TECHNOLOGY TRANSFER EVOLUTION:
DRIVING ECONOMIC PROSPERITY

Report of the Technology Transfer Evolution Working
Group of APLU's Commission on Innovation,
Competitiveness & Economic Prosperity (CICEP)

ASSOCIATION OF
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INTRODUCTION

The Technology Transfer Evolution Working Group of APLU's Commission on Innovation, Competitiveness, and Economic Prosperity (CICEP) was charged by Pradeep Khosla, Chancellor of University of California San Diego and CICEP Chair, with examining how university technology transfer is evolving, in the context of broader economic engagement strategies. The charge was: examine this issue in detail, point to examples of the ways in which technology transfer is changing, identify challenges or obstacles to the ongoing advancement of changes, and make recommendations regarding what universities must do to continue the evolution.

CICEP's Technology Transfer Evolution Working Group began its work in 2016 by framing the issues. The group noted that public research universities have a responsibility to help drive economic and social prosperity in their regions and beyond. In the context of that responsibility, the working group observed that "quickly fading are the days of technology transfer offices focusing solely on patenting and licensing." Today, universities are moving beyond a revenue-driven, transactional technology transfer approach and integrating the efforts of technology management offices into the broader engagement activities of institutions. Universities are becoming active in regional and national innovation ecosystems, preparing students for today's disruption economy, and driving economic and social prosperity. In response, technology transfer must connect with institutions' work to be engaged in economic, community, and talent development. The working group committed to emphasizing a re-definition of expectations by university leaders and governing boards about the purposes and success indicators for university engagement in innovation and technology transfer.

TECHNOLOGY TRANSFER EVOLUTION: THE VISION

To guide conversations and recommendations, the working group established the following vision for the evolution of technology transfer:

> University leaders are increasingly responding to the needs of the innovation economy—and in particular their local economies—by including innovation, entrepreneurship, and "economic engagement" programming in their strategic planning processes. As part of this response, university technology transfer offices are evolving, and must continue to evolve, toward participation in a broader scope of efforts—with patents and licensing as one emphasis, and also *connecting with and engaging in other efforts* that support the learning and discovery missions of the university. In evolving toward broader participation in <u>university economic engagement</u>, technology transfer offices will develop deeper relationships with industry and other community partners; broaden their reach to areas such as education, technology development, and entrepreneurship; and integrate more closely with other supportive administrative functions such as industry contracting. While budget and resource threats to the university research enterprise are creating increased pressure to generate revenue from licensing and innovation activities, university leaders must recognize that successful economic engagement will not be focused on short-term income, but rather on longer-term work on relationship development and ecosystem building.

WORKING GROUP PROCESS

The working group was first convened in December 2016. The 27 members were drawn from innovation leadership at both public and private universities. The group was also supported by an advisory committee with representatives from interested organizations including the Association of American Universities (AAU), Association of University Technology Managers (AUTM), the Council on Governmental Relations (COGR), SSTI, and the University Industry Demonstration Partnership (UIDP). See Appendix 1 for a complete list of members of the Technology Transfer Evolution Working Group.

As described above, the working group was charged with the following:

1. Examine the evolution of technology transfer in detail.
2. Point to examples of the ways in which technology transfer is changing.
3. Identify challenges or obstacles to the ongoing evolution.
4. Make recommendations regarding what universities must do to continue the evolution.

The working group developed a set of five topic areas for exploration, along with key points for examination and discussion:

- *Engaging the Local and Regional Ecosystem*
    - relationship-building with industry
    - working with government and community partners
    - innovation management in economic development

- *Redefining Expectations of Technology Transfer Offices*
    - institutional policies to facilitate success: measurements and indicators of success, clarity of purpose, lowering barriers for rapid movement of technology to market
    - beyond patents, licensing, and transactions: linking to broader economic engagement, education, and research missions
    - partnership development across the triple helix (universities, government, and business)

- *Adapting Innovation Management Structures*
    - aligning and connecting innovation management with industry liaison, research parks, entrepreneurship, economic development, and other related activities
    - reporting structure for different aspects of economic engagement, including where innovation management is placed in the organization, to whom it reports, and which units it directly supervises or works with laterally
    - people and skill sets

- *Fostering an Entrepreneurial Culture*
    - entrepreneurship awareness and education for faculty, staff, and students
    - connecting and aligning across entrepreneurial education efforts
    - mentoring and entrepreneurs in residence
    - institutional policy in support of entrepreneurial culture

- *Supporting University Startups*
    - definitions of "startup," and in particular definitions that are sufficient to encompass all relevant entrepreneurial activity
    - innovation management mechanisms for startup support (for example: incubators, accelerator programs, etc.)
    - role of innovation management in activities like demo days, business plan competitions, technology challenges, etc.
    - programs to stimulate startup formation

Subcommittees of the working group were formed, one each for the five topics for exploration. In line with the working group's charge, each subgroup addressed three areas:

- Examples: What are universities doing well?
- Obstacles: What is getting in the way of technology transfer evolving toward the vision?
- Imperatives: What universities must do to continue the technology transfer evolution.

The results of the examination and discussion by each of the subgroups were published in a series of five briefs, and these briefs have been incorporated into this final report.

