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Study for Roles of Major Players in Technology Commercialization Processes and their Case Studies

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Abstract

Technology commercialization network platform includes several major players such as principal investigators, technology licensing offices, accelerators or incubators, innovation capitalist, local governments and they have their own specific roles in enabling or facilitating the transition from embryonic technologies to markets. This study includes case studies involved with major players in technology commercialization processes as well as their roles, and case studies focus on the case of Georgia Institute of Technology and the State of Georgia for a more effective discussion. Particular interests are paid in the information flow between, and the incentives for, each of these network participants.

Keywords: *Technology Commercialization, Technology Commercialization Process, Commercialization Network Players*

1. Introduction

Technological innovation plays a critical role in economic development and job creation. However, innovation per se has only limited impact unless it is transformed into commercial output that can be manufactured, marketed, and consumed. The transition from innovation to commercial products is a notoriously challenging process, characterized by extremely high uncertainty and involving many players, each of which can perform only a part of the necessary functions for the transition. The difficulty in making that transition holds true not only for technologies generated from primary research institutions such as universities and government labs, but also for those from firms (small and medium sized firms in particular) operating in competitive markets, in which only "proven" technologies get rewarded.

This calls for the establishment of a platform that supports the process by effectively linking across and motivating the involved players: [1]. Recognizing the importance of technology commercialization, governments increasingly make concentrated efforts to build and manage such platform that can facilitate the seamless transition from technological innovation to technology commercialization.

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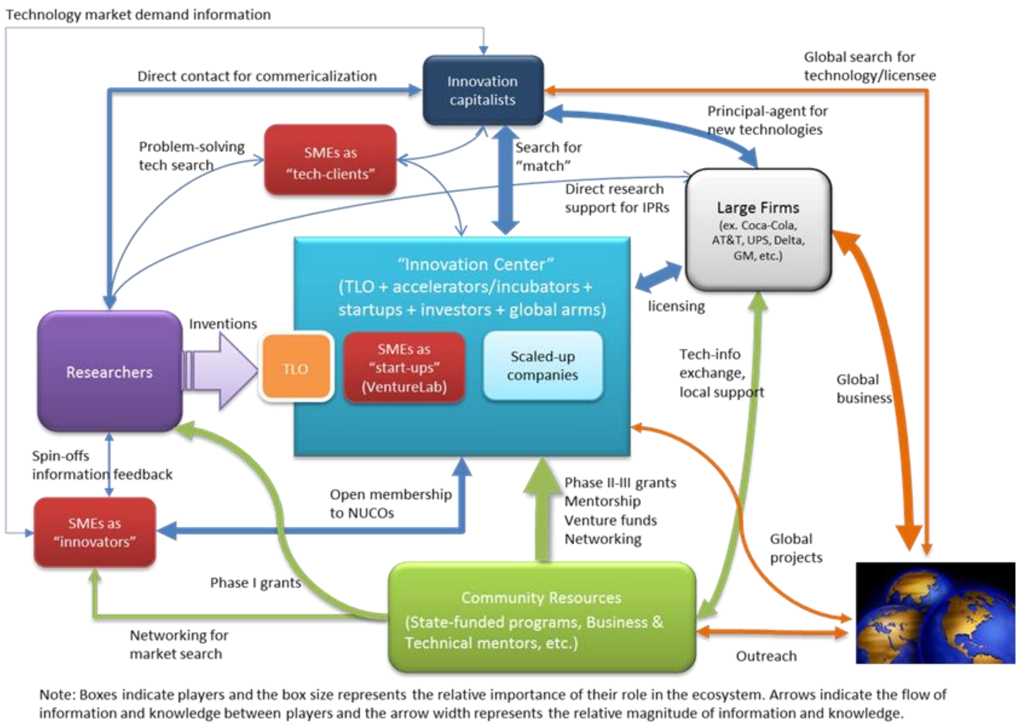

Figure 1. Hybrid Multi-Platform Model (Benchmark Model): [1]

This study describes the major players and their roles in technology commercialization network platforms, focusing on the case studies in the State of Georgia in the U.S., in order to understand how influential they can be in technology commercialization network platform (TCNP).

