing productivity and higher firm value through (a) valuing customers as assets, (b) managing the portfolio of customers, and (c) nurturing profitable customers, as shown in Figure 1.

**FIGURE 1. IMPLEMENTING THE CUSTOMER VALUATION THEORY (CVT)**

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Metrics</th>
<th>Strategies</th>
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<tbody>
<tr>
<td>Valuing Customers as Assets</td>
<td>Managing Portfolio of Customers</td>
<td>Nurturing Profitable Customers</td>
</tr>
<tr>
<td>Measure future customer profitability</td>
<td>Create portfolio of customers</td>
<td>Build customer relationships</td>
</tr>
<tr>
<td>Augment future customer profitability with targeted strategies</td>
<td>Identify value segments on the basis of augmented customer value</td>
<td>Inculcate an interaction-oriented approach to manage customers</td>
</tr>
<tr>
<td>Monetize customers' referral behavior, online influence and feedback potential</td>
<td>Maximize customers' referral behavior, online influence and feedback potential</td>
<td>Develop strategies toward building customer engagement</td>
</tr>
</tbody>
</table>

the customer, (b) the marketing efforts of the firm to that customer, (c) the identity and profile of the customer (i.e., demographic variables), and (d) the environment in which the customer exists (i.e., economic and environmental factors). In addition to modeling CFP, business intelligence software systems can be used to score CFP, update customer information, and rescore CFP periodically. Technology also can be incorporated to target customers in real time through relevant messages to increase future cash flows. So how can such a valuation approach be put to work?

**CUSTOMER VALUATION THEORY: A NEW WAY FORWARD**

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As shown in Figure 1, unpacking the various components of the CVT is important in driving firm value.

**Valuing Customers as Assets**

Here, concepts such as customer assets and conceptualizing customer value are developed. Because customers pose risks in terms of generating returns in the future, the volatility and vulnerability affect overall financial performance. However, the impact of those risks on customer profitability is not uniform across all customers. That entails identifying future customer profitability and designing marketing guidelines that will advise managers on profitable customer management. Specifically, that can be understood along the following lines:

- **Direct economic value contribution.** Some customers are more profitable than others. That is a simple truth in customer management. In addition, customers who are profitable now do not necessarily continue to be so. In such a case, how can firms accurately measure the future profitability of their customers? The customer lifetime value (CLV) metric which refers to the present value of future profits generated from a customer over his or her lifetime with the firm—provides a more reliable estimate of customer profitability than other comparable metrics (Reinartz and Kumar 2003). The CLV metric helps the firm in identifying opportunities to contain the variation in returns, also known as cash flow volatility, and thereby the total risk of changes in the value of the firm (Venkatesan and Kumar 2004; Shah et al. 2017).

- **Depth of direct economic value contribution.** Computing CLV is only one part in managing customer profitability. Augmenting the CLV with related strategies that can maximize customer future profitability will help enhance firm value (Kumar and Shah 2009). Further, Kumar (2008) generated a portfolio of strategies (known as the “Wheel of Fortune” strategies) that has enabled firms to address marketing issues with greater confidence and ensure better decision making. The portfolio of strategies consists of the following: (1) identifying the “right” customers to manage, (2) ensuring that customers are loyal and profitable, (3) optimal allocation of marketing resources, (4) ensuring that customers buy across multiple product categories, (5) deciding the timing of a product offering to a customer, (6) identifying profitable prospects to acquire, (7) managing the product returns behavior, (8) managing multichannel shopping behavior, (9) linking investments in branding to customer profitability, (10) balancing customer acquisition and retention efforts to enhance firm profitability, (11) realigning firm focus around customers, (12) encouraging customer referral behavior, and (13) leveraging the CLV metric to increase shareholder value.

- **Breadth of indirect economic value contribution.** The CLV metric also can be applied to determine customers’ indirect profit contributions to the firm from their (a) referral behavior (i.e., the customer referral value, or CRV), (b) online influence on prospects’ and other customers’ purchases (i.e., the customer influence value, or CVI), and (c) review or feedback on the products and services they consume (i.e., the customer knowledge value, or CKV) (Kumar et al. 2010). By exploring such options, firms can increase their profit realizations and also expand their engagement opportunities with customers.

**Managing Customer Portfolios**

After the conceptualization of CLV, metrics can be developed to determine the value of customers. Such metrics advise firms on managing customer profitability and ensuring a healthy bottom line. That goal can be facilitated through creating and managing customer portfolios. That process can be understood as follows:

- **Direct economic value contribution.** Maximizing direct economic value contribution hinges on constructing a customer portfolio. By drawing on the fundamentals of modern portfolio theory, with some marketing-specific adjustments, firms can create customer portfolios. The modern portfolio theory seeks to eliminate unique risk by diversifying the stock portfolio through the constant buying and selling of stocks. But because customers cannot be acquired and divested at will, firms must constantly rebalance the allocation of resources (as determined by CLV), not “rebalance” customers themselves, such that enough resources are being leveraged toward the most profitable customers.

- **Depth of direct economic value contribution.** To identify the most profitable customer segments, a decile analysis can be performed that factors in both the net profits (i.e., baseline CLV) and the value added by the “Wheel of Fortune” strategies (i.e., augmented CLV). Both the most profitable customers and the customers most receptive to marketing efforts should be identified. Later, the
HOW TO GENERATE MORE VALUE FROM YOUR CUSTOMERS?

right communication channels and a customer contact strategy can be developed to extract more value from customers (Venkatesan et al. 2007).

- **Breadth of indirect economic value contribution.** In addition to considering the indirect profit contributions (CRV, CIV, and CKV), firms have also used the CLV metric to develop a host of other customer-focused marketing actions that can collectively help firms measure and maximize indirect customer contributions (see Figure 2).

The customer-focused marketing actions shown in Figure 2 must be managed independently because a customer could contribute in multiple ways. Further, firms must identify the ideal combination of direct and indirect value contribution from the metrics that yields the highest profits to the firm.

NURTURING PROFITABLE CUSTOMERS

Finally, the concepts and metrics discussed earlier lead to the establishment of strategies that will aid in growing customer value. In that regard, the CLV metric is ideal for firms aiming to grow and nurture customer profitability. When firms adopt a CLV-based approach, they can make consistent decisions over time, about (a) which customers and prospects to acquire and retain, (b) which customers and prospects not to acquire and retain, and (c) the level of resources to be spent on the various customer segments. That process can be understood along the following lines:

- **Direct economic value contribution.** Several firms have instituted loyalty programs on the following viewpoint: The more you spend, the greater the reward. That approach encourages loyalty, but does it also give importance to future customer profitability? The answer is not a clear yes. Research findings has shown that (a) loyal customers do not cost less to serve, (b) loyal customers consistently paid lower prices, and (c) customers who were attitudinally and behaviorally loyal were more likely to be active word-of-mouth marketers than those who were only behaviorally loyal (Reinartz and Kumar 2002). Therefore, building relationships (i.e., profitable customer loyalty) with those customers who provide the most value to the company and prioritizing the marketing efforts accordingly are essential.