The Technology Transfer Evolution Working Group reviewed and built upon prior initiatives of APLU and partner organizations, including the Association of American Universities (AAU). Previous APLU work includes the 2014 Task Force on Tenure, Promotion, & Technology Transfer and the 2015 Task Force on Managing University Intellectual Property. In 2015, AAU also undertook an effort related to intellectual property and technology transfer, and the 2015 APLU and AAU efforts provided the basis for an article published in *Technology & Innovation, Journal of the National Academy of Inventors*, in 2017. These activities provided some of the basis for discussions by the Technology Transfer Evolution Working Group:

- APLU Task Force on Tenure, Promotion, and Technology Transfer
- Statement to APLU Members: Recommendations on Managing University Intellectual Property
- AAU Technology Transfer Working Group Statement on Managing University Technology Transfer in the Public Interest
- Technology Transfer for All the Right Reasons

In addition to engaging participants from across a number of universities, the Working Group also connected with relevant partner organizations throughout the process. Organizations

were represented in regular discussions among working group members, and working group representatives also presented at other organizations' meetings throughout 2017 to gather input and feedback from members of those organizations. The working group was represented at the Association of University Technology Managers (AUTM) meeting, the Biotechnology Innovation Organization (BIO) meeting, the Deshpande Symposium for Innovation & Entrepreneurship in Higher Education, the University Industry Demonstration Partnership (UIDP) Project Summit, and APLU's Council on Research (CoR).

THEMES

Throughout the conversations among working group members, and in the topical briefs prepared by the group, a number of issues regularly surfaced. These issues were explored across multiple topics, and they provide a set of overarching themes in the context of the ongoing evolution of technology transfer. While it is important to review the examples, obstacles, and imperatives included with each of the topic areas in the next section, the following list of themes can provide an overarching framework for deeper exploration of the issues by individual universities.

1. *Success in technology transfer should not be measured by revenue, but by contributions to economic prosperity.*
   Members of the working group noted time and again that the ways in which we assess the value of technology transfer and the success of the offices that lead this work need to shift away from licensing revenue as a driving metric to a broader set of measures that takes into account the full breadth of contributions to economic development and other societal benefits. Members noted the APLU Innovation & Economic Prosperity (IEP) University designation as a potential platform for this broader set of measures. The emphasis needs to move from transactional to relationship building; from revenue-generation to realizing the translational potential of the technology. Working group members agreed that a shift in success measures is an important precursor to effectively translating technology into both startups and established companies.

2. *Technology transfer must better integrate and align with the broader economic engagement efforts of the university.*
   University leaders should clearly describe an institutional economic engagement strategy that includes innovation management as one element of that strategy. This approach will require the appropriate alignment of functions across the campus, including technology transfer, entrepreneurship, corporate partnerships, industry contracting, accelerator programs, advancement, alumni relations, and other activities. The broader economic engagement enterprise should include a "concierge" service that helps external audiences connect with the right type of resource on campus, and that helps faculty identify appropriate resources matching their needs. Such a service can assist in determining whether technology transfer is the right place for a partner or faculty member to start. When technology transfer is undertaken not primarily for revenue generation but for broader purposes of serving the public good, it must be clearly aligned with and connected to other activities at the university.

3. *Strategic resource allocation for technology transfer, including funding and staffing, must take into account a broader scope of activities and expectations.*
   The broader scope of technology transfer offices should be balanced with better linkages to other activities across the university. However, it is important to note that as technology transfer offices become more connected to the broader economic engagement efforts at the university, and as expectations of these offices shift from transactions alone to include partnership development and other services, technology transfer offices must be adequately and appropriately staffed and funded. New skill sets may be required in addition to those that are already in place, and funding will need to cover not only patent and licensing activity, but also costs of other kinds of engagement efforts.

4. *Make the economic engagement story more explicit.*
   Messages about the benefits of university engagement in society and the economy need to be central to university communications—both to internal and external audiences. University leaders must communicate across the institution the value of economic and societal engagement, and underscore that technology transfer—along with other parts of the innovation management enterprise—help the university achieve its engagement goals. It is equally important to share this message of economic and of societal engagement with *external* stakeholders, ensuring that the university's research and education missions' impact is recognized. The broader economic and societal engagement story helps external stakeholders understand that technology transfer and other innovation management activities are undertaken for the public good.

TOPIC AREAS

Each of the briefs developed by the Technology Transfer Evolution Working Group are included here. Each brief includes examples, obstacles, and imperatives. Examples illustrate the ways in which university technology transfer offices are evolving toward the vision outlined in the introduction. Obstacles identify the hurdles that must be overcome to reach a higher scale of success in technology transfer evolution. Imperatives specify what must be done to continue or begin the evolution.

ENGAGING THE LOCAL AND REGIONAL ECOSYSTEM

This focus area centers on the intellectual property and broader innovation of the university, and the institution's ability to work with other players in the regional innovation ecosystem in transferring those assets. This includes how the university leverages its role in the ecosystem to create new opportunities. The local and regional ecosystem comprises the university, industry, government, economic development organizations, and other innovation and entrepreneurial entities.

Examples: What are universities doing well?

- Leading institutions are moving toward an organizational structure consisting of coordinated collaboration among engagement functions, providing more holistic approaches to university–industry relationships.

- Industry perspectives are being incorporated into events, support programs, and advisory boards.

- University of Central Florida, University of South Florida, and University of Florida: With the goal of supporting the development of research, workforce, entrepreneurship, and industry innovation, the Florida High Tech Corridor (HTC) is a regional economic development initiative that combines the academic and research capabilities of three leading universities with the industrial resources of companies in a 23-county region. This example demonstrates how universities can collaborate in creating regional innovation and economic development ecosystems, and how they can partner closely with industry to align objectives.

