EXECUTIVE SUMMARY

Technology transfer is a collaboration between universities, government, and industry that results in the transfer of ideas, knowledge, and/or products. Working with the National Research, Development, and Innovation Office (NRDIO) of Hungary, students at American University looked further into the practice of technology transfer across the United States and Hungary by conducting field interviews with the main actors in technology transfer partnerships. This report aims to determine best practices regarding technology transfer, barriers that prevent further cooperation, and steps that can be taken next in order to sustain technology transfer. This topic is significant, as the global economy is becoming dependent upon technology; if a country wants to become a major global force, it needs substantial research and development (R&D) to support an innovation-based economy. Overall, findings suggest that with alterations to current technology transfer practices, both Hungary and the United States can substantially increase their R&D and innovation efforts.
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Since the beginning of industrialization, the use and development of technology has served as a key component in stimulating economic expansion. The current globalized world is no exception to this; rather it puts a greater emphasis on the need for technology and innovation. While companies and governments can choose to develop technology through a closed innovation process, the alternative of utilizing external research has become increasingly popular. Use of external research and interagency collaboration stimulates development within a country and can offer nuanced innovation—this leads to a process known technology transfer (Susulka, 2015).

In the context of this report, technology transfer is defined as a collaborative effort between government, private entities, and universities—often referred to as the “triple-helix”—which results in the commercialization of ideas, knowledge, and/or products. It is a collaborative effort that moves ideas from the lab or university into the market. Depending on the climate surrounding technology transfer, ideas can move directly from the lab to the market or
flow through other entities, which facilitate the transfer. Overall, the goal is to find practical applications for abstract, technical knowledge in the form of products, processes, applications, materials, or services.

The main actors surrounding technology transfer are universities, private companies, and the public sector. Each relationship can vary and the transfer adapts to this relationship. In some cases, a private company will seek out research generated by a university or government lab in order to develop a specific project. In other cases, university or government labs will export their research to private companies with the intention of bringing innovation into the market. Technology transfer can produce various types of products or services. In some cases, it is the transfer of knowledge from one entity to another, either in the form of competencies or software. In other cases, these partnerships can create tangible products, including components of larger products.

Both universities and profit making companies have the same goal: to release innovation into the public sphere. Due to the ways in which each partner is situated in the market, motivations and roles behind this goal may vary. Traditionally, universities and labs operate to expand knowledge in order to benefit society; whether that is by making daily tasks more efficient, or by curing ailments through medical innovation. These “research” parties are not situated as profit-seeking entities. On the other hand, private companies need to attain capital in order to survive in the market. Regardless of intention, corporations need to generate profit to continue producing products or providing services. In regard to technology transfer, each party contributes certain levels of expertise and each can serve to complement the other.

The benefits of technology transfer are evident, but there is also room for growth. This report will detail the experience of over 15 interview subjects in both Hungary and the United States. Participants commented on the current state of technology transfer in their region and offered suggestions to promote future sustainability of technology transfer.

**LITERATURE REVIEW OF TECHNOLOGY TRANSFER**

Companies have traditionally participated in a “closed” innovation process—the concept that the bulk of technology development and research is conducted within an organization’s boundaries. These companies require that new technology respond to the demands of consumers, or act to develop new, profitable products. Typically, closed innovation processes concentrate on internal research and technology development. The transfer of technology between organizations or firms tends to be limited, and direct collaboration is rare (Keller, 1990). For instance, companies are often apprehensive to participate in the transfer of their own technological knowledge and expertise to outside recipients, because they fear that doing so will increase competitor potential (Lichtenthaler, 2010). In previous decades, this concern has limited the incentive for companies to initiate collaboration with external institutions or universities.

In recent years, experts in the field, including technology transfer expert at Johns Hopkins University, Joshua Powers, have noticed that “universities, particularly large research institutions, have rapidly escalated their involvement in technology transfer, the process of transforming university research into marketable products. This is fueled in part by redefined external expectations for economic development as well as internal pressures to
generate new sources of revenue” (Powers, 2003). This shift has led to an “open” innovation approach, which allows firms and universities to actively collaborate with external partners to develop new technologies and expand their own research. Some firms seek out new research from external sources that complement their internal research and development (R&D) and when they find it, a technology transfer relationship forms. For example, a private firm can engage technology transfer when it requires university research to develop specific software that would run an automotive system they are developing. Alternatively, public or private labs can utilize their own technology and direct it toward external sources in order to commercialize their own technology. For instance, a university can license a concept that is developed within their lab to an external manufacturer, who can produce and sell the concept. In most cases, universities and government labs serve to expand knowledge, not to reap profit. In the technology transfer relationship, private firms take this expanded knowledge and move it into the market place, which is their area of expertise. Additionally, firms can combine inbound and outbound open innovation in coupled processes (Chesbrough, 2003).