- **Depth of direct economic value contribution.** A firm that implements strong customer engagement strategies will foster deeper commitment from its customers. Although the direct benefits of engagement are evident, the long-term and indirect value contributions are most notable. An engaged customer base will result in increased brand awareness and recognition. Even during recessions, when marketing efforts are curbed as a result of diminished budgets, an engaged customer base will pick up some of the slack and continue to promote the brand.

IN LIGHT OF THE ABOVE DISCUSSION, THE CVT IS RELEVANT FOR THE FOLLOWING REASONS, ESPECIALLY IN COMPARISON WITH THE APPROACH ADOPTED BY FINANCIAL THEORIES IN MANAGING ASSETS

The CVT implicitly accounts for customer risks (i.e., volatility and vulnerability in cash flows) when modeling future customer profitability. Thus, it focuses on how the

FIGURE 2. MAXIMIZING INDIRECT VALUE CONTRIBUTION

![Figure 2](image-url)
risks ultimately affect customer (and firm) profitability and treats it accordingly. Therefore, the CVT enables managers to identify and manage the diversifiable risks through tailored offerings by focusing on the drivers of customer value.

- Because the CVT focuses on customer profitability, it accounts for the variation in associated customer costs at the individual level.
- The CVT enables managers to monitor customer relationships and undertake necessary remedial measures. That is possible by dynamically managing the volatility and vulnerability in cash flows.
- The CVT-based strategies advise that managers better manage their acquisition and retention of profitable customers, which can then be used to actively refine and manage the customer valuation approach.
- Given the nonlinear nature of the investment-to-earnings relationship, the CVT uses an appropriate customer valuation approach, which is then reflected in the customer strategies that can be developed.

The CVT shows that by linking their actions to customer value and ultimately to firm and shareholder value, firms can begin to realize the potential of valuing customers as assets. However, firms would like to know about the benefits of adopting CVT. That is, why implement CVT?

**WHAT’S IN IT FOR ME?**

The CVT provides benefits not just for firms but also for other entities involved in a business exchange. Specifically, the benefits can be observed in the following areas:

**To firms.** A firm that adopts CVT will be able to attract and retain the most valuable customers, nurture the customer–firm relationship, improve its products and services to meet customer expectations, and accurately predict customer responses. Doing so will maximize profit at every stage of business activity across all customers.

**To customers.** The CVT considers customers the unit of analysis for every marketing action. That, in turn, gives customers the avenues and incentives to connect (e.g., personalized and relevant product offerings) and collaborate with both the firm and one another.

**To employees.** In prioritizing the optimization of customer value, the CVT also values the existence of an engaged workforce that can effectively carry out firm-level strategies. Only an engaged workforce can successfully engage with customers.

**To the society.** Implementing CVT-based strategies affords members of society (a) the ability to express clearly their expectations to firms, (b) the opportunity to align with firms that match their needs and expectations expeditiously, and (c) the empowerment to exercise their choice, free will, and advocacy in all matters concerning the marketing transaction process.

**To the environment.** The CVT enables firms to allocate resources effectively and efficiently so that the right strategies are targeted toward the right customers. That approach results in less wasteful expenditures of valuable environmental resources and ensures improved sustainability.

Altogether, the CVT provides a strategic road map for firms to maximize value through their customers. Doing so results in an abundance of wide-ranging benefits—not only to the firm but also to customers, employees, society, and the environment.

In conclusion, using a CVT-based approach, firms can acquire and retain profitable customers, employ resources productively, and nurture profitable customers that would ultimately result in higher firm value.

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HOW TO GENERATE MORE VALUE FROM YOUR CUSTOMERS?


ABOUT KUMAR:
An acknowledged expert on marketing research methods, V. Kumar is considered a leading scholar in customer relations management, a field critical to every for-profit or nonprofit organization.

Kumar’s areas of interest include measuring customer lifetime value, modeling diffusion of wireless services, analyzing scanner data, developing new models and methods to forecast sales and market share, and identifying market segments. He conducts research in e-commerce, direct marketing, sales management, customer satisfaction, the Internet of things, engagement, and international marketing.

Kumar has provided thought leadership consulting on marketing research projects and has directed marketing research projects for companies. He is known for developing sophisticated statistical models and creative marketing strategies.

Kumar received a doctorate in marketing from The University of Texas at Austin.

Kumar has served on the faculty of the University of Iowa, the University of Houston, the University of Connecticut, and Georgia State University, where he also serves as the executive director for the Center for Excellence in Brand and Customer Management.

He is a member of the International Institute of Forecasters, the Academy of Marketing Science, and a fellow of the American Marketing Association.

Kumar has received numerous awards, including the Routledge–Taylor & Francis/Society for Marketing Advances Distinguished Scholar Award and the Academy of Marketing Science’s Cuto/Vector Distinguished Marketing Educator Award.

He has published more than 250 articles in leading academic journals and has been recognized with fourteen lifetime achievement awards.

Kumar collaborated with faculty and students in the Mays Business School.
When I was in graduate school in economics at Stanford University in the mid-1970s, the field of law and economics did not exist, although there were signs that this new field was about to emerge.

I, like many others, discovered the field through an intensive course in law for economists held on Key Biscayne in the summer of 1980 and organized by then-Dean Henry Manne of the University of Miami School of Law. The course was taught by some of the country’s most distinguished legal scholars and was an exhilarating intellectual experience. I returned to the University of Illinois and taught a course on law and economics in the economics department for several years before being invited to come to the law school to teach the subject. I was one of the first people in the nearly one hundred years of the University of Illinois College of Law to teach at the law school without a law degree. I experienced some growing pains in adjusting to the law school, and I’m certain that my students and colleagues were sometimes puzzled by what I might be doing. Other economists were invited to teach the course at leading law schools at about the same time—including Bob Cooter at the University of California, Berkeley; Charlie Goetz at the University of Virginia; Vic Goldberg at the University of California, Davis, and Columbia University; Al Klevorick at Yale University; Mitch Polinsky at Stanford; and Steve Shavell at Harvard University.
Before the appearance of law and economics as a single field, the two separate disciplines had touched only at certain obvious points, such as tax law and policy, governmental regulation of the economy, and the computation of money damages for legal wrongs. But the essence of the new field was the use of microeconomic theory to provide a new, nonphilosophical justification for, or critique of, prevailing legal doctrine in almost every area of the law. I’ll give examples shortly.

What led to the birth of that new academic field, and what made it prosper to become “the most important innovation in legal scholarship of the twentieth century”? The foundational work in modern law and economics was an article by the economist Ronald Coase (Figure 1), who was then teaching at the University of Chicago Law School. As with many sacred texts, many interpretations exist of Coase’s marvelous article. Two ideas stand out. First, as Coase showed, what the law considers to be one person’s illegally interfering with another person’s legally defined and protected rights is often what economics would consider an “externality”—a cost or benefit of one person’s activity that is imposed, without consent, on another person. An example would be when the sparks from a passing railroad locomotive fall onto and burn part of a cornfield next to the track. Second, in a related point, Coase considered why the two parties in those situations did not bargain to “internalize” the harm being done. Why didn’t the railroad offer to compensate the farmer for the corn that would be lost as a result of running the trains? The answer Coase gave was that they might be impeded from concluding a bargain by “transaction costs”—the costs of identifying someone with whom to bargain, negotiating with that person or entity, and enforcing the terms of the agreement.