- Kansas State University: The Knowledge Based Economic Development (KBED) program in Manhattan, Kansas was established by Kansas State University in 2008 to align the city's strategy for economic development in a way that capitalizes on the university's research strengths and the area's growth opportunities. KBED is an illustration of university innovation management and economic engagement across academic, civic, and private entities.

- Georgia Research Alliance, University System of Georgia: The Georgia Research Alliance (GRA) is an independent nonprofit organization that works in partnership between the University System of Georgia and the Georgia Department of Economic

Development. GRA is an example of coordination across partners on shared objectives in innovation and economic development.

Obstacles: What's getting in the way of technology transfer evolving toward the vision?

- Technology transfer offices are frequently understaffed and under-resourced, and separated from units more directly responsible for the teaching and research missions of the university.

- Intra-university tensions are created by commercialization initiatives across other units, separate from technology transfer offices, competing for budget and resources.

- Limited patenting budgets result in the technology transfer office not being able to pursue all commercializable discoveries, frustrating some faculty. Limited budgets also frustrate some industry partners when protections cannot be secured.

- There is a lack of alignment between university and industry expectations related to goals, outcomes, timelines, technology readiness, and other aspects of innovation management.

- There are cultural differences between universities and industry, sometimes exacerbating the lack of alignment.

- Collaboration among institutions is critical for effective ecosystem development, but public universities rely heavily on government funding, and when budget cuts occur universities view each other as rivals rather than collaborators.

- Technology transfer offices are often focused on individual technologies, and a broader landscape and opportunity focus is required to effectively engage the regional ecosystem.

- Universities have not effectively communicated with university stakeholders—including policy makers, business and industry, and the public—about the purposes and strategies of universities, including about innovation management. As a result, misperceptions and misguided assumptions about university technology transfer drive the public discourse.

- Too often, university leaders view technology transfer as a revenue generation opportunity for the institution, rather than a platform for participation in economic development and advancing regional prosperity.

- In engaging business and industry partners, universities tend to overlook small and medium size enterprises (SMEs) and the supply chain as partners or as providers of resources and expertise.

Imperatives: What must universities do to continue the technology transfer evolution?

- Continue or begin to develop broader skill sets in technology transfer office staff, and promote professional development opportunities.

- Focus on relationship-building among partners—both on- and off-campus. Place more emphasis and effort on relationship-building across campus, with the objective of building more capacity and capability for working with industry and government. Support and value collaborative initiatives that are physically located off campus—university innovation does not always have to happen on the university campus.

- In relationship-building, place more emphasis on collaboration with R&D teams, rather than focusing only on company licensing and acquisition groups. Work with industry to co-develop technologies that will end in licensing agreements.

- Engage industry further upstream—before an invention is created. In doing so, universities work with industry to co-develop technologies that may result in future licensing arrangements.

- Communicate the value of university economic engagement. Clearly articulate the overall university contribution to the innovation ecosystem, and the university's economic impact. Define the university value proposition in specific terms and back it up with examples and data. Ensure the success metrics used in communications tell a fuller story, changing or expanding currently used metrics as necessary.

- Work together with other universities, and with other stakeholders in applicable regional ecosystems, to engage more effectively in advocacy at the state and national levels.

- Break down silos within and between universities, focusing on critical initiatives, and build stronger cases for stakeholder support of university economic engagement.

REDEFINING EXPECTATIONS OF TECHNOLOGY TRANSFER OFFICES

Technology transfer offices find themselves in a dynamic environment where they must balance internal and external stakeholder expectations, including those of institutional leadership, industry, and others in the community in which the institution engages. Examination of this topic area included a focus on institutional policies that facilitate success for technology transfer as part of broader strategic goals for the institution. The working group examined issues such as clarity of purpose for technology transfer offices, ways to lower barriers for the rapid movement of technologies to the marketplace, and the broadening mandate of offices beyond a transactional focus on patents and licensing, toward inclusion of partnership development across academia, industry, government, and not-for profit organizations.

Examples: What are universities doing well?

- Institutions are moving to broaden the mission of technology transfer offices such that they undertake new functions under a broader economic engagement mandate. For example, offices have become more involved in venture formation and startups through incubators and accelerators. Startups are ideal vehicles to push technologies into the marketplace, advance the institution's intellectual property portfolio, create jobs, and drive regional economic development. Startups can also lure outside support and resources to undertake these efforts.

- University of California, San Diego's "open-flow innovation" model is highlighted as an example of technology transfer units supporting startups by helping companies access technologies in an efficient manner. A centerpiece of this model is a redefined expectation of fiscal year revenue. Included in new revenue expectations are not only licenses but also translation and development of technology through startup firms.

- As expectations for technology transfer offices are evolving to be more aligned with the university's broader economic engagement mission, messaging of technology transfer activities to internal and external audiences is also evolving to better and more accurately communicate impact. Institutions are sharing stories of how discoveries are having a positive impact on the lives of people in the region, state, nation, and the world. These stories expand the view of the value of technology transfer, beyond a focus on revenue, number of patents or licenses issued, and other transactional data. These new communication approaches change what success looks like in the eyes of internal and external stakeholders.