For a company to reach successful technology transfer, they must first develop “absorptive capacity”, or the ability to acquire and utilize external information (Lichtenthaler, 2010). Absorptive capacity assumes that a company enters a relationship with previous technological knowledge and acquires additional innovative technologies from external sources. This existing capacity gives a firm the ability to identify marketable information and knowledge, which leads to successful absorption. A company may be able to identify new technology that is required to develop a product, but is unable to properly develop the knowledge inside their firm. This demonstrates that a company has pre-existing technological knowhow in order to identify and acquire new technology that will further their efforts (Cohen and Levithal).

Companies must also focus on expanding the complementary notion of “desorptive capacity”, which refers to a firm’s outward technology transfer capability (Lichtenthaler E. and Lichtenhaler U., 2009). This capacity can be thought of as the counter-strategy to absorptive capacity, but involves a firm’s outward technology transfer strategy and how technology application is facilitated toward external sources. Unlike absorptive capacity, desorptive capacity involves two stages: (1) identification and (2) transfer. The current market under utilizes the identification process, as several firms are unable to properly identify external players that could utilize existing technology that the firm produces (Davis, J.L. and Harrison, S.S., 2001). Once an external group has been identified as a potential technology transfer partner, the second stage is transferring technological knowledge and facilitating its application at the recipient. Many times, licensing agreements depend upon the success of integrating technology into a specific product (Sherry E.F. and Teece, D.J., 2004). Due to the fact that a firm develops the initial concept, and is already using this technology in their own products, it is important that a close, collaborative effort takes place during the technology transfer. This will ensure that the technology is commercialized in the most efficient and productive manner.

In order to develop and promote technology transfer, a government must play an active role in supporting innovation. To provide consistency and stability throughout the development of R&D, government
systems must support companies and universities by enacting policies that promote effective technology transfer. Both Hungary and the United States have made innovation a priority and have led recent initiatives to advance R&D practices.

CURRENT STATUS OF TECHNOLOGY TRANSFER IN THE UNITED STATES

In the United States, the key players in government led technology transfer are the federal agencies, federal labs, Office of Research and Technology Applications (ORTAs), and the Federal Laboratory Consortium for Technology Transfer (FLC). Both the Department of Commerce (DOC) and the Department of Defense (DOD) play a significant role in facilitating technology transfer. The DOC maintains the National Technical Information Service (NTIS), which serves as “the largest central resource for government-funded scientific, technical, engineering, and business-related information” (FLC, 2007). Additionally, the DOD maintains the Defense Technical Information Center, which “provides a central point within the DOD for acquiring, storing, retrieving, and disseminating scientific and technical information” (FLC, 2007).

In addition to the main actors, the United State has over 200 federal agencies that are involved with technology transfer and each is authorized to establish an independent Office of Research and Technology Applications (ORTA) (United States Government, 2015). Each ORTA office serves to facilitate technology transfer for that specific federal agency. As Figure 1 shows, “the ORTA is the laboratory’s focal point for implementing technology transfer and performs the role of a technology ‘broker,’ connecting the people and organizations inside and outside the laboratory that are essential to effective technology transfer” (FLC, 2007).

Regardless of their specific research interest, each lab is dedicated to the common mission of the United States government (FLC, 2013). In regard to technology transfer, the federal government aims to “improve the economic, environmental, and social well-being of the United States by—establishing organizations in the executive branch to study and stimulate technology…[establish] cooperative research centers…[and] encourage the exchange of scientific and technical personnel among academia, industry, and Federal laboratories” (FLC, 2013).

While there is no comprehensive national policy to enhance or encourage technology transfer, both the United States Code and Executive Orders reflect the “need for such a policy, including a strong national policy supporting domestic technology transfer and utilization of the science and technology resources of the Federal Government” (FLC, 2013).