Before Coase’s article, economists had not really considered the possibility that market exchanges might cost the traders time, effort, and resources. Rather, economists assumed that exchanges were costless.

But once you realize that some beneficial exchanges might be costly—including so costly that they might not take place—you have an important tool in hand to explain when voluntary exchange might or might not work. For example, a beneficial exchange might not occur if hundreds of people must consent before a transaction can take place because the costs of negotiating with all those people can be extraordinarily large. Recognizing
that, we might seek to reduce the transaction costs of getting the consent of hundreds by requiring that only a majority or a supermajority needs to consent for all to be bound. Or one might further try to reduce the transaction costs by appointing a single bargaining agent for the hundreds.

The notion of transaction costs and of externalities as explanations of law were so powerful that they led directly to the reexamination of much of legal theory. For example, scholars examined contract law as a way to reduce the transaction costs of mutually beneficial exchange. So, the legal rules for determining which agreements to enforce or not enforce, what information the parties should be required to disclose or withhold in negotiating a contract, what remedies to make available for failing to perform a contractual promise, and more could all be shown to be rules that facilitated contracting by reducing its transaction costs. Parties, led by their lawyers, could simply follow the rules of contract law and mutually consent to change only those rules that did not suit the present circumstances.

FIGURE 2. JUDGE POSNER

As a further example, legal scholars showed that the high transaction costs between potential victims and potential injurers explained the existence and doctrines of tort law (the law for determining liability for unintentional accident losses). How could a potential victim identify people who might injure him or her and bargain with those potential injurers to reach a contractual agreement for determining who would pay for accident losses if an injury occurred? The victim couldn’t; the transaction costs of concluding all those contracts are simply too high. Tort law was a clever way to induce all people (whether they might become an injurer or a victim) to take precautions to minimize their expected liability and, thereby, the social costs of accidents, per the formulation by Judge Guido Calabresi in The Costs of Accidents: A Legal and Economic Analysis (1970). Suppose that a legal standard of due care exists that specifies a particular amount of precaution that one ought to take. If an accident occurs and the injurer has complied with that standard, he is likely not to be liable for the victim’s injuries. That means that astute potential victims will take any precautions that are cost-effective (those that confer greater expected benefits than costs) because they want to minimize their own expected losses, which they will have to face if they are injured by someone who is complying with the legal standard of care and thus likely to be held not liable for the victim’s losses.

Throughout the 1970s and 1980s, legal scholars applied that style of economic analysis to every field in the law. One of the most important people who did so was a lawyer at the University of Chicago Law School named Richard A. Posner (Figure 2). His Economic Analysis of Law (whose first edition appeared in 1973; it is now in its ninth edition) became the leading text in the field. Judge Posner, appointed to the federal bench in 1981, has been one of the most prolific and influential legal scholars of his generation. Indeed, the field of law and economics was extremely fortunate to have such a marvelously skillful and clear expositor as it had in him.

During the 1980s, law and economics matured and began to influence legal education and legal policy. A separate course in law and economics became a standard part of many top law-school curricula. More important, law-and-economics concepts began to become a routine part of what was taught in the standard curriculum. For instance, many contract casebooks and classes began a student’s introduction to the subject by discussing “efficient breach of contract.”
That intellectual innovation also had practical effects. A younger generation of legal scholars went into practice equipped with the learning of law and economics that may have changed the practice of law. One possibility is that generations of young lawyers, using the tools of law and economics, may do a better job of anticipating and assigning risk in business deals, engage in more renegotiation if unexpected contingencies arise in contractual relationships, identify and bargain more skillfully to reduce transaction costs in legal relationships, and so on. One effect might be less litigation because of better transactions. In fact, researchers conducting careful empirical studies have already observed a steep decline in private litigation rates since the mid-1980s, although no one has explicitly related that decline to the rise of law and economics in legal education.2

Law and economics has also influenced policy disputes in and shifting practices of the criminal justice system. Economic analysis had long suggested that criminal sanctions might have a strong deterrent effect on crime. Specifically, the more certain, swifter, and precise those sanctions, the greater the deterrent effect. That insight (strengthened by the findings of much empirical research of the 1970s) led to state and federal statutes that replaced indeterminate with determinate sentencing—a change now reversing itself, for reasons we’ll see).

One of the most laudable characteristics of law and economics is that it has continued to grow. Two current trends in the field have extended what we know about the law. The first is empirical legal studies. That field brings statistical analytical techniques from the social and behavioral sciences to bear on legal issues.

The examples of empirical legal studies are numerous and important. As mentioned, the empirical work on the deterrent effect of criminal sanctions has been ongoing since the 1970s. In that literature, a particularly contentious issue has been the deterrent effect of the most severe criminal sanction—the death penalty. Professor Isaac Ehrlich famously found in the early 1970s that each execution of that penalty deterred at least seven later homicides. That finding had both critics and supporters, but no strong consensus.

In the early part of this century, a new set of studies came out that used the additional data of the 1980s and 1990s and such statistically fortuitous events as death penalty moratoria, such as that in Illinois in the first decade of the 2000s. In some of those new studies, researchers found huge benefits from executing the death penalty (savings of more than one hundred lives), but a consensus seems to be emerging that those claims were overblown and that the deterrent effect of the death penalty has not been proven.4,5

The second example of continued vitality is the rise of behavioral law and economics. First, some background: When economics was first brought to bear on law, the standard tools of microeconomics played a central role. Of those tools, perhaps the most striking was the economist’s use of the theory of rational choice. All decision makers were thought to know their likes and dislikes and to be able to predict the likely effect on their satisfaction or happiness of any bundle of goods and services or course of action. To most economists, that seemed like a useful and sensible simplifying assumption to make about human decision makers. But it struck many noneconomists, including most lawyers, as preposterous. As one law faculty member once said to me, “Who are these rational people you’re talking about?”

While the economics profession was using the trope of the rational man or woman, some cognitive and social psychologists were doing some fascinating experiments designed to see whether real people really behaved as the theory of rational choice predicted. Did people, in making current decisions, rationally ignore fixed costs and focus only on variable costs? No. They used both kinds of costs to decide what to do next: “I’ve invested a lot in this project already; if I pull out now, those costs are a complete waste.” Could people make accurate judgments about the likelihood of bad or good things happening to them? No. Typically people thought that they were much more likely than average to have good things happen to them and much less likely than average to have, say, bad health or divorce. In assessing the world, did they use objectively verifiable information, or did they use readily available information? Readily available information? Most people think murder, which is reported, is much more common than suicide, which is typically not reported. But suicide happens twice as often per year as murder. In assessing new information, do people weigh that new information for its intrinsic worth or as it fits in with their existing beliefs? They place much greater weight on information that supports their existing beliefs. As a result, opinions and beliefs are hard to change.
Those and related findings are due largely to the work of Daniel Kahneman (Figure 3) and Amos Tversky, two brilliant Israeli psychologists who performed experiments that illustrate two important correctives to the hypothesis of the rational man or woman.6,7 First, people make mistakes in judgment and decision making. Those mistakes are predictable, pervasive, systematically in one direction, and hard to overcome. We all make them, no matter how well educated, thoughtful, or experienced we are. They are not so much symptoms of irrationality as of our imperfect rationality.