2. Major Players and their Roles in TCNP

2.1. Principal Investigators

A technology transfer begins with a scientific discovery at the bench lab by university scientists, conventionally called the principal investigators (PIs). PIs then have two main paths to choose from: disclose it to the TLO, which is the formal route, and bypass the TLO, which is the informal route. The formal technology transfer is usually seen as a mechanism to allocate intellectual property rights: [2]. In principle, all academic inventions with commercial potential should be disclosed to the TLO, which then decides what to do about the inventions. However, according to studies on the bypassing issue, a significant portion (26-33%) of academic inventions circumvent the TLO: [3], [4]. University-generated technologies tend to be more embryonic and hence require a greater involvement of PIs for further development. To encourage invention disclosures and more active participation of PIs in the development phase, universities provide to PIs royalty incentives for their inventions that are successfully licensed out to firms. The inventor share of the licensing revenue in U.S. universities ranges between 25-100%, with a median of 40%: [5]. Inventions resulting from privately sponsored projects are normally licensed back to the sponsor and, much less often, their IP rights are shared between the university and the sponsor. Not all scientists engage in commercially-oriented research. For instance, Lee and Stuen report that, in their sample of university researchers in nanotechnology, only 12.2% have at least one patent in the technology field, with the rest only publishing: [5]. Some university scientists are, however, extremely active in commercial activities, sometimes giving rise to a new industry or transforming the existing industry (Zucker, Darby and Brewer, 1998). Hence, university scientists are by far the primary generator of inventions with great commercial potential in the overall technology commercialization network platform.

2.2. Technology Licensing Offices (TLOs)

Technology licensing office is also called as technology transfer office (TTO) or office of technology commercialization (OTC). Many universities also use different names for the organizations that are responsible for the functions that TLOs perform. Despite the variations in organization names, the essential operational goal of TLOs is to facilitate the process of technology transfer from universities, government labs, or other research institutions to a wider range of users who can then further develop and exploit the novel technology into new products, processes, applications, materials, or services. To enhance our understanding about how the TLO operates with other units around the ecosystem of technology commercialization network platform, we first discuss the big picture on the paths of university-generated inventions.

2.2.1. Taxonomy of the Ultimate Fate of University-Generated Inventions

There are no official statistics on where the inventions generated from university labs end up. However, according to experience-based estimation, about 50% of the inventions disclosed to the university's TLO get discarded after evaluation (i.e., determined not to pursue an IP protection for the invention) – based on interviews with innovation capitalist firms such as IP2Biz.

Of the disclosed inventions that are sought for an IP protection, about 85% get licensed to a firm which, typically with an "open innovation" organization inside the firm, actively seeks external technologies to source in. Some of these inventions may not be commercialized at all because of various reasons such as technical difficulty in turning the prototype into a commercial product, insufficient economies in mass-production, limited market, etc. Firms sometimes "shelve" the technology even after licensing it in order to keep utilizing their own technology so as to protect their market position, while universities try to avert this kind of non-use licenses.

Another about 12% of the disclosed inventions is sought for commercialization by university-based startups. These startups are often called the "Near-University Companies (NUCOs)" because they are typically founded by members of the inventing team (e.g., PhD student, Post-Doc, or less infrequently faculty themselves). According to an estimate, these NUCOs attract about $10-12 billion annually in the U.S. Most of these NUCOs fail, however.

The rest 3% or so of the "above-the-bar" inventions form "serious startups" that tend to have raised significant capital and hired professional management. Hence, the oft-cited model cases of successful commercialization of university-generated technologies take a really small portion of the university inventions. Assuming 67% of the inventions are disclosed to TLOs (that is, excluding the inventions that circumvent TLOs), these serious startups explain only 1% ($=0.67\times0.5\times0.03$) of the total inventions generated from universities.