In 1950, President Harry Truman issued the first Executive Order that addressed technology transfer in. The goal of the Order was to provide uniform patent policy for innovations created by the government, including its employees. In 1980, legislation was established to serve as oversight for the field of technology transfer. The Stevenson-Wydler Act “concerned the dissemination of information from the federal government and getting federal laboratories more
involved from the federal government and getting federal laboratories more involved in the technology transfer process” (FLC, 2013). The Act encouraged laboratories to take an active role in facilitating technology transfer, as well as to reserve a portion of their annual budget to encourage technology transfer. Also enacted in 1980, the Bayh-Dole Act established additional patent requirements for federally-funded research and development (FLC, 2013). A coordinator at the Federal Laboratory Consortium for Technology Transfer (FLC), which is an organization created by Congress, puts these pieces of legislation into practical context:

“The Congressional intent surrounding Bayh-Dole and Stevenson-Wydler, was for tech transfer to promote economic growth and development in the United States; to find a way to move the technologies created in these labs into the marketplace—in order to accomplish that economic development and growth—and to try to retain that economic growth in the US...Congress has put into the Cooperative Research and Development Agreement (CRADA) statutes two considerations, they are not requirements, but they are preferences that when our labs work with an external or private party, that number one, we try to work with small businesses...so, if we are going to patent and license something, it would be nice to find a small business to license it to...Second, Congress has asked us in the statute to...“substantially manufacture” any product coming out of that technology in the United States...Congress really wants the jobs created with that manufacturing to be in the US, for obvious reasons, because it is based on technology created on taxpayer dollars” (Jones, 2015).

President Ronald Reagan issued the second Executive Order regarding technology transfer in 1987, which ensured greater collaboration between federal laboratories, universities, and the private sector. Additionally, Reagan’s Executive Order aimed to strengthen collaboration through pre-existing programs, such as the Interagency Working Group on Technology Transfer (FLC, 2013).

Various legislation was enacted after Reagan’s Executive Order, which aimed to increase technology transfer; make patents more effective; promote small business; incorporate technology transfer into laboratory missions; establish a conduit between government, universities, and the private sector; aid public/private cooperation; protect intellectual property; and allow for the donation of extra technological equipment to educational institutions and non-profit organizations (FLC, 2013).

In 2011, President Barack Obama released the most recent Executive Order regarding technology transfer, noting that “[o]ne driver of successful innovation is technology transfer, in which the private sector adapts federal research for use in the marketplace” (FLC, 2013). The Order acts upon five clear goals, as established through the Startup America Initiative: (1) unlocking access to capital; (2) connecting mentors; (3) reducing barriers; (4) accelerating innovation; and (5) unleashing market opportunities (FLC, 2013).

Unlocking Access to Capital
In order to ease financial barriers, Obama’s Order calls upon Congress to facilitate tax credits and incentives for professionals performing technology transfer. While federal laboratories are required to allocate sufficient funding to support an ORTA—as well as subsequent technology transfer activities—small
businesses and universities encounter the greatest financial barriers to entry (FLC, 2013). Private and academic firms can rely upon the “bidirectional sharing between federal laboratories [which] includes not only technologies, but personnel, facilities, methods, expertise, and technical information in general” (FLC, 2013). All parties involved in the transfer of technology can stretch their research dollars through creative collaboration.

**Connecting Mentors**

The Federal Laboratory Consortium for Technology Transfer (FLC) was established by Congress to serve as a conduit between federal laboratories and the outside world. The FLC’s mission is to develop and administer “techniques, training courses, and materials concerning technology transfer to increase the awareness of federal laboratory employees regarding the commercial potential of laboratory technology and innovations” (FLC, 2013). The FLC coordinates with each government ORTA to connect mentors across the public and private sectors by providing advice and assistance, serving as a clearinghouse for requests, facilitating communication, calling upon federal expertise in all areas, providing technical assistance, and aiding the establishment of technology transfer programs at universities or small businesses (FLC, 2013).

**Reducing Barriers**

The two most common barriers that prevent development of technology transfer relationships are access to capital and knowledge of resources. To limit these barriers, the FLC attempts to market federal research partnerships. In addition, federal agencies reaching a certain expenditure mark can implement a cash rewards program to incentivize “inventions, innovations, computer software, or other outstanding scientific or technological contributions of value to the United States due to commercial application or due to contributions to missions of the federal agency or the federal government” (FLC, 2013). Obama’s Order suggests that the technology transfer process can be simplified through reducing student loan burdens, boosting access to grants, faster patent processes, and creating a dialogue between all technology transfer parties.