Second, because those glitches in rationality are common, we should not begin our legal (or other social or behavioral science) analysis from the assumption that people are rational. Rather, the law should begin its analyses by incorporating the assumption that imperfectly rational individuals (and groups) are those whose behavior it is trying to guide. Consider criminal justice policy. We want to deter crime to minimize its substantial social costs. If one begins from a rational-choice presumption about human decision making, one sees criminal sanctions as deterring rational people. However, if one sees people as imperfectly rational—if they believe, for instance, that others may be caught committing a crime but that they will not—sanctions may not deter. And if, as further evidence suggests, incarcerated felons adjust to confinement fairly quickly and completely (in the sense of returning to their preincarceration level of subjective well-being within six months of going to prison), even the experience of imprisonment may not deter as much as we had believed it would.

The behavioral results are not theoretical. They are based on strong empirical investigations. Nonetheless, we are still at a relatively early stage of incorporating behavioral insights into our analysis of law. There are still many more experiments to be run and more knowledge to gather. The legal scholarly community is energized by the intellectual revolution that law and economics began. I assure you that we will know more and more about how people respond to law and about how best to structure the law to help people achieve their own and society’s goals.

7 Thomas S. Ulen. 2014. The Importance of Behavioral Law. The Oxford Handbook of Behavioral Law and Economics. Doron Teichman and Eyal Zamir, eds

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FIGURE 3. DANIEL KAHNEMAN
(b. 1934)
ABOUT ULEN:
Author of pioneering textbooks and journal articles, Thomas S. Ulen has devoted his career to examining a variety of issues related to economics, legal scholarship, and legal education. Thanks largely to Ulen’s work, the field of law and economics has become a dominant approach to analyze legal issues.

His highly regarded textbook, Law and Economics, is in its sixth edition and has been translated into Chinese, Japanese, Spanish, Korean, French, and Russian.

Ulen earned a doctorate in economics from Stanford University in 1979 and joined the faculty of the University of Illinois at Urbana–Champaign as an assistant professor of economics. He directed the Illinois Program in Law and Economics and in 2010 was named holder of the Swanlund Chair Emeritus, one of the highest endowed titles on the campus. In addition, he is Professor Emeritus at the University of Illinois College of Law.

Ulen is a founding member of the American Law and Economics Association, a member of the American Economic Association, and an associate member of the American Bar Association.

Ulen received an honorary doctorate from the Catholic University of Leuven, Belgium, and was a visiting fellow in 2005 at the Max Planck Institute in Bonn, Germany.

Ulen cowrote two books and has published more than eighty articles in peer-reviewed journals and nineteen chapters for books. He has served on the editorial boards of several professional journals.
2018–2019

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“THESE FACULTY FELLOWS WILL ENGAGE OUR FACULTY AND STUDENTS IN RESEARCH THAT CUTS ACROSS THE ACADEMIC SPECTRUM TO APPLY A MULTIDISCIPLINARY APPROACH TO SOLVING GLOBAL PROBLEMS.”

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Northwestern University

Cameron Jones
Monash University

Stefan H. E. Kaufmann
Max Planck Institute for Infection Biology

H. Vincent Poor
Princeton University

Robert D. Putnam
Harvard University

Andrea Rinaldo
École Polytechnique Fédérale de Lausanne

William G. Unruh
University of British Columbia

DISTINGUISHED LECTURER

Joseph William Singer
Harvard Law School
VANDERLEI SALVADOR BAGNATO

Full Professor, Department of Physics and Materials Science
University of São Paulo and the Institute of Physics of São Carlos, Brazil

In his pioneering research, Vanderlei Salvador Bagnato has explored the kinetics of collisions and reactions, high-resolution spectroscopy, metrology, cooling and trapping atoms, quantum fluids, optical instrumentation, and finding applications for lasers in the life and health sciences. He has studied Bose–Einstein condensates, atomic physics, laser cooling, and biophotonics, as well as refining ways to commercialize scientific technologies in biophotonics. He also has investigated quantum turbulence in relation to atomic superfluids as well as time and frequency metrology. For the first time in Latin America, he and his research group implemented the clinical use of photodynamic therapy to control microorganisms (avoiding infection without contributing to antibiotic resistance) and treat cancer. His team built and evaluated the first atomic clock developed in Latin America. Bagnato also oversaw the first pilot plant for producing high-precision microscopes.

Bagnato holds a PhD from the Massachusetts Institute of Technology, which he received in 1987. He graduated in 1983 with a master’s degree in physics from the University of São Paulo in Brazil. As an undergraduate, he completed a dual degree, studying materials science engineering at the Federal University of São Carlos and physics at the University of São Paulo.

In his efforts to communicate and value scientific research findings, Bagnato runs a TV channel that showcases a special program to promote science education and practice. In addition, he forges strong relationships between industry and research to facilitate high-technology industries in optics. Bagnato has written more than 600 peer-reviewed publications in such journals as Lasers in Medical Science, Journal of the American Academy of Dermatology, Journal of Biophotonics, Photodiagnosis, and Photodynamic Therapy. He wrote chapters in Skin Cancers (using optical imaging in diagnosis), Advanced Aspects of Spectroscopy (new ways to mathematically analyze spectroscopic data), Highlights in Skin Cancer (treating nonmelanoma skin cancers with photodynamic therapy), and Human Skin Cancers (using optical methods to analyze the relationship between skin cancer in pigs and humans).

He is a foreign associate member of the National Academy of Sciences (inducted 2013), one of only 80 members of the Pontifical Academy of Sciences of the Vatican (nominated 2012), and a member of the World Academy of Sciences (2009) and the Brazilian Academy of Science (2005). Bagnato also is the coordinator of the University of São Paulo Agency for Innovation. His honors include being a Commander of Brazil’s National Order of Scientific Merit (awarded 2007).

Bagnato will collaborate with faculty and students in the College of Engineering.
Most people may not often consider reality outside the three dimensions of space and one dimension of time, but Michael Duff’s inquiries lie beyond the world that we can readily perceive. As a theoretical physicist, Duff has explored facets of reality as diverse as elementary particles and black holes. As part of that exploration, he edited *The World in Eleven Dimensions: Supergravity, Supermembranes, and M-Theory*, the first book devoted to M-theory.

Having discovered conformal anomalies and found ways to apply index theorems, he has significantly advanced the understanding of supergravity. His research has been crucial in developing and refining string theory and M-theory. Duff also has studied quantum gravity, quantum informatics, and Kaluza-Klein theory. He led a groundbreaking study in—and continues to pursue—one of the most sought-after goals of theoretical physics: reconciling quantum mechanics and general relativity to synthesize a unified theory that describes all physical phenomena. He also excels at applying science to emerging concepts such as quantum computing.