2.2.2. Case Study: The Office of Industry Engagement at Georgia Tech

The Office of Industry Engagement consists of three main functions: (i) industry-sponsored projects (industry collaborations and affiliated licenses); (ii) technology licensing (innovation commercialization and translational research); and (iii) international transactions (international contracts and technology transfer). The last function specifically focuses on business transactions with international companies including sponsorship from global companies. For this function, the office leverages Georgia Tech's international presence in campuses outside the U.S. such as those in Europe, Latin America, and Asia. The rationale behind putting these three units together under one umbrella is to reflect the ongoing trend in the U.S. in managing the relationship with firms.

Traditionally, technology transfers started with faculty who utilizes their personal and/or business relationships to move their technology to the market. This portion used to take the majority (2/3) of the technology transfers. Another important channel of transfer (15%) was TLO professionals' use of their personal and/or business relationships. The rest of transfers (small portion) were done through direct marketing efforts, which proved very ineffective. This motivated changes in the practice in TLOs. Now most universities try to unify the channel by concentrating interactions to the TLO-firm interface. Put differently, the faculty is less frequently involved in initial contacts with potential licensees, though faculty's personal and/or business contacts still remain as important marketing instruments. The model of combining the management of industry-sponsored projects with technology licensing is to facilitate the relationship with the sponsoring firm in that, from the sponsor's perspective, it is much less costly to deal with a single contact point.

However, at least two areas are deemed less effective in the roles of TLO as a platform connecting inventors with the end users of the technologies. First, when the industry has a demand for a very specific technology, the likelihood of good matching is relatively low because TLO simply has no capacity to identify the expertise of all faculty members. To resolve this problem, the office utilizes the internal network (i.e., personal relations in other departments of the campus) to identify the expertise within Georgia Tech. This solution still has one limitation: due to a relatively high turnover in TLO staff, such informal information system needs to start again whenever there is a change in personnel. Second, TLO cannot provide necessary help when the technological application lies outside the intended domains of the technology. For instance, consider a microchip technology developed for an extreme environment such as furnace, which, however, was applied to cardiovascular surgeries, later. In this case, even systemic information on the faculty expertise may not help.

For the technology transfer, there is roughly an equal ratio (50:50) between "in-sourcing," in which firms first contact OIE for technology and "out-reaching," in which the OIE contacts firms for possible licensing and commercialization. Firms that do in-sourcing are typically mid- to large-sized companies; small firms can rarely do this because, first, they don't know whether such channel exists; second, they consider the engagement with universities an expensive route to locate a technology. Even the firms that do insourcing often need to hire third parties, called "technology scouts," to identify the right source/owner of technologies they need. This is not costless either, which is another reason why small firms can rarely utilize insourcing. When the OIE outreaches, they tend to approach large firms. This is mainly because of the way interpersonal relationships evolve. These relationships are developed through external activities such as the Association of University Technology Managers, trade meeting, conferences, etc., which only large firms can afford to send their employees or managers to. For both in-sourcing and out-reaching, lowering the cost of using TLO in general appears to be a critical issue. The easier it is to use TLO, the more interactions take place on the TLO platform. Therefore, currently the U.S. TLOs try to transform themselves from "protectionists" to "facilitators" while Wozniak admits that this evolution is seen as a (very) slow process to outsiders.

2.3. Accelerators and Incubators

For any successful technology commercialization network platform, it is crucial to provide accelerated, well-organized, and mentor-guided learning programs to entrepreneurial ventures: [6]. This is particularly so for those in knowledge-based industries. We refer to as accelerators or incubators those that provide entrepreneurship education programs that accelerate learning during venture gestation: [7]. Programs educate ventures through mentorship and seminars, and often organize 'Demo Day' events where venture founders curate their business ideas and future products to potential investors. In most cases, accelerator programs set a limited duration after which the current cohort "graduate," and then a new cohort enters the program. By this, entrepreneurs become a part of a group of "firms," observing and learning from peers.

Cohen and Bingham attempt to distinguish accelerators from incubators: [6]. According to their definition, accelerators differ from incubators in that (i) they set a pre-determined time for graduation but incubators may allow for indefinite stay; and (ii) incubators charge rent while accelerators typically make equity investments. Such distinction, however, appears practically not so clear cut because even our interviewees used these terms interchangeably. Even if the two are indeed different, such distinction does not seem critical. Thus, in our report, we use the terms accelerator and incubator interchangeably. We now discuss case studies on two different local units that function as incubators or accelerators.