**Accelerating Innovation**

Within the Federal agencies, technical research and development is accelerated, as “[a]ll laboratory scientists and engineers are required to consider technology transfer an individual responsibility, and technology transfer activities are to be considered in employee performance evaluations” (FLC, 2013). Government employees take pride in their research and feel a value in their work. On the other hand, private individuals can often feel stifled by barriers and low rates of recognition. The United States Code, as well as Obama’s Order, aims to accelerate innovation through granting fuller recognition to “individuals and companies which have made outstanding contributions to the promotion of technology or technological manpower for the improvement of the economic, environmental, or social well-being of the United States” (FLC, 2013).

**Unleashing Market Opportunities**

In order to unleash market opportunities, Obama’s Order focuses on success across all fields, such as health, education, and energy. Two main factors that promote success across all three fields are: (1) manufacturing in the home country; and (2) promoting small business. Small businesses that are

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1 The United States established the Small Business Administration to foster and
headquartered in the United States are given preference for all patents and licenses that come out of federal research and development (FLC, 2013).

Overall, initiatives in the United States aim to create a sustainable link between government, education, and the marketplace. In the United States, facilitation of technology transfer is decentralized to allow each federal agency to tailor technology transfer to their specific mission or need. The FLC serves as an information hub to support federal agencies in carrying out technology transfer. Like in the United States, Hungary has set a priority to enhance R&D and further support technology transfer.

CURRENT STATUS OF TECHNOLOGY TRANSFER IN HUNGARY

In Hungary and Europe, globalization and the rapid development of IT sectors in other parts of the world have made technology transfer a priority for governments. To support further development of Hungarian-based R&D, Hungary created the National Research, Development, and Innovation Office (NRDIO). This office is responsible for creating a stable, institutional framework for government coordination of the national research, development, and innovation ecosystem by providing predictable funding and implementing an efficient and transparent use of available resources (National Research, Development, and Innovation Office, 2015).

Currently, the government is one source of funding for the development of innovation. Hungary has also gained access to structural funds of the European Union (EU), which can be used to narrow development disparities and create greater economic, social, and territorial cohesion among member states (Europa, 2015). The EU also launched the Horizon 2020 initiative, which focuses on innovation and aims to revitalize industrial production, boost industry engagement through partnerships, provide access to finance, and reinforce Small and Medium Enterprises² (SMEs) (Europa, 2015). Through these EU initiatives, Hungary has received grants to further develop R&D, as well as technology transfer partnerships with universities. The local Hungarian government provides funding in two ways: (1) institutional support and (2) programs (Inzlet, 2004). While funding from business has increased to 35 percent as of 2001, public subsidies comprise over 50 percent of R&D funding (Inzlet, 2004).

Since the Hungarian government’s change in political structure, there have been multiple legislative actions that have encouraged research within universities. In 1996, an amendment to the Higher Education Act suggested that a portion of each university’s budget should be dedicated to directly supporting R&D (Inzlet, 2008). Co-operative Research Centres made universities the centerpiece of collaboration, rather than business; this served to build the universities’ potential as drivers of growth in the knowledge economy (Inzlet, 2004). In 2004, Hungary developed the Pazmany Peter-Regional University Knowledge Centre program, which aimed to integrate existing knowledge bases and to support their development through research collaboration (Inzlet, 2008). However, there

² In the European Union, SMEs are companies with fewer than 250 employees; in the United States, SMEs are companies with fewer than 500 employees.
are still gaps between public sector research and the private sector. Two of the main concerns are: (1) short-term, market oriented research contracts that fail to create stable, long-term relationships; and (2) a lack of critical mass from universities to support research capacities and competences (Inzlet, 2008).

Private companies also serve as a large source of funding for innovation in Hungary. Many universities collaborate directly with private companies at the regional level. For example, the Szechenyi University has close ties with the car manufacturer, Audi. Through this partnership, students at the university work on projects that are exclusively designed and managed by Audi. Students are able to gain direct training from Audi researchers, which leads to practical skills that can be transferred to the professional field.