Duff studied physics at Queen Mary College in London, where he completed his bachelor’s degree in 1969. He earned his PhD in theoretical physics from Imperial College London in 1972, studying under Nobel laureate Abdus Salam. Duff has done postdoctoral research at the International Centre for Theoretical Physics, the University of Oxford, King’s College London, Queen Mary College, and Brandeis University. He served at Imperial College in 1979 as a staff member on a Science Research Council Advanced Fellowship. He later took a leave of absence to visit the Theory Division at CERN, the European Organization for Nuclear Research in Geneva, Switzerland. From 1984 to 1987, he joined CERN as a senior physicist. He has held visiting professorships and fellowships at The University of Texas at Austin; the University of California, Santa Barbara; the University of Kyoto; and the Isaac Newton Institute at the University of Cambridge. In 1988, he joined the faculty of Texas A&M University and was named a distinguished professor in 1992. He served as the Oskar Klein Professor of Physics at the University of Michigan in 1999, where he also directed the Michigan Center for Theoretical Physics from 2000 to 2005. He rejoined Imperial College London in 2005 as principal of the physical science faculty. Now he is a fellow of the Royal Society of London, the American Physical Society and the Institute of Physics. He holds the Trotter Prize in Information, Complexity and Inference from Texas A&M University (2018), the Paul Dirac Gold Medal and Prize from the U.K.’s Institute of Physics (2017), a Distinguished Achievement Award for Research from Texas A&M (1998), and a Meeting Gold Medal from El Colegio Nacional in Mexico (2004).

Duff will collaborate with faculty and students in the Institute for Quantum Science and Engineering and in the College of Science.
YONGGANG HUANG

Walter P. Murphy Professor of Mechanical Engineering, Civil and Environmental Engineering, and Materials Science and Engineering
Northwestern University

Yonggang Huang has channeled his extensive education and research experience in engineering into an impressive array of projects— theoretical and applied, material, and mechanical. Among his research endeavors are the mechanics of stretchable and foldable integrated circuits, additive manufacturing, and deterministic 3D assembly. His research has potential for bettering technology in medicine and athletics. He developed pliable circuits for use in wearable flexible sensors, microfluidic devices, and transmitters. He introduced a type of single-crystal silicon that can stretch for use in high-performance electronics on rubber substrates. Huang also has worked on projects that involve injectable, cell-scale electronics with applications in wireless optogenetics; biodegradable silicon sensors for the brain; inorganic light-emitting diodes for semitransparent displays that can bend; and digital cameras whose designs are based on the eyes of arthropods. Huang has written two books and more than 500 peer-reviewed publications (including nine in Science and three in Nature).


A noted educator, Huang has been repeatedly recognized for teaching and advising undergraduate students. He was named the Most Supportive Junior Faculty Member from the Department of Aerospace and Mechanical Engineering at the University of Arizona in 1993. He received the Engineering Council Award for Excellence in Advising from the College of Engineering at the University of Illinois at Urbana–Champaign in 2007. Huang won the Cole–Higgins Award for Excellence in Teaching and Advising from the McCormick School of Engineering at Northwestern University in 2016.

Huang will collaborate with faculty and students in the College of Engineering.
Cameron Jones leads an internationally recognized research group in developing new and fundamental facets of main-group and transition-metal chemistry. He and his team seek to refine existing views on structure, bonding, and stability of hydrido, low-coordination-number, or low-oxidation-state metal complexes. The new complexes that his lab group develops were often believed not to be able to exist. Jones’s lab also applies highly reactive, low-oxidation-state systems to areas as diverse as synthesis, catalysis, materials chemistry, and hydrogen storage.

He received his honors bachelor’s degree in 1984 from the University of Western Australia. In 1992, Jones earned his PhD from Griffith University in Brisbane for his work in advancing the understanding of Group 13 metal hydrides. Between those milestones, he served at Royal Perth Hospital in the University Department of Surgery as a research officer. He undertook postdoctoral studies from 1992 to 1994 at Sussex University. At the University of Wales in Swansea, Jones held a lectureship starting in 1994. Then he had the opportunity to hold a readership in inorganic chemistry at Cardiff University in 1998. In 2002, Cardiff promoted him to a personal chair in Inorganic Chemistry. Jones also founded Cardiff’s Centre for Fundamental and Applied Main Group Chemistry in 2004, serving as codirector. He took a position in 2007 at Monash University, working as an Australian Research Council Australian Professorial Fellow (a five-year fellowship) as well as a professor of chemistry. In 2015, he cofounded and still directs MonCat, the Monash Centre for Catalysis.

Jones has received several notable fellowships and prizes over his career. He holds the Return Senior Research Award (2017) and the Senior Research Award (2008) of the Alexander von Humboldt Foundation, is an elected fellow of the Australian Academy of Science (2017), and holds the 2016 Royal Society of Chemistry (U.K.) Australasian Lectureship (2016). Jones is an honorary member of Magdalen College in Oxford (2014–2020) and has won both the Frankland Award of the U.K.’s Royal Society of Chemistry (2014) and the H.G. Smith Memorial Medal of the Royal Australian Chemical Institute (2013). He was named a Fellow Commoner by The Queen’s College, Oxford (2013). In 2004, Jones won the Royal Society of Chemistry’s Prize and Medal for Main Group Element Chemistry and was an elected fellow of the Royal Society of Chemistry in 2003. He served as a Visiting Academic Fellow of the Royal Society of Chemistry in 2002 and held that organization’s J.W.T. Jones Visiting Research Fellowship in 1996.

Through more than 350 peer-reviewed journal articles, reviews, and book chapters, as well as nearly 150 invited lectures, Jones has communicated his findings. His work appears in the Journal of the American Chemical Society, Nature Chemistry, Dalton Transactions, Chemical Communications, and an array of other research publications that span the world. Since 2007, chemical society and general science magazines have continually showcased Jones’s research—for example, in Chemical and Engineering News, Specialty Chemicals Magazine, and Chemistry in Australia.

Jones will collaborate with faculty and students in the College of Science.
Immunologist Stefan H.E. Kaufmann and his colleagues strive to better the understanding of infectious disease, primarily tuberculosis. He is best known for his research in intracellular pathogens—those that can exist inside living cells—such as *Mycobacterium tuberculosis*. Kaufmann's work involves basic and translational research. His group has developed a potential tuberculosis vaccine being tested in phase III human clinical trials. Kaufmann's team also has designed clinically useful sensitive biomarkers—measurable biochemical clues that indicate susceptibility or resistance to infection. His body of research incorporates studying innate as well as acquired immunity. His work has helped clarify the role of cytokines and types of T cells in the immune response, regulation, and memory in the immune system’s responses; mucosal immunity and vaccination; regulatory RNA; and the systems biology of tuberculosis. To make the public more aware of immunology, Kaufmann created the Global Day of Immunology.

He received his PhD with highest honors from the Johannes Gutenberg University of Mainz in Germany in 1977. He was a professor of medical microbiology and immunology at the University of Ulm from 1987 to 1991, then served as full professor of immunology there until 1998. He also holds an honorary doctorate from Aix-Marseille University in France.

Kaufmann is a former president and honorary member of the German Society for Immunology, and he served as president of the European Federation of Immunological Societies and the International Union of Immunological Societies. He also is an elected fellow of the Royal College of Physicians of Edinburgh, an elected member of the German National Academy of Sciences Leopoldina, and a member of the Berlin-Brandenburg Academy of Sciences. He is a member of the European Molecular Biology Organization and the Robert Koch Foundation’s executive committee, and he chairs the board of the Schering Foundation. Kaufmann also is active with the Lindau Nobel Laureate Meetings as a member of the scientific advisory board and the board of trustees. From 2010 to 2013, Kaufmann served on the board of the Global Alliance for Vaccines and Immunizations; from 2009 to 2014, he was active on the scientific board of the Global Alliance for TB Drug Development. In 2015, he served as scientific adviser on health for the G7 summit in Elmau, Germany, and for 2017’s G20 summit in Hamburg.