- Arizona State University's Venture Devils (formally Catalyst) is launching a new startup accelerator—The Furnace—in partnership with the university's technology transfer office, Arizona Technology Enterprises (AzTE). The Furnace is aimed at entrepreneurs starting companies based on ASU intellectual property. The program is improving the technology transfer process by making it easier for entrepreneurs to access research discoveries and intellectual property as the basis for new companies. Incentives for entrepreneurs and researchers to form a company and apply to the accelerator include searchable technologies ready for licensing, seed grants, space, and demo days supported by venture funds. The participants invited into Furnace must incubate their new companies in the co-working space available to them at ASU SkySong, the university's innovation center in Scottsdale.

- More technology transfer offices offer proof of concept funding to move inventions closer to the market and facilitate licensing. Examples include the Michigan State University Innovation Center ADVANCE Grant Program which is sponsored by the Michigan Economic Development Corporation on behalf of all public universities in Michigan, the University of Illinois's campus proof of concept program, and the University of Colorado-Boulder's Advanced Industries Accelerator (AIA) Program which funds top innovations showing high commercial potential.

- The Association of University Technology Managers (AUTM)'s Better World Project has for years provided an excellent example of powerful storytelling efforts around university technology transfer successes.

- Institutions are aligning technology transfer with the broader university economic engagement mission by restructuring or creating corporate engagement offices. These offices better allow technology transfer units to connect with other kinds of business engagement activities—including sponsored research or workforce development efforts. Through these offices, institutions help to shift expectations of technology transfer offices away from narrow measures of success (licenses, revenue) toward a comprehensive evaluation approach based on varied forms of university-industry collaboration. An early innovator of a corporate engagement model accomplishing this kind of shift in expectations was Pennsylvania State University, which developed a streamlined sponsored research agreement to ease access to university intellectual property.

Obstacles: What's getting in the way of technology transfer evolving toward the vision?

- Many senior administrators, faculty, trustees, and alumni are primarily focused on the revenue generation potential of technology transfer operations and less on the societal benefits that can be reaped by moving intellectual property of all kinds into the marketplace, even those that may not result in immediate, high revenue returns.

- For many institutions, economic development and engagement as a central mission component is new and has led to confusion regarding the roles and responsibilities of individuals and units involved, including technology transfer offices and related professionals. New outreach duties often require coordination across multiple campuses, schools, departments and units, which makes collaboration and reporting a challenge. Many technology transfer offices lack the adequate staff, training, or resources necessary to meet the evolving expectations placed on them in the context of economic engagement.

- Institutions sometimes face difficulty in giving credit where credit is due, for instance, when technology transfer offices are sharing partnership development responsibilities with other units. On many campuses, technology transfer offices used to be the main externally facing office for the university in the realm of business and industry. This is often no longer the case, and the new reality requires a level of coordination that is not typical practice. Moreover, reporting lines and measures of success are not consistent across different kinds of university offices, and it becomes very difficult to execute strategic, campus-wide partnerships involving external audiences.

Imperatives: What must universities do to continue the technology transfer evolution?

- University leadership needs to clearly define and communicate the role that technology transfer offices are expected to play in broader partnership and translation efforts, including communicating how offices serve the larger economic engagement strategy for the campus.

- University leaders need to ensure that someone is playing a convening and coordination role for all major units contributing to the institution's economic engagement mission, including technology transfer offices.

- University leaders must highlight how technology transfer offices and other units contributing to the university's overarching economic engagement goals. Leaders should leverage reporting lines and incentive structures to encourage collaboration across units. University leadership should clearly communicate expectations, and provide incentives, for collaboration.

- Leaders must expand and refine metrics used to assess technology transfer to reward and promote activities that further the university's economic engagement mission, beyond measures of revenue generation. Institutions might consider APLU's work on metrics including the New Metrics Field Guide: Measuring University Contributions to the Economy, and the Association of American Universities (AAU)'s work on technology transfer indicators.

- Universities need to set expectations for both external and internal stakeholders with regard to the kinds of outcomes and impact technology transfer can have as part of a broader economic engagement strategy. In setting expectations, university leaders should reiterate the importance of shifting away from a revenue-focused model, toward one that holistically examines technology transfer contributions to economic engagement.

- University leaders—including deans, department chairs, and faculty— should reinforce the concept that the technology transfer operation is a resource for faculty and students and that technology transfer offices are: 1) a valued service provider rather than solely or primarily an income generator; and 2) a potential conduit to other sources of research funding. Further, research funding secured through partnerships should be considered to be as valuable as licensing revenue.

ADAPTING INNOVATION MANAGEMENT STRUCTURES

Entities that serve the innovation management mission of public universities have developed rapidly over the past 20 years. Unsurprisingly, given the idiosyncratic process through which these innovation management systems were created, the organizational structure and scope of responsibilities of the systems vary greatly among institutions, often having been influenced by the priorities of institutional leaders and their changing vision of the innovation ecosystem. The imperative for states to foster economic development has become a powerful influence on expanding innovation and entrepreneurship programs at public research universities and has also helped to shape approaches to structuring innovation management.