2.3.1. Case Study I: VentureLab

VentureLab is a state-funded business incubator program and part of the Enterprise Innovation Institute (EI2). Together with the Advanced Technology Development Center (ATDC), VentureLab helps the founding of startups. While ATDC focuses on startups in a later stage, VentureLab focuses on entrepreneurs in a very early stage. VentureLab works independently but closely with the OIE, which owns all IP rights at George Tech, as all invention disclosures are in principle copied to VentureLab. Annually, about 350 inventions are disclosed to the OIE. Of these, about 100-150 are "encumbered" as company-sponsored projects, so the corporate sponsors retain the first right. A smaller portion of the inventions is classified IPs as they result from government sponsored projects. In the end, VentureLab evaluates around 200 inventions each year for potential startup ideas. The entrepreneurs accepted to VentureLab are normally at their very early stage, at times even only with a business idea. Thus, they need to go through the incubating process. In fact, VentureLab's primary missions are summarized as a three-stage integrated process of educating, curating, and creating.

First, VentureLab educates would-be entrepreneurs, focusing on helping them to form and refine their innovation concepts by performing reality checks. Notably, VentureLab followed a supply-side approach in its early era by working with the researchers (PI, post-docs, and students) to start a venture. However, realizing the weakness of this approach, and helped by the launch of the NSF I-Corps program, VentureLab recently shifted to a demand-side approach. The education is open to any entrepreneur, even outside of Georgia Tech network. Once accepted to VentureLab, the entrepreneurial teams go through a six-week long program called the Startup Gauntlet (i.e., a customer discovery boot camp). In the program, the entrepreneurial teams go outside the campus to do a reality-check of their business ideas by talking to 10-12 industry people per week (a total of 60-70 people throughout the program). They then refine the business concepts based on the feedback they receive from those contacts. This idea refining process uses the Business Model Canvas, a brainstorming tool: [8]. During the program, each team has a three-hour weekly meeting with its industry mentor. The mentors, called VentureLab Fellows, are normally those who had successful experience in startups and are looking for the next challenges. Naturally, these mentors can provide hands-on tips and guidance to the entrepreneurs on actual problems that startups can face.

Second, VentureLab leads a promotional activity focusing on creating interactions between VentureLab and faculty and students. Given the over $600 million annual research funding that Georgia Tech has, VentureLab makes efforts to leverage scientific discoveries that result from such large scale funding. For this purpose, VentureLab reaches out to PIs and students to learn about their research while striving to trigger their interest in entrepreneurial opportunities. Typically, PIs are discouraged to be directly involved in startups as they are deemed less suited for managerial positions. Instead, they are advised to bring in professional managers on board. VentureLab boasts about 400-600 VentureLab Fellows who serve as industry mentors and advisors, helping this mission of curating.

Finally, each VentureLab personnel, called Principal, takes startups by their industry expertise to help move the startup to the next step by assisting them to apply for funding from the NSF (under the I-Corps program) or Georgia Research Alliance (through GRA Ventures) and to identify potential customers and entrepreneur managers. Once an entrepreneur grows up through VentureLab's incubation, they may graduate to the phase of acceleration at ATDC.

2.3.2. Case Study II: Advanced Technology Development Center (ATDC)

ATDC is a state-funded accelerator that focuses on maturing a Georgia Tech-based startup. As of June 2013, there are over 330 startups residing at ATDC. 34 of them are "Select" companies while the rest are "Member" companies. Select companies are chosen based on their status (e.g., funding record, revenue potential, etc.) and are entitled to a greater variety of services provided by ATDC such as Select Roundtable, where the entrepreneurs meet with CEOs at large corporations. Invitations to ATDC are open to the entire Georgia Tech community (mostly, labs) and VentureLab is just one of the channels by which startups can join the ATDC. When a Select company hits a $1 million sales milestone, the company is considered ready to "graduate." Failures do occur even after graduation for various reasons such as market changes, staff changes, economic cycle, or explorative diversion. The characteristics in these failures do not exhibit specific patterns. If any pattern can be identified, that can be fed back to the nurturing process to help prevent the repetition of the same mistakes.