Most recently, Kaufmann won the 2018 Gagna A. and Ch. Van Heck Prize, one of the most prestigious Belgian awards in the biomedical sciences. He also holds the Gardner Middlebrook Lifetime Achievement Award from Becton Dickinson Diagnostic Systems, the Dr. Robert Pfleger Award from the Robert Pfleger Foundation, the Merckle Research Prize, the SmithKline Beecham Science Prize, and the Award of the German Society for Hygiene and Microbiology.

He has published more than 900 peer-reviewed journal articles and written eight books, and he has been one of the most highly cited researchers in immunology.

Kaufmann will collaborate with faculty and students in the colleges of Veterinary Medicine and Biomedical Sciences, Medicine, Engineering, and Agriculture and Life Sciences.
H. Vincent Poor’s ongoing research endeavors include advancing the rapid development of technology, such as in wireless networks, energy and power systems, and social networks.

As it becomes ever more digital, the world needs more capacity and higher performance from networks. But energy and bandwidth—the two main resources in wireless networking—are in short supply. Researchers explore how cooperative communications, spectrum sharing, energy harvesting, cloud processing, and infrastructure densification might address those constraints. Poor’s work involves finding the limits of what those techniques can accomplish by analyzing relay and interference channels and how feedback in those channels can improve performance. He develops and analyzes new structures for signaling and networking. Poor also works to determine how radio channel physics can offer insights into securing data transmission.

On the power side of the equation, Poor has focused on the smart grid, a technology essential to making electricity distribution and consumption more secure, efficient, and effective. Such work is crucial as the power grid becomes more diverse, incorporating wind and solar power. He also explores privacy issues related to the power grid and uses a variety of approaches—including game theory and prospect theory—to understand how grid participants behave.

In social networks, Poor’s work looks at how social interaction affects collaborative sensing and decision-making. He also models the connectivity of small-world networks.

Poor completed his doctorate in electrical engineering and computer science in 1977, both from Princeton.

In 2017 alone, he was elected as a foreign member of the Chinese Academy of Sciences, as an honorary member of the Republic of Korea’s National Academy of Sciences, and a foreign member of the National Academy of Engineering of Korea—as well as being named a fellow of the International Union of Radio Science. Poor is a member of the National Academy of Sciences (2011), the National Academy of Engineering (2001), a foreign member of Academia Europaea (2013), and the U.K.’s Royal Society (2014). He also is a fellow of the National Academy of Inventors (2015), the World Academy of Sciences (2015), and the American Academy of Arts and Sciences (2005).

From the Institute of Electrical and Electronics Engineers, Poor received the Alexander Graham Bell Medal (2017), the Eric E. Summer Award, the Signal Processing Society Award (2011), and the Communications Society’s Edwin Howard Armstrong Achievement Award (2009). He holds the John Fritz Medal from the American Association of Engineering Societies (2016) and the Booker Gold Medal from the International Union of Radio Science (2014). In 2002, the John Simon Guggenheim Memorial Foundation selected Poor as a fellow. He has been awarded 18 patents, has written 20 books, and has published more than 1,700 peer-reviewed journal articles.

Poor will collaborate with faculty and students in the College of Engineering and the College of Science.
Robert Putnam's research has encompassed an array of topics, including religion in society, the fall and revival of American community, and opportunity gaps with respect to achieving the American dream. He has written 15 books that have been translated into 20 languages. Two were especially prominent: Making Democracy Work: Civic Traditions in Italy and Bowling Alone: The Collapse and Revival of American Community and have been some of the best-selling and most-cited books in the past 50 years. The best-selling Our Kids: The American Dream in Crisis describes how the class gap among U.S. youth is growing. American Grace: How Religion Divides and Unites Us, which he cowrote with David Campbell, won the 2011 Woodrow Wilson Foundation Award for best book on government, politics, or international affairs from the American Political Science Association. Putnam's work is ongoing as he completes a broad examination of U.S. economic, social, political, and cultural trends in the 20th century.

He received his bachelor's degree in 1963 from Swarthmore College, after which he spent a year studying at the University of Oxford's Balliol College in England. He returned to the United States to pursue his master's and doctoral degrees, both from Yale University. In 1968, Putnam became a lecturer in political science at the University of Michigan, later rising to the rank of professor. In addition, he worked on the National Security Council's staff. He joined the Harvard faculty in 1979, was appointed in 1989 to be the Don K. Price Professor of Politics, and in 1996 the Stanfield Professor of International Peace. In 2000 he assumed the Peter and Isabel Malkin Professorship. At Harvard, he served as the Kennedy School's dean, as associate dean of the Faculty of Arts and Sciences, and as director of the Weatherhead Center for International Affairs.

Putnam is a member of the National Academy of Sciences and the American Academy of Arts and Sciences, and he is a past president of the American Political Science Association. He also is a fellow of the British Academy and holds the Johan Skytte Prize in Political Science, the highest award a political scientist can attain. Putnam served on the President's Council on Service and Civic Participation. He consulted for presidents Bill Clinton, George W. Bush, and Barack Obama, as well as for U.K. Prime Ministers Tony Blair and David Cameron and for Irish Taoiseach Bertie Ahearn.

Putnam cofounded the Saguaro Seminar, a group (including President Obama) with a mission of brainstorming ways to bring about civic renewal. He received the National Humanities Medal, the highest honor for contributions to the humanities, from President Obama in 2013. Putnam won the Karl Deutsch Award for cross-disciplinary research from the International Political Science Association in 2018. Over his career, institutions in eight countries have bestowed on him 16 honorary degrees, including one from the University of Oxford.

Putnam will collaborate with faculty and students in the College of Liberal Arts.
Andrea Rinaldo is among the world leaders in the hydrologic sciences, with his work yielding advancements in hydrology, ecology, and the environmental sciences. His research led to a theory of self-organized fractal river networks and of efficient transportation networks. At Texas A&M, he will take part in research on the coupled evolution of coastal geomorphology and vegetation through the random action of waves and wind. His work will include modeling based on both fluid mechanics and the stochastic drivers of geomorphological processes. He also will give lectures for graduate students in ocean engineering, civil engineering, and biological and agricultural engineering.

He earned his baccalaureate degree in hydraulic engineering from the University of Padua in Italy in 1978, where he has held the title of professor of civil and environmental engineering since 1992. Studying fluid mechanics, he received his PhD from Purdue University in 1983. He has been a full professor in the Italian Academic System since 1985. From 1993 to 2001, Rinaldo was a visiting professor and research associate in the Ralph M. Parsons Laboratory of the Massachusetts Institute of Technology's Department of Civil and Environmental Engineering. He was a visiting professor at Princeton University between 2004 and 2007.