Technology transfer offices are the most longstanding, and often most visible, component of the innovation management ecosystem. A number of institutional structures exist for the placement and reporting paths of these offices. The majority of technology transfer offices are formal administrative units within universities, serving the university research enterprise. In this structure, the head of the technology transfer office generally reports to the vice president or vice chancellor for research. Less frequently, offices operate as a business unit reporting to the institution's equivalent of chief operating officer. Still others operate as distinct business entities, separate from the university, but with reporting lines back to the university leadership. In these instances, the technology transfer office may have parallel reporting lines to multiple offices, such as the office of research, the chief financial officer, and/or a university foundation. The [University of Pittsburgh Vice Chancellor of Technology Management and Commercialization](#), for example, reports to two university officials: the senior vice chancellor and provost as well as the senior vice chancellor for health sciences and dean of the school of medicine.

Examples: What are universities doing well?

- Leading institutions are creating innovation management structures that include not only traditional technology transfer but also corporate engagement, economic development, and entrepreneurship creating a larger economic engagement entity.

- [Innovate Carolina](#) produces an [impact dashboard](#) of key metrics about how UNC-Chapel Hill is commercializing research, launching new ventures, preparing tomorrow's entrepreneurs, and growing the state's economy.

- [Technology Transfer at University of Houston](#) is composed of the Offices of Intellectual Property Management and the Office of Innovation & Partnerships. [UH Innovation](#) is a new university initiative, aimed at growing its innovation ecosystem, led by the Center for Innovation & Partnerships.

- The University of Kansas (KU) created [KU Innovation & Collaboration](#) (KUIC) to drive the economic engagement mission of KU through corporate partnerships, technology commercialization, and entrepreneurship.

- [Innovate New Mexico](#) is a network among the leading technology transfer organizations in the state including research institutions and federal laboratories. As a "front door" to UNM technologies, Innovate New Mexico accelerates technology commercialization, supports job creation, and contributes to economic growth and advancement of the innovation economy through the creation and development of new companies.

- Though many startup incubators affiliated with research universities are managed as external affiliates, at Texas Tech University, the [Innovation Hub at Research Park](#) is an example of an incubator/accelerator reporting directly to the Vice President for Research.

- The [UCLA Technology Development Group](#) operates as a distinct unit separate from the university management structure, with its own Board of Directors. This is intended to create a program that is more flexible and responsive to its customers, and also helps to bring additional private sector expertise to the operation.

Obstacles: What's getting in the way of technology transfer evolving toward the vision?

- Technology transfer offices are often under pressure to relegate the innovation management function—and overall economic engagement functions—to a secondary role in an office where resources are limited and revenue generation is a primary driver imposed on the office.

- Management of the intellectual property assets of the university is only one function of the economic engagement mission of the university. University structures often have multiple offices that are externally focused on innovation activities like entrepreneurship, economic development, corporate engagement, and technology transfer. If these offices are not incentivized to actively collaborate, synergies may be lost in developing relationships with companies, including those focused on licensing technology.

- Success is frequently measured at the individual office level, rather than across the economic engagement enterprise. When measures of success are not shared across units within the innovation management function, offices can be working at cross purposes, or competing for credit. In addition, the metrics by which each office is measured are not always aligned with the greater strategic plan for the institution, and can place individual offices in a position where their goals are in conflict with one another.

- Some aspects of innovation management—for example, education for innovation and entrepreneurship and fundraising for these activities—represent

both the academic and research functions of the university and require either participation across both missions, or a willingness to develop new, innovative, "out-of-the-box" approaches. Issues of ownership and "turf" can arise unless there is a clear mandate for collaboration from senior university leadership, starting with the chancellor or president.

Imperatives: What must universities do to continue the technology transfer evolution?

- Effectively communicate the desired culture that each unit needs to adopt in dealing with their stakeholders—both external and internal. This culture also needs to be clearly communicated to the faculty, so they can act as ambassadors, and so that the university communicates with a single voice.

- Review operations across the entire institution to ensure that the goals and metrics for all units are aligned with the strategic plan of the institution as a whole. Further, leaders should ensure that all units operate in a manner that advances the overall innovation management mission and does not create friction or conflict between units.

- Promote effective communication across the institution among units engaged in technology transfer, entrepreneurial education, industry relations, venture development, and any other innovation management function. The rapid growth in intensity and scope of innovation management activity requires such communication at all levels from senior management through operational "on-the-ground" functions.

- Bring elements of the innovation management infrastructure into closer geographic and administrative proximity to faculty researchers. Such organizational strategies support the overall culture change and evolution to a broader economic engagement approach by reducing barriers to faculty participation in entrepreneurial activity.

- Develop an "innovation message" that is understood by all elements of the university and can be clearly and consistently communicated to external stakeholders.

- Make strategic use of intermediary foundations and other, separate, but affiliated 501(c)(3) corporations. Such organizations can house some or all aspects of the innovation management pipeline and have become a common strategy for universities. These entities can create layers of separation from the university when necessary, allowing components of the innovation ecosystem—those involved with startup companies, for instance—to operate at the speed of business.

- Create outposts for innovation management at regional campuses, affiliated business accelerators, and business and urban centers. This can be a useful strategy for spreading the geographic influence of university innovation management across regional ecosystems, and for engaging a broader range of partners in supporting the technology translation pipeline.

FOSTERING AN ENTREPRENEURIAL CULTURE

If universities are to be full partners in the innovation economy, we must prepare our students and faculty to participate in this new world, characterized in part by continuous technological and market disruption. More and more, people are creating their own job and career paths, rather than having that path dictated for them by companies and other employers. Acknowledging this, our universities support student and faculty entrepreneurship, and work to create an environment that provides access to resources needed for entrepreneurial success. To create this environment, universities must develop ways to create cultures that not only incubate companies, but also incubate influencers, leaders, entrepreneurs, and other agents of change. Collectively, these are the forces that will drive innovation and economic and societal progress in the future.