Member companies pay an annual fee of $5,000 and receive benefits such as mentoring provided by over 40 Entrepreneurs-In-Residence (EIRs) who are specialized by industry, access to research equipment at Georgia Tech, other ancillary services like legal, accounting, tax, etc. Member companies pay subsidized rents on the office space, which varies by membership status and firm size, considerably lower than the market rate. However, to accelerate graduation, the rent goes up by year. Member companies are given three years, and by the third year, the rent is almost no different from the market rate.

Through various programs (e.g., Industry Connect, Entrepreneur Education), ATDC has focused extensively on nurturing. Note that EIRs are separate from the industry mentors for VentureLab. EIRs are typically established, serial entrepreneurs who have started a successful venture and perhaps sold the company, and are willing to help younger entrepreneurs. Industry mentors in EIRs are paid for their work and are strictly prohibited from taking any equity in the ventures they advise. Startups that seek advices from some of these EIRs make an online reservation with the EIR they want, based on the background and expertise. ATDC manages and monitors the appointments through the customer relationship management system, which helps ensure that EIRs do not simply maintain their affiliation without bearing any burden of startup mentoring.

2.4. Innovation Capitalists

Innovation capitalists are considered as one of innovation intermediaries that link between large firms' insourcing activities and external sources of innovation. In particular, they seeks out promising new ideas from independent inventors and other sources, invest in those ideas to transform them into market-ready concepts, and sell or license the related intellectual properties to large client firms: [9].

2.4.1. Who are Innovation Capitalists?

An innovation capitalist is different from a typical venture capitalist in that it does not go through the time- and capital-intensive process of building a stand-alone company. Instead, an innovation capitalist focuses on locating and validating a technology at the request of its clients or for recommending a technology for the potential specific use by its clients. Innovation capitalists identify a cluster of smaller investments in an early stage technology based on its clients' needs to move the technology toward commercialization. Their exit point is usually the time when the client takes the form of a license from the technology source. This is in quite a contrast to the traditional flow that technology holders search for potential clients. In fact, many innovation capitalists claim themselves as efficient match-makers that bridge the demand-side to the supply-side.

2.4.2. Case Study: IP2Biz

- IP2Biz's Initial Supply-Side Approach to Commercialization

IP2Biz as an innovation capitalist seeks out and evaluates ideas and technologies from the inventor community and early stage corporations on behalf of a client. After this search and validation stage, the company tries to develop and refine the technology to the point where the market innovation potential is determined. Note that it does not partake in ownership rights for the innovation; all ownership rights are delivered to the client. The client can make optional investments in the technology to reduce its acquisition costs and early-stage risks. While the current business model for IP2Biz settled into this market- and needs-driven approach, it initially started with the supply-side approach, i.e., first identifying the technology to commercialize and then scouting for the buyer/user of the technology. More specifically, IP2Biz targeted some inventions that were determined not to be pursued further by the TLO but deemed to have potential for a commercial use. If the technology reached a stage that was sufficiently "ready," normally evaluated as 7 or above on the technology readiness levels (TRL), it was considered worth trying for a sale to firms. Soon after, however, IP2Biz learned that this business model did not work well. One primary reason is that early stage technologies require considerable additional exploration and complementary technologies to be commercialized and turned into a viable product. They claim that TLOs are not well aligned for this kind of task. Moreover, there is a fundamental barrier between the university and the firm, with little understanding from both sides. Besides, even on the firm side alone, there are differences in the focus between senior executives and (corporate) IP lawyers. Senior executives are mostly concerned about potential cannibalization, while IP lawyers focus on legal aspects such as the possibility of infringement. Thus, it appeared to him very hard to pull these parties together to move forward.