Rinaldo is a member of the National Academy of Sciences, the National Academy of Engineering, and the Royal Swedish Academy of Sciences. He has served on the editorial boards of *Water Resources Research, Advances in Water Resources*, and the *Proceedings of the National Academy of Sciences* (also editing the last two). He has written more than 300 peer-reviewed publications—as of June 2018, they have been cited more than 17,000 times. His 1997 monograph *Fractal River Basins: Chance and Self-Organization*, cowritten with Ignacio Rodriguez-Iturbe, is the standard of reference in the field and was reviewed in prominent publications such as *Nature, Science, and Physics Today*. Geomorphologist William E. Dietrich of the Department of Earth and Planetary Science at the University of California, Berkeley, called it the most important book on geomorphology in the past 25 years.

He holds the Distinguished Scholar Medal from the American Society of Agricultural and Biological Engineers in New Orleans (2015), the Luigi Tartufari International Prize in Geosciences from the Lincean Academy in Rome (2014), the Borland and Hydrology Days Award from Colorado State University (2010), the 4th Prince Sultan Abdulaziz International Water Prize from the Kingdom of Saudi Arabia (2010), the Dalton Medal from the European Geosciences Union (2005), and the Hydrologic Sciences Award from the American Geophysical Union (1999). He holds fellowships from multiple organizations, including the American Academy of Arts and Sciences (2018); the National Academy of Sciences in Rome (2014); the American Geophysical Union (2000); the Galilean Academy of Science, Letters, and Arts in Padua (2000); the Water Academy in Oslo (1999); and the Institute of Science, Letters, and Arts in Venice (1995).

Rinaldo will collaborate with faculty and students in the College of Engineering.
Working at the nexus of quantum physics, gravitational theory, and cosmology, William Unruh has substantially advanced the knowledge base of theoretical physics. His research includes contributions to general relativity and, with Stephen Hawking, refining the foundations of quantum mechanics in relation to black holes. Unruh showed that the phenomenon of black hole evaporation, also known as the Hawking effect, can occur in other situations. That discovery allows for experimentally verifying that effect in Bose–Einstein condensates, nonlinear optical systems, and even flowing water. He also predicted that an observer experiencing acceleration will observe blackbody radiation in proportion to the acceleration, whereas an inertial observer would not—that is, the background would seem to be warm from an accelerating frame of reference. Known as the Unruh effect, that prediction was crucial in developing new lines of thought in fundamental physics. The eponymous Unruh particle detector, Unruh vacuum, and Unruh temperature all are results of his endeavors. Unruh also is involved with areas of science other than theoretical and mathematical physics. He regularly participates in outreach programs for students.

He earned his bachelor’s degree from the University of Manitoba in 1967 and obtained his master’s degree (1969) and his PhD (1971) from Princeton. He undertook a National Research Council postdoctoral fellowship at Birkbeck College in London and then held a Miller fellowship at the University of California, Berkeley. Returning to Canada, Unruh taught applied mathematics at McMaster University. In 1976, the University of British Columbia recruited him to the Department of Physics. From 1984 to 1988, he served on the Canada Council Killam Selection Committee. He also was a member of the Astronomy Committee of the Natural Sciences and Engineering Research Council of Canada (NSERC) from 1989 to 1992. Unruh has written more than 130 peer-reviewed publications in such journals as Reports on Progress in Physics; Physical Review D—Particles, Fields, Gravitation, and Cosmology; Foundations of Physics; and Physical Review Letters. In addition, he edited the compilation Quantum Analogues: From Phase Transitions to Black Holes and Cosmology.

Unruh is a fellow of the Royal Society of both London and Canada as well as of the American Physical Society, and he is a foreign honorary member of the American Academy of Arts and Sciences. He was the founding director of the Cosmology and Gravity Program at the Canadian Institute for Advanced Research, a group that draws on the world’s best minds to address the greatest challenges of the human race. He holds the Canada Council Izaak Walton Killam Memorial Prize in the Natural Sciences (1996), the Steacie Prize (1984), and Steacie Fellowship (1984–1986) from NSERC, the Rutherford Medal from the Royal Society of Canada (1982), and the Herzberg Medal (1983) and the Medal of Achievement (1995) from the Canadian Association of Physicists. He also won an Alfred P. Sloan Fellowship (1978–1980) as well as the British Columbia Science Council Distinguished Research Award (1990).

Unruh will collaborate with faculty and students in the College of Science.
Joseph W. Singer is the intellectual architect of a modern social theory of property that has substantially redirected scholarship in the field. This school of thought focuses on social justice concerns, including the connection between property law and distributive justice, antidiscrimination law, and equitable social relationships.

Singer has written nearly 100 law journal articles—which have appeared in *Yale Law Journal*, the *Harvard Law Review*, and the *Stanford Law Review*—and six books, including his path-breaking "Entitlement" in 2000 and "No Freedom Without Regulation" in 2015. He recently was identified as one of the top three most cited U.S. property scholars this decade.

In 2016 Singer received the nation’s highest honor for property scholars, the Brigham-Kanner Property Rights Prize. Past recipients of the prize include Richard Epstein of NYU, Professor Carol Rose of Yale, and former U.S. Supreme Court Justice Sandra Day O’Connor.

In the past year, he published six law journal articles, wrote an amicus brief to the U.S. Supreme Court, substantially updated multiple casebooks and treatises, signed a new book contract, and organized a substantial conference. In addition to his record as a scholar, Singer is a property teacher, an advisor to numerous graduate students working on property-related topics, and a mentor to many property law scholars across the country and around the globe.
A YEAR IN REVIEW

Some of the events that shaped an extraordinary year for the Hagler Institute—a year that saw unprecedented opportunity and real momentum in engaging the Texas A&M community.

JAN 19
DISTINGUISHED LECTURE
Hagler Institute co-sponsored “Celebrating Applied Physics, Featuring Nobel laureate Steven Chu” with The Institute for Quantum Science and Engineering.

FEB 23
HAGLER GALA
Hagler Institute held its black-tie gala to induct and honor the new Faculty Fellows. Jon Hagler gave the keynote speech.

MAR 6
EMINENT SCHOLAR LECTURE
V. Kumar presented the Institute’s Spring Eminent Scholar Lecture, “Engagement Marketing: A New Source of Competitive Advantage.”

AUG 31
TURBULANCE WORKSHOP
Hagler Institute co-sponsored a Turbulence Workshop featuring Distinguished Lecturer of the Hagler institute K. P. Sreenivasan.
OCT 18
EXTERNAL ADVISORY BOARD MEETING

The Hagler Institute held its annual External Advisory Board meeting to discuss critical long-term issues important to the Institute.

OCT 10
EMINENT SCHOLAR LECTURE


SEPT 20
FACULTY FELLOW RECEPTION

Hagler Institute announced the 2018-2019 Faculty Fellows and its new Distinguished Lecturer.

DEC 4
ADMINISTRATIVE BOARD MEETING

The Hagler Institute discussed key issues related to Faculty Fellow nominations at the Administrative Council meeting.
FINANCIAL OVERVIEW

In fiscal year 2017, Jon Hagler ’58 committed $10 million cash and a $10 million estate gift to help endow what is now the Hagler Institute for Advanced Study. Coupled with the commitment by Texas A&M University President Michael K. Young of Academic Master Plan funds ($1.8 million per year) and Heep Foundation earnings ($400,000 per year), the Hagler Institute will serve permanently as a beacon of excellence at Texas A&M.