Currently, Hungary has numerous initiatives aimed at supporting technology transfer. As part of the Europe 2020 initiative, Hungary adopted the National Smart Specialization Strategy (S3) and the National RDI strategy. These strategies aim to strengthen the innovation system as a whole (NIH Investment in Future RDI Strategy, 28) and:

“By 2020, the key participants of the national innovation system [research and development organizations, enterprises, government institutions, universities, etc.] will be significantly reinforced through the active support of RDI policy and will become equal partners in global innovation processes in Hungary. They will then be able to invigorate the national innovation system as a whole, due to the follow-through effects, and thus contribute significantly to enhancing the competitiveness of the Hungary economy together with transforming it to a sustainable knowledge economy” (NIH Investment in Future RDI Strategy, 28).

As seen in the National RDI Strategy and the National Smart Specialization Strategy, the Hungarian government has made innovation and R&D a priority. Through a strong RDI policy set by the government, as well as EU initiatives, Hungary expects its companies and researchers to achieve the knowledge economy they desire.

While there are many benefits associated with technology transfer, most universities still do not engage external expertise for research. At the same time, a majority of innovation companies rely on themselves for innovation, showing a huge disconnect between the ideal technology transfer system and the current system (Novotny, 2008). However, interview participants have identified barriers in the field and suggest areas in which the government could play a direct role in improving technology transfer relationships.

COUNTRY COMPARISON

Overall, the United States and Hungary exhibit many similarities regarding economic factors that affect technology transfer. As shown in Table 2, high-technology exports are about 18 percent of manufactured exports for both Hungary and the United States, showing that this is a significant field for growth in both countries.
The graph shows that Hungary has 8 percent of foreign direct investment (FDI) and fewer procedures for registering a business, which can contribute to larger amounts of R&D and company development. However as Figure 3 details, compared to the United States and other European countries, Hungary spends at least 1.5 percent less on R&D as a percentage of GDP.

<table>
<thead>
<tr>
<th>Country</th>
<th>R&amp;D (% of GDP)</th>
<th>World Rank</th>
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<tbody>
<tr>
<td>Finland</td>
<td>3.80</td>
<td>3</td>
</tr>
<tr>
<td>Sweden</td>
<td>3.39</td>
<td>5</td>
</tr>
<tr>
<td>Denmark</td>
<td>2.98</td>
<td>6</td>
</tr>
<tr>
<td>Germany</td>
<td>2.89</td>
<td>7</td>
</tr>
<tr>
<td>Slovenia</td>
<td>2.47</td>
<td>14</td>
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<tr>
<td>European Union</td>
<td>2.04</td>
<td>23</td>
</tr>
<tr>
<td>United States</td>
<td>2.76</td>
<td>9</td>
</tr>
<tr>
<td>Hungary</td>
<td>1.22</td>
<td>41</td>
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In order to be a high-technology exporting country and to grow innovation and research in Hungary, a larger percentage of GDP will need to be allotted for R&D by the government.

Hungary and the United States also exhibit similarities in their technology transfer processes and goals. In Hungary, the government created the National Research, Development, and Innovation Office (NRDIO) to facilitate technology transfer and provide consistent funding. In the United States, the current administration has placed an emphasis on technology transfer through Executive Orders. While both governments aim to further technology transfer through domestic programs, they also acknowledge the important role that the education system plays in furthering technology transfer. In the United States, current education initiatives promote innovation through STEM—Science, Technology, Engineering and Mathematics—at the university level, as well as intermediate levels of education. The Hungarian government also called upon the education system to promote innovation by requiring that a certain amount of funding be allotted to create technology transfer offices within universities. Additionally, the emphasis Hungary has made to further research and innovation is mirrored in EU policies and initiatives.

While Hungary and the United States emphasize the need for additional technology transfer and an education system that supports research, they also exhibit differences regarding the expected role of the government. In the United States, the government role is limited when it comes to facilitating technology transfer partnerships between universities and industry. The main role of government run technology transfer offices is to facilitate communication between laboratories and industry. Also in the United States, technology transfer offices are decentralized because it allows for specialization by each department. This is intended to efficiently support research throughout the large federal system maintained by the United States. In Hungary, the government seeks a more direct role regarding technology transfer. The development of a single office for research, development, and innovation allows for standardized support across the entire field of technology transfer.
METHODOLOGY

The data in this report comes from qualitative research interviews, which seek to describe and discover central themes regarding technology transfer. These interviews not only attempt to cover factual understanding of technology transfer, but to also understand the personal experience of each interviewee. Each participant was identified as a relevant actor within the technology transfer field. The following companies and universities were interviewed, based upon their prior experience regarding technology transfer:

United States
1. American University, Kogod Incubator
2. Association of University Technology Managers (AUTM)
3. American University, Kogod School of Business
4. Federal Laboratory Consortium for Technology Transfer (FLC)
5. Georgetown Law Center for Privacy and Technology
6. Washington University, Department of Physics
7. Texas State University, STARR Incubator
8. United States Environmental Protection Agency (EPA)

Hungary
1. Central European University (CEU)
2. Ericsson Hungary
3. IKU Innovation Research Centre
4. National Instruments
5. Prezi
6. Szechenyi University
7. University of Szeged

Interviews were coded using NVivo software, taking into account literal responses from each participant, as well as general tone of the interview. The following thematic analysis links general ideas that were reflected in multiple interviews. In his 2010 text, Interviews in Qualitative Research, Nigel King defines themes as “recurrent and distinctive features of participants’ accounts, characterizing particular perceptions and/or experiences, which the researchers see as relevant to the research question.” Thus, it is critical to take into account the details and cultural characteristics surrounding each interview. This report identifies three main topics that were expressed by a consensus of interview participants: (1) best practices regarding technology transfer; (2) barriers to enter and maintain relationships; and (3) steps toward sustainable systems of technology transfer.

DATA ANALYSIS: BEST PRACTICES

Entering the Market through Networking

Many times, relationships surrounding technology transfer arise when individuals network regarding a product that they are attempting to bring into the market. In a field interview with a researcher at Central European University (CEU), the participant stated that:

“I see corporations partnering with research labs to bring products to market. It is essentially about servicing the needs that they have internally or their clients’ needs; working with labs to develop that technology to meet those needs. I think it comes down to collaboration, trust, and working with the partnership to ensure that everyone is getting something that they need from the relationship” (Farkas, 2015).

3 See Appendix A for interview questions.
Individuals involved with technology transfer attempt to stretch their research or production funds by sharing resources. Clear communication between parties allows for individuals to set clear expectations in order to move forward with the partnership.

Networking plays a key role in the establishment of technology transfer relationships. Interview participants insinuate that research labs and universities need to be more aggressive regarding their technology transfer role. In the Hungarian context, an academic researcher endorses a more active role from the university players:

“In principle, all the universities created these laboratories and technology transfer positions, and it is their job to communicate what is happening in their universities. They need to facilitate transferring that technology to the commercial sector...This is something the universities need to be proactive about...because it is in their interest to commercialize and benefit” (Farkas, 2015).

In the United States, a coordinator at the FLC mimics the ways in which federal labs have a duty to facilitate relationships surrounding technology transfer:

“There are always ways to improve and I think the biggest thing is to continue to find ways to make it easier for businesses to find us and then to work with us. The tech transfer offices at the labs play an important role in making sure that the effort surrounding research and development gets into the market place” (Jones, 2015).

Employees of the Environmental Protection Agency’s (EPA) Office of Research and Technology Applications (ORTA) continue to note this facilitating role, as many of their researchers seek out relationships surrounding technology transfer:

“Most of the time, we find that the collaborations arise because of the networking that the colleagues do. So, our researchers obviously know of the work that is being done at universities or small businesses—or they are aware of an interest or need that a business may have—and a lot of times the partnership arises out of a discussion through conferences, workshops, training centers, journal articles, etc.” (Bauer, Sarah and Graham, Kathleen, 2015).

While there is a desire to bring products or technologies into the marketplace, it can often be difficult for small businesses to assert themselves. To combat this barrier, and create successful collaborations, each individual that is employed by an ORTA office is responsible for seeking out:

“...collaborating opportunities; they are going to trade shows, exhibiting, talking to folks, that is their job. On the other hand, industry—particularly large industry—has active technology scouts looking for technology. It is the small businesses or start-ups that don’t have the resources to find us as easily. That is the challenge that we face in trying to make them aware of [the FLC]. What we have done to try to help our members find partners, or to help partners to find our members, is to develop some search tools that we have available on our website” (Jones, 2015).

As they support federal agencies, the FLC attempts to retain any economic growth that emanates from technology transfer relationships within the United States. This is accomplished through a federal mandate, which suggests that federal laboratories “...should try and favor small and medium size businesses, [and] provide them the economic opportunities for growth...” (Bauer, Sarah and Graham, Kathleen, 2015).
The EPA notes their compliance with this initiative, as about “20-30% of [their] CRADA\(^4\) partners under cooperative research and development agreements are small businesses; about 50% of [their] licensees are small businesses” (Bauer, Sarah and Graham, Kathleen, 2015).