This topic focuses on the ways in which universities can create an entrepreneurial culture on their campuses, in part by evolving the roles and purposes of university technology transfer. In order to define "entrepreneurial culture," we relied on many of the elements of the *Guiding Framework for Entrepreneurial Universities* proposed by the Organization for Economic Cooperation and Development (OECD). These elements include:

> Visibility of entrepreneurship and entrepreneurism at the highest levels of the university; support and encouragement for startups both for students and faculty, which should include all of the resources needed by these entrepreneurs; evidence of an entrepreneurial ecosystem— including various units with responsibilities for the entrepreneurship agenda and indications of how each work closely together; regional engagement in entrepreneurship initiatives and programs, including a network of seed or venture capital groups who provide services and resources; and active engagement of alumni in entrepreneurship programs and activities. (OECD, 2012)

This topic was addressed by the working group in the context of a number of sub-topic areas: education and awareness for faculty, staff and students; connecting and aligning across entrepreneurial education efforts; mentoring efforts, including entrepreneurs in residence; and institutional policy in support of entrepreneurial culture.

Examples: What are universities doing well?

- The University of Illinois has created a highly connected ecosystem described collectively in the web portal Entrepreneurship at Illinois. Many partners across campus, including the Office of Technology Management, work together to provide support and resources to the entrepreneurial community.

- Entrepreneur in Residence programs assist technology transfer offices in bringing experienced entrepreneurs to the university to advise and assist students and faculty as they explore market possibilities for research discoveries and inventions. The UCLA Technology Development Group (TDG)'s Entrepreneurs in Residence (EIR) program connects UCLA technologies with industry executives, serial entrepreneurs, and the

larger investment community. EIRs work closely with inventors, entrepreneurs and the TDG team to provide guidance to faculty and student entrepreneurs; additionally, they speak on campus, and meet with inventors to provide perspective on the entrepreneurial potential of technologies.

- The Venture Center at University of Michigan (UM) Technology Transfer serves as a hub for all startups based on UM intellectual property. The Venture Center serves as a front door to the infrastructure available to launch venture ready businesses. This infrastructure includes mentors-in-residence, funding, a Venture Accelerator that provides access to labs and office space, and connections to a network of partners and other resources.

- Large events that celebrate and promote innovation and entrepreneurship are used by technology transfer offices to promote an entrepreneurial culture. UNeMed and the University of Nebraska Medical Center (UNMC) Vice Chancellor for Research's Office sponsor Innovation Week. The University of Florida (UF) Office of Technology Licensing and others host a "Celebration of Innovation Startup Showcase" each year to highlight startup companies built on UF technology. The event helps to advance development of an internal entrepreneurial culture at UF.

- Entrepreneurial education offered at institutions is often leveraged by technology transfer offices to create more sustainable startup companies. The University of Colorado Boulder (CU) Research & Innovation Office supports an Innovation & Entrepreneurship Initiative that provides opportunities for students, faculty, staff, industry partners and the community to engage in and explore innovation and entrepreneurship experiences. This includes academic courses, workshops, events, internships, and competitions that provide connections, education, and resources to start new ventures.

- Given that technology transfer offices sit at the interface between the university and the private sector, they can act as a natural focal point of entrepreneurship on campus, and help to provide a roadmap to all the resources available to entrepreneurs. The University of Missouri Kansas City (UMKC) Innovation Center partners with the community to drive entrepreneurial efforts in the region. The UMKC Innovation Center provides education, counseling, and access to resources for aspiring and existing businesses. The University of California (UC) provides an example of a system-wide approach in their Innovation and Entrepreneurship Initiative which leverages the scale and diversity of UC's campuses, medical centers and national labs.

- Easy startup licensing terms adopted by University of California San Diego, University of Kansas, and others allow for open innovation models to thrive, supporting the creation of an entrepreneurial culture.

Obstacles: What's getting in the way of technology transfer evolving toward the vision?

- Technology transfer offices have limited funding to support an ever-broadening range of services necessary to drive an entrepreneurial culture at a university.

- Technology transfer office professionals are not always skilled in leading accelerator programs, education programs, or other hallmarks of an entrepreneurial ecosystem. Collaboration across campus or through EIR programs to incorporate this talent is often required.

- Development of startup companies can result in conflicts of interest when licensing technology to the startup is required.

- The mission of the technology transfer office can be misdirected at protecting institutional assets rather than service to faculty, making it difficult to drive entrepreneurial culture.

- The large volume of technology portfolios under management by some technology transfer offices can limit their capacity to drive entrepreneurial programming and events. Effective collaboration with other institutional units, for instance, colleges of business, on messaging and activities can help mitigate this obstacle.

- Availability of mentors and EIRs is dependent on the surrounding business community, and the university's alumni network. Many geographically isolated universities have trouble engaging a sufficient number of EIRs or mentors with the breadth of experience required for science-based startups. Technology transfer offices are sometimes asked to manage these resources when available, which again puts them in a conflicted position when it comes to executing license agreements.

- There is often a lack of alignment between EIR and mentoring programs managed by the technology transfer office and similar efforts managed by other units or through other reporting lines. This can limit the effectiveness of these programs.