- Demand-Side (Needs-Based) Approach

Now, IP2Biz is entirely working from the corporate side. They think that most university scientists are very much willing to collaborate and share their research outcomes. Also, corporations typically have well established systems or formal processes for product development and commercialization and their employees are responsible for the execution. However, in "front-end innovations," where IP2Biz mostly works on, firms tend to be inefficient because it is hard to standardize routines or processes for this kind of innovation. The development process is also highly uncertain and requires intense interpersonal connections. To overcome this challenge, they normally contact corporate senior executives to listen to their existing, but unfilled needs, though these are usually just ideas (as it may well be in their very early stages). These corporate executives tend to have experiences in which they thought about something and tried to develop the ideas by discussing them with their own R&D personnel, but abandoned those ideas after learning some negative reactions from the R&D personnel, who are accustomed to formal processes. Once they identify these needs and problems, their team starts a global search of potential technologies that can solve them. Their team consists of hard scientists who are specialized in such scientific fields as material science, mechanical engineering, physics, etc. The first stage search involves a literature survey to identify the front-end researcher in the corresponding field. This quickly yields a short list of experts in the area. The solution often requires multiple technologies because rarely does a single technology alone solve the issue at hand. Hence, the search normally involves searches of adjacent or supporting technologies. In this search process, the company also utilizes their scientific advisory committee (SAC) who gives professional referrals or references to their contacts. This SAC, developed and accumulated primarily through personal connections, is a network of scientists at universities and national labs around the world.

Once the experts are identified, they strike a conversation with the PI through phone calls and personal visits to the lab for further discussions. These in-person meetings often lead to a dialogue on new technologies the PI is currently working on, which may not even be disclosed or published. These related dialogues also help get a better understanding of the focal technology and the kinds of research that the PI (and his/her NUCO) is working on, as well as the stage of the firm regarding funding status, development stage, future roadmap, etc. This information can then lead to linkages to other client firms that are looking for certain technological solutions or even possible acquisitions.

Their corporate clients range from small to huge in size. There should be two reasons why innovation capitalists are necessary: First, R&D personnel in corporations are limited to his/her own research domain and hence cannot find out opportunities as well as an innovation capitalist does. TLOs tend to become protective especially when dealing with large firms that are looking for technologies, which can make deals go awry. Second, many large firms send their employees to TLOs to scout technologies but these corporate people working with universities and TLOs are not properly prepared to deal with early stage technologies which are extremely perishable and unmolded. Since PIs resist dealing with administrative issues to get their technologies moved ahead and commercialized, and TLOs are not well suited to fill in the need, someone with passion has to start the process to get the commercialization going. For an exemplary case, there is a chemical company with $30 billion revenue and 750 R&D personnel, which had put aside $600 million for a CO2 recycling project. When this company could not come up with a technology for the project, IP2Biz hired by the company scouted among 32 countries (using its contacts at universities) searching for the technology and ultimately found a NUCO that has the necessary solution. This is a match that would not have been possible under a traditional TLO model.

- Opinions for a Successful Model of TCNP

Several ideas may serve crucial for a successful model of any technology commercialization network platform. First, it is noted that early stage technologies are extremely "perishable," and hence require careful stewardship for carrying them through the process. Technologies are better commercialized when pursued without strong profit orientation until they reach a mature stage. However, most venture capitalists are more interested in profiting from the technology and less concerned about nurturing the technology. Thus, they pose risks of constraining the possibly much greater potential of early stage technologies. From this standpoint, the ideal process to commercialization from an invention is that, more than anything else, the technology needs to be clarified and protected first. Then, TLOs can come into the scene, though it might be very inefficient, which is perhaps not surprising since there is no monetary incentive for them to play as an active platform. After this stage, the key is to generate sequential conversations between the PI and the corporate firm on the demand side, much like an open forum where open conversations, not actual steps to exploit the invention, should be encouraged. The focal technology can then gradually move through the process step by step.