REVENUES AND EXPENDITURES
The Institute’s current financing is enough to support an average of almost ten new Faculty Fellows per year. Looking forward, we see a new era of growth to a near-term average in the midteens of new Faculty Fellows per year.

Two major contributors that enable the growth of the Institute are earnings from Jon Hagler’s cash endowment and earnings from endowed Hagler Institute College Chairs. During 2019, the Institute will fully realize for the first time earnings from Jon Hagler’s cash endowment. Those earnings will be generated each year in the future.

Faculty Fellow salaries are the largest expenditures of the Hagler Institute, accounting for about half of the Institute’s financial outlays. That expense is followed by fellowships awarded to graduate students to work directly on research with Faculty Fellows and their A&M faculty hosts. Finally, operating expenses and staff salaries factor in.

CASH ENDOWMENTS AND PLANNED ESTATE GIFTS
Former students such as Jon Hagler have provided impressive support for the development of Texas A&M. For those alumni wanting to leave a legacy of ultimate academic excellence, the Hagler Institute is an ideal solution. Donors of a cash endowment or a planned estate gift will have their names associated with a series of the world’s most remarkable scholars for the life of the University. Endowed chairs for Hagler Faculty Fellows and endowed fellowships for graduate students to work with Faculty Fellows are among the most prestigious on campus. Contributions will enhance Texas A&M’s reputation and keep it on the forefront of solving the world’s biggest mysteries and problems.
A rewarding aspect of managing the Hagler Institute has been to see Texas A&M faculty members who are not alumni contribute support for the Institute. Some have walked in unsolicited with a check in hand, and others have called to ask for help in making a planned gift to leave their estate to the Institute.

During this last year, Walter Buchanan, professor in the College of Engineering’s Department of Engineering Technology and Industrial Distribution, a graduate of Purdue University and Indiana University, donated his estate to establish the Walter and Charlotte Buchanan–Hagler Institute for Advanced Study Chair for the College of Engineering. Professor Janet Bluemel and University Distinguished Professor John Gladysz, holder of the Dow Chair in Chemical Invention, both from the College of Science’s Department of Chemistry, have made provisions in their wills to potentially contribute to the Hagler Institute. Those endowments, along with others, will serve as valuable sources of funding for the Hagler Institute.

Former Faculty Fellows are another unexpected source of support. Robert Skelton, Faculty Fellow from the Class of 2014–15, has committed funds to be matched by the Hagler Institute to endow a discretionary account emphasizing graduate student support. Katepalli Sreenivasan, Faculty Fellow from the Class of 2012–13—the first group of Fellows that the institute recruited—made an impressive cash gift during this past year. Another former Faculty Fellow from that same class, Alan Needleman, did the same—not his first such contribution.

*With that support, the Institute is moving steadily toward its goal of enhancing the recognition of academic excellence at Texas A&M. We invite you to join in supporting that prestigious mission.*

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**REVENUES = $3,470,000**

- **HEEP Foundation** $1,200,000
- **TAMU Academic Master Plan** $1,869,600
- **Grants, Endowments, Earnings, Gifts** $400,400

**EXPENDITURES = $1,400,000**

- **Student Fellowships** $360,000
- **Operating Expenses** $516,300
- **Faculty Fellow Salaries** $547,100

**BALANCE = $2.1 M***

*The $1.2 million in HEEP Foundation revenues consists of promised payments from prior years that were received in fiscal year 2018 and will be depleted quickly. Faculty Fellow salary expenditures by the Institute were relatively small due to earnings from Hagler Institute College Chair funding within the colleges for some Faculty Fellows and a one-time grant from the Bradley Foundation that paid the cost of a Faculty Fellow in the Law School. The balance of $2.1 million, consequently, cannot be viewed as typical.*
The Hagler Institute is a means to help achieve the overall goal of Vision 2020: to continue the academic evolution of Texas A&M so that it will be generally considered among the ten best public universities in the United States by 2020, while retaining, or even enhancing, many of the unique features that have set the University apart.

Each year, Cornerstone will recognize planned estate gifts and other gifts. The Institute’s planned estate gifts are established through the Texas A&M Foundation for the sole benefit of the Hagler Institute. Those gifts can take many forms and may have unusually beneficial tax advantages for the donor.

The Texas A&M Foundation will focus on increasing the endowments for the Hagler Institute, its endowed college chairs, and its endowed graduate fellowships. Special emphasis is placed on endowments for Hagler Institute chairs established for a specific college as designated by the donor. Such chairs, as with any Hagler Institute chair, are devoted exclusively to Faculty Fellows while they are in residence as part of the Hagler Institute for Advanced Study. The college-designated chairs can be filled only by a Faculty Fellow for that college. Such chairs are important because nominations drive recruitment of Faculty Fellows. All colleges receive the same number of nomination opportunities. A Hagler Institute College Chair ensures that college’s participation in the Hagler Institute’s mission. For the donor who wants to increase a college’s participation, a Hagler Institute College Chair is an excellent option. In addition, those endowments usually provide enough funds to cover both the college’s funding of Fellows and the Institute’s obligations. The designated colleges now also receive two $30,000 graduate student fellowships for each Faculty Fellow appointment; the Institute supplies those fellowships from other funding sources.

Because they are linked with a sequence of world-class scholars, Hagler Institute endowed chairs and fellowships are among the most prestigious positions in the University. They also are among the largest endowed positions, at $3 million per chair and $800,000 per fellowship. Those chairs and fellowships will be permanently named for the donors.

Abraham Lincoln said, “The best way to predict your future is to create it.” Please join our colleagues in the Legacy Society and help create the future by giving back to Texas A&M through the Hagler Institute for Advanced Study.

WE CHART THE WAY FORWARD WITH TWO MAIN DEVELOPMENT THRUSTS:

1. additions to the Institute’s portfolio of planned estate gifts and
2. additions to commitments to endow chairs for Faculty Fellows and fellowships for students.

The Institute’s long-term goal is to recruit twenty world-class scholars each year to be in residence for up to twelve months at Texas A&M. Achieving that goal will accelerate the University toward world-class academic stature. The Institute’s ability to attract twenty Fellows annually and to substantially increase its impact depends on those endowments.

FOR INQUIRIES, CONTACT
Clifford L. Fry, Ph.D.
Associate Director
979-458-5723
cfry@tamu.edu
THE LEGACY SOCIETY

ENDOWMENT AND CASH GIFTS

Signature Donors
$10,000,000 or more
  Jon L. Hagler

$1,000,000–$9,999,999
  Trisha and L. C. “Chaz” Neely
  Thomas W. Powell
  Eric Yong Xu

$100,000–$999,999
  Jerry and Kay Cox Foundation
  Robert Skelton
  Bradley L. Worsham

$99,999 or less
  Altria Group Inc.
  Norm Abramson
  Jean-Louis and Janet Briaud
  Walter Buchanan
  Alan Needleman
  K. R. Sreenivasan

LEGACY PLANNED ESTATE GIFTS

Janet Bluemel
Walter and Charlotte Buchanan
Judy and Clifford Fry
John Gladysz
Jon L. Hagler Foundation
Elouise and John Junkins
Ozden Ochoa

GRANTS

$100,000
The Lynde and Harry Bradley Foundation Inc.

$50,000
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