- Development of an entrepreneurial culture can be hampered by inflexible policies and procedures, and the process of changing policy is often itself so bureaucratic that evolution toward more flexible policies is sometimes blocked. As an example, exceptions to policy that could enable entrepreneurial activities on student owned intellectual property could take years to get to a university's board of governors for approval.

- Focusing on traditional technology transfer success metrics, such as patents and licensing revenue, rather than broader impact metrics, such as engagements with the entrepreneurial ecosystem, can limit technology transfer offices' emphases on activities that promote an entrepreneurial culture.

- Conflict of interest policies often create impediments to entrepreneurship because they are not updated to address a broader array of entrepreneurial activities (makerspaces, student startups, venture funding, proof of concept efforts, etc.).

Imperatives: What must universities do to continue the technology transfer evolution?

- Shift the mandate for technology transfer offices from protection of intellectual property to *enabling and enhancing* entrepreneurial opportunities. Develop open innovation programs that collaborate across the campus and remove barriers to moving discoveries to market.

- Include faculty inventors in the development of technology transfer policies and procedures. Faculty committees can help develop inventor engagement programming, promoting buy-in and interest in entrepreneurship among faculty.

- Enhance the role of the technology transfer professionals as key partners in achieving the institution's entrepreneurial goals. Technology transfer offices can act as conveners of institutional entrepreneurial units, and can play a key role in identifying appropriate resources for faculty.

- Change the messaging of the role of technology transfer offices by developing coordinated communication strategies that "tell the story" of campus entrepreneurship, including the support and assistance of the technology transfer office.

- Engage technology transfer offices meaningfully in developing the university economic development strategy and communicating the impact of that strategy.

- Collectively engage all parties responsible for the development of university entrepreneurship in assessing EIR and mentorship needs, and in planning how these resources should be identified, allocated, and managed. An internal advisory council with members from different constituencies across campus will allow for relationship building and strategy development.

- Engage the fundraising units on campus to ensure that alumni and industry engagement with mentor programs is valued and can be included in the incentive structures for development staff.

- Understand that technology transfer is part of a much larger system of supporting growth of an entrepreneurial culture at the university. Diversity of units, engagement types, skill sets, and focus areas are essential.

- Fund the development of an entrepreneurial culture appropriately for achievement of expected results. Diversify and broaden the funding base beyond coverage for facilities and administrative costs from the office of research or a portion of licensing revenue.

- Provide a flexible governance structure that allows for development of entrepreneurship friendly policies and procedures.

SUPPORTING UNIVERSITY STARTUPS

This topic focuses on the expansion of the mission of technology transfer offices to holistically include programs that support the launch and development of university-based startup companies, potentially including licensing technology but also broader support for startups. For the purposes of this discussion, "university startups" are defined as new companies or firms that are dependent on university-issued licenses to new technologies as defined by the Association of University Technology Managers (AUTM).

Examples: What are universities doing well?

- Technology transfer offices are positioning themselves as conveners to create environments of collaboration, relationship-building and networking that support startup growth and funding. They are linking budding university-affiliated entrepreneurs with educators of entrepreneurship to facilitate the illumination and education of core entrepreneurial and business competencies.

- Universities partner with local and regional economic development organizations to offer training opportunities that help entrepreneurs leverage federal programs including Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards. The Kentucky Science and Engineering Foundation offers SBIR/STTR assistance to Kentucky-based R&D businesses that helps them develop proposals and identify matching funds. University of Wyoming's SBIR/ STTR Initiative provides assistance to startups through training, access to mentors, peer networking, and a "Phase Zero" program.

- Universities have established internal programs that provide capital for university-affiliated startups. Such programs typically engage internal and external stakeholders throughout a multi-stage review process. Further, university-backed venture capital funds invest university resources into the institution's startup companies. The University of Minnesota's Venture Center at the Office for Technology Commercialization is an example of such a fund where licensing is a major instrument of venture funding. The Venture Center also helps identify promising technologies from the university startup pipeline and prepares them for market. Indiana University's Research and Technology

Corporation manages the [Innovate Indiana fund](#) which provides seed and series A financing to companies with a significant university connection. The University of California, San Diego's [Triton Fund](#) invests exclusively in UC San Diego spin out companies. Triton provides funding to source and prepare startup teams for presentation to investment committees.

- Streamlined licensing programs for university startups remove a significant barrier for translating technologies to market. The University of California, San Diego's [Open Flow Innovation](#) program minimizes time-consuming or bureaucratic steps in the licensing process. The program helps translate technologies into new start-up companies with terms appropriate to their development stage. Washington University in St. Louis offers a [quick start license](#) to speedily foster venture formation based on university technologies. The University of Kansas has a similar [Swift Startup license](#).

- The National Science Foundation's i-Corps program supports teams through critical market and commercialization evaluations associated with a specific technology. Customer discovery and feedback is a key element of NSF i-Corps. This core tenet has been incorporated into many technology and invention disclosure evaluation processes. The [State University of New York (SUNY) Technology Accelerator Fund](#) added a specific requirement to its application for funding that mandates a completed customer discovery evaluation.

- Universities are working to achieve greater levels of diversity and inclusion in startup leadership. The University of Florida's Office of Technology Licensing collaborates with the [Empowering Women in Tech Startups](#) program to provide budding female entrepreneurs with hands-on training and skills development. University of Florida also includes an Entrepreneurial Women's Center in its incubator space.