Secondly, it is pointed out that one agent cannot drive the whole activities in building a working system. For examples, venture capitalists are too profit-oriented; IP lawyers are fixated on legal aspects; state/federal government has little capacity to assess technologies. It is suggested that U.K. Imperial College has a very unique approach, which could serve as a model case for the university's role in the commercialization process. The TLO at the College is put outside the university, operating completely independent, but it actively participates in college decisions and administrations such as attending the provost meeting. Philadelphia QED program, as a proof-of-concept program for early-stage life sciences research, is another model that can be learned from. Any model of commercialization platform should serve as a facilitator between PIs on the supply side and the senior executives of firms on the demand side.

2.5. Local Governments

Through our investigation on the technology commercialization network platform, we have realized that multiple local government entities are taking part in various stages of this process, though their specific names, organization, funding mechanisms and target areas vary across states. In this report we focus on the state of Georgia, particularly the state-funded programs through Georgia Research Alliance (GRA).

2.5.1. Case Study : Georgia Research Alliance (GRA)

- GRA Missions

Georgia Research Alliance, established in 1990 as an independent non-profit organization, has the mission of advancing economic development by expanding cutting-edge research at Georgia's universities. Through this mission, GRA expects to facilitate the launch of new companies and creation of high-wage jobs. Specifically, GRA is currently focused on the following three areas:

1) Eminent scholars program is a recruitment tool to bring world-class researchers into six Georgia research universities: Georgia Tech, Emory, University of Georgia, Georgia State University, Georgia Health Sciences University, and Clarke-Atlanta University;
2) Building infrastructure to develop sophisticated research facilities and equipment at Georgia universities;
3) Commercialization program to provide seed capital to science and technology startups.

In all three programs, GRA works in partnership with the six universities. The budget comes from the state of Georgia, but the majority of the funds permeate back to Georgia through grants to PIs. Though Emory University and Clarke-Atlanta University are private, the grants to the PIs in these universities are also broadly considered as "payback" because the money essentially stay within the state. The funding for GRA's operation such as maintenance, employee compensation, etc. comes from private sources, including large corporations, individuals and foundations who donate money for philanthropic purposes.

- Commercialization Program

We focus on the GRA Ventures program that targets to identify technologies with commercial potential and invests resources (about $25 million since 2002) to realize them as successful businesses.

Funds are allocated through direct grants to PIs. Thus, the typical initial process is to identify PIs with promising technology and then solicit them to submit proposals to GRA to be considered for selection. Funding follows for the milestones that characterize each of the three phases. The primary goal of Phase I activities is to identify and prioritize risk factors typical arising in technology, market, financing, and intellectual property to enable a decision on whether or not to form a company. Phase II activities aim to mitigate identified risks in various manners such as building a prototype or define value proposition. If a startup is still promising after the first two phases, then GRA tries to help the startup to scale the business through Phase III activities, specifically focusing on operational and execution-related issues. If necessary, GRA makes a loan, normally through ATDC, to the startups (e.g., 5-year notes). GRA operates a separate financing arm, GRA Venture Fund, which invests in these startups in exchange for equity stakes.

A successful technology transfer and commercialization needs to overcome the different challenges depending on the technology phase. To increase the effectiveness, GRA works closely with other organizations such as VentureLab and I-Corps and also provides direct funding to startups in the portfolio. In addition, GRA is well aware of the importance of mentoring and hence it tries to provide the grantees with links to industry experts. For instance, there is a startup company that is developing skin care dermatology products based on a technology developed at Emory University. Through personal network, GRA connected the entrepreneur to a major pharmaceutical firm that can help the startup going through the development process, which is quite lengthy and complex. This kind of industry linkages is crucial for crossing the valley of death. The success (or survival) rate of GRA portfolio firms was around 25-30% in its early time; nowadays the rate hovers around 60%. This significant improvement in the success rate is considered attributable to GRA's efforts to get industry experts involved, primarily through management and mentoring.

GRA runs an annual online survey of the firms it supported to follow up with their business activities, such as growth and funding raised. For practical feedback to improve their operation, they frequently reach out to PIs and entrepreneurs to check up on the status and any areas that need further help. There are over 20 other states also have programs similar to GRA (e.g., see www.ssti.org for the association of such organizations).