Obstacles: What's getting in the way of technology transfer evolving toward the vision?

- Identifying management talent is an ongoing challenge for developing the leadership teams of new startup companies.

- Access to capital is a persistent issue for university-affiliated startup companies. This is particularly an issue when there is a lack of university programs available to assist in early financing for startup companies.

- There is a need for unified metrics and incentives that reinforce startup priorities and promote best practices, both at the technology transfer offices and for startup firms.

- Faculty don't always find it easy to prioritize startup activities, particularly if there is not clear articulation of benefits for their primary roles and objectives (teaching, research, publication, promotion and tenure, etc.).

- From a technology transfer perspective, organizing a license with a startup can take more effort and resources than licensing to an established company. There is a need for programs, incentives and clarity in technology transfer that encourage and allow for efficient licensing to startups.

- It can be challenging to clearly define, specify and promote the evolving mission of technology transfer offices – shifting away from maximizing royalty revenues and toward a focus on economic development, student/faculty experiences, public benefits. There is also a challenge in articulating this mission uniformly across a university system.

Imperatives: What must universities do to continue the technology transfer evolution?

- Universities must strongly encourage their technology transfer offices to connect and partner with regional innovation communities to attract experienced entrepreneurs who can serve as mentors to budding campus entrepreneurs. Universities must serve as the bridge between seasoned entrepreneurs and university startups.

- Universities must take an active role in assisting with early-stage financing of university startups including through SBIR/STTR support, infrastructure assistance, and university-sourced seed funds. Coordination and alignment of resources is necessary, as is promotion of lesser known local, state and regional investment sources.

- Universities must align metrics and incentives, across campus and systems, that encourage faculty and student entrepreneurship as well as engagement with startups. Steps could include broadening promotion and tenure criteria, streamlining conflict of interest policies, clarifying revenue distribution policies, and promoting opportunities to students through living-learning communities and advising offices. Curriculum flexibility can also encourage and support students' entrepreneurial endeavors.

- Universities must streamline the licensing processes for university startups, aligning these processes with the needs and capacities of new firms. Alignment of processes must be focused on the success of the startup.

- Universities must develop clear policies that reinforce the role of the technology transfer office in new company creation while making sure not to overstate expectations.

- Universities must support the inclusion of women and other underrepresented groups in the entrepreneurial ecosystem across campus. Diversity must be developed among student/faculty entrepreneurs, mentor and capital networks, and company management recruiting efforts.

NEXT STEPS

To realize the promise of economic engagement, and effectively leverage technology transfer evolution, efforts will need to be undertaken at both the national level and at individual universities. Outlined here are potential next steps that can be pursued by APLU and its national partners, as well as university leaders.

NATIONAL EFFORTS

APLU will continue to work with partners on the national level, including the many national organizations that participated in this work, to advance the importance of technology transfer as part of universities' economic and societal engagement mission.

- In partnership with other national organizations—and through coordination among APLU member groups such as the Council on Research (CoR), the Coalition of Urban Serving Universities (USU), the Council on Engagement and Outreach (CEO), Cooperative Extension, and others—APLU's Commission on Innovation, Competitiveness, and Economic Prosperity (CICEP) will continue to help define the field of university economic engagement, including technology transfer and other innovation management activities.

- APLU will continue to develop and disseminate tools that help universities better organize economic engagement efforts, appropriately resource these activities, measure their effectiveness, and communicate about impact.

- APLU will look for opportunities to communicate the imperatives outlined here to university governing boards, presidents and chancellors, senior research officers, engagement leaders, and others that can play a role in helping to evolve technology transfer.

- APLU will advocate for public policy that supports a vision for technology transfer as part of universities' broader economic and societal engagement efforts.

UNIVERSITY LEADERSHIP

University leaders—including governing board members, presidents and chancellors, senior research officers, provosts, and engagement leaders—should explore the implications of the examples, obstacles, and imperatives outlined in this report. In particular, leaders should:

- Reexamine and redefine measures and indicators of success for university technology transfer. University leaders can look to guidance on this front provided by APLU's New Metrics Field Guide, AAU's Indicators of a Successful University Technology

Transfer Office, and AUTM's proposal for an Institutional Economic Engagement Index.

- Work to organize or reorganize university economic engagement operations, and more effectively connect technology transfer to activities across the university's economic engagement and innovation management efforts. Many examples of how universities are doing this are included in this report, and additional examples can be found in case studies from APLU's Innovation and Economic Prosperity Universities program.

- Develop strategies for effectively allocating resources to support the evolution of technology transfer into the broader economic engagement enterprise. New expectations and roles will require new skills and perspectives. An evolving set of responsibilities and activities will demand new funding and business models. University leaders should develop strategic resource allocation plans for economic engagement and innovation management that fully support the advancement of technology transfer offices within these mission areas.

- Make the economic engagement story more explicit—for both internal and external stakeholders—illustrating the role and value of technology transfer in delivering on the university's promise for economic and societal impact. The learning and discovery missions of the institution do not by themselves achieve impact—they achieve impact through concerted engagement efforts in technology and knowledge transfer. Leaders should develop external messages and communications strategies, and also signals for faculty and staff, that fully convey the value of technology transfer and other innovation management efforts as part of the overall engagement and impact story.

APPENDIX 1:
TECHNOLOGY TRANSFER EVOLUTION WORKING GROUP PARTICIPANTS

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APPENDIX 2: RESOURCES

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