2.6. Other Players

There are other players in the ecosystem that also perform important functions in moving the early technology through the commercialization process, creating startups in the process, and reinforcing the regional cluster of technology commercialization network. Below we discuss one of such players that we identified in our study, particularly those that are an integral part of the technology commercialization network platform around Georgia Tech and Greater Atlanta area.

2.6.1. Case Study : National Science Foundation I-Corps Program

The Innovation Corps (I-Corps) is an NSF-funded program started that in early 2012. I-Corps noted that there are four risks that need to be solved for startups (in the reverse order of importance): financial, people/management, technology, and market. Unfortunately, even aspiring entrepreneurs have often ignored and not well understood the market risk. The I-Corps program focuses on addressing precisely this issue. Each I-Corps session lasts six week with each cohort having 25 startup teams. Each startup team comprises three members: a PI, an entrepreneurial lead (PhD student or Post-doc), and an industry mentor. For the industry mentor, either the PI already has some contacts or the ATDC/VentureLab provides connections to the team. Once selected through a competitive selection process, the team gets a one-time $50,000 NSF grant, which can be used for travels, hiring consultants, and/or prototype building.

I-Corps is essentially a startup boot camp, an intensive period of training, experimentation, and consultation with an ultimate goal of identifying market needs. The first week is used for classroom teaching, focusing on how to conduct market experimentation. For the remaining five weeks, the teams are required to meet with at least 100 potential customers or customer groups and get their feedback on the business idea and the technology. This means the teams are expected to talk to about 20 customers per week, which is quite intensive. The teams begin with a working hypothesis about the specific target customers of their technology and then meet with these customers to listen to their needs, figuring out if their technology is expected to meet these needs. The list of customer contacts is primarily drafted by the team (based on their working hypothesis). Nonetheless, this does not appear working fine because, very often, the teams are surprised to find out that the very core customer they have envisioned express no interest or excitement in the proposed technological solution. In discussing with potential customers, the teams are to learn from these customers, not try to “sell” the technology to them. Also, the teams are encouraged to find out the “why” side of interest (i.e., motivation, excitement), rather than simply yes or no. This helps further refine the technology or the business concept. Note that these contacts are required to be in-person; no survey or email correspondence can replace these customer contacts, though phone calls are accepted.

The teams then report back to the program with their findings. Finally, the I-Corps instructor, joint with the team, makes the decision of whether or not to pursue the business idea (i.e., go vs. no-go). According to I-Corps experience of four cohorts so far (i.e., 100 teams), about one third of them continue with the idea, while the rest decide not to. During the six-week program, the instructors are said to be intentionally rude to the entrepreneurs, frequently stopping in the middle of their idea presentation and constantly trying to remind them that their ideas are “wrong.” These “insulting” behaviors from the instructor can potentially agitate the PIs who try to defend their students. To avoid such conflicts, a staff from the NSF sits through the business presentations. Through these challenges, the entrepreneurs are expected to learn to face the reality, which is what they have been rarely used to. The purpose of the I-Corps program is not limited to the focal project; they intend to help the (academic) entrepreneurs to start thinking differently about their research going forward (i.e., towards commercialization). Currently, some challenge to the I-Corps initiative is seen because it is not easy to scale up the operation. While the instructors currently cannot do a one-on-one session with the teams (at best, 6-8 teams in one session), finding a right person for the instructor’s role remains a challenge.

3. Concluding Remarks

Several issues have been covered in TCNP with the previous studies: the roles of major players evidenced in field interviews and case studies, SMEs and their information-related issues, critical factors of successful technology transfer and commercialization, and exemplary models of the global TCNP: [1, 10].

Nonetheless, we do not claim that our work provides a complete understanding of the global technology commercialization network platform, which would certainly require follow-up investigations. There should be, for sure, some of the major constraints in the Korean situation, such as the underdeveloped venture capital system, lack of sufficient pool of successful or serial entrepreneurs, relatively weak research capabilities of universities and technology transfer practices, and low level of initiatives at local governments, which we should definitely consider for effectively successful technology transfer or commercialization under unique circumstances. It is expected that the issues covered will be useful guidance for future policy directions toward this avenue.

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