Certain companies serve as a unique link between academia and industry. For example, National Instruments is a private corporation that produces products for educational institutions. National Instruments attempts to engage in technology transfer by making their “products widely known and [to] disseminate the knowledge of [their] products especially to academia...[they] have a program that starts in Kindergarten and programs for all levels of education...[they also] participate in EU research projects that incorporate the Horizon 2020 initiatives. The goal overall is to show [National Instruments’] platform and make it familiar for researchers” (Abraham, 2015). Through networking, companies such as National Instruments can better understand consumer needs and explicitly target the right market. Although networking is important, technology transfer can only last if substantial relationships are formed.

**Building Collaborative Partnerships**

Regardless of the size of the business or research institution, relationships surrounding technology transfer are most successful when true, collaborative partnerships are formed. A researcher from Washington University in St. Louis demonstrates the importance of shared relationships:

"I prefer the idea that I can collaborate with the companies. I don’t so much like the idea that I work under contract for a company. I’m not talking about the formalities; I’m talking about the relationship, so to some extent if a company feels that it has a collaborative arrangement that is better than a company who feels that it has bought the services of some professor or some activity. So in a broad sense, I am saying that if you treat me as a fellow professional, I think we will get along really well. If you treat me as hired help, you probably won’t get as much of the creative juices flowing for the benefit of the company. I think most of us react that way and I think that spirit is a very positive spirit. What kind of gets in the way of that and becomes almost adversarial, is if too much time and effort has gone in negotiating specific terms of the contract it leads to less than positive personal relationships” (Miller, 2015).

Not only do these relationships need to reflect a human element, but clear expectations also need to be established. Senior officials at Ericsson Hungary agree that everyone in the relationship “has to find the long-term vision and expectation...Partnerships need defined responsibilities” (Beskid, Vilmos and Jakab, Roland, 2015). At CEU, researchers suggest

\(^4\)“A Cooperative Research and Development Agreement (CRADA) is a written agreement between a private company and a government agency to work together on a project. Created as a result of the Stevenson-Wydler Technology Innovation Act of 1980, as amended by the Federal Technology Transfer Act of 1986, a CRADA allows the Federal government and non-Federal partners to optimize their resources, share technical expertise in a protected environment, share intellectual property emerging from the effort, and speed the commercialization of federally developed technology.” (United States Government, 2015).
that forming these expectations:

"comes down to standard agreements, standard terms, [and] a way to engage. One of the failings of the universities here, there is no clear way to license the intellectual property and for that reason most venture capitalists will not touch it" (Farkas, 2015).

Clear expectations ensure that each party is committed to the relationship and can proceed in an efficient manner.

A researcher at the STARR Incubator at Texas State University notes that productive relationships are established when a flexible focus is maintained on:

"what is good for the project as opposed to [what is good for] the entities involved in the process. This produces the best product in the end. [Starr seeks] out more of a partnership and collaboration with these companies to ensure that we are in a productive relationship" (Venembaker, 2015).

Adapting for the betterment of the technology transfer also displays a sense of commitment from each party and creates a stable relationship, despite challenges that may arise.

Ericsson officials shared an example of industry adapting to the needs and timeline of the university system:

"The most important is a long-term vision. A university won’t work with short-term. You need a long-term especially with PhD students because they need a topic to research for 2 or 3 years. Also, a win-win approach. We are not at a university because we want to drain their brain capacity. Universities should always retain their brain capacity in order to invent new things. Usually industry wants to go to universities, take experts and pay them well and then it is a bad relation. One of the drawbacks, eventually a university may stop working with an industry if it continuously soaks up all its intellectuals. From Ericsson, we always have a long-term view and they know that we will not hurt them. It helps if the company is a good company that is investing in its R&D so people at the university are happy to work with the company" (Beskid, Vilmos and Jakab, Roland, 2015).

Researchers at IKU confirm consistent, defined relationships between universities and industry, as they recently completed a:

"small-scale survey of the largest Hungarian companies and it seems that those firms who are collaborating with universities they are collaborating on a regular and kind of contractual basis and they have strong relationships with these universities and higher education partners" (Csonka, 2015).

An interesting combination of academia and industry occurs when technology transfer offices are established within universities. The manager at National Instrument’s Science Park notes that this allows for teachers to be driven beyond the standard curriculum, which encourages innovation. Additionally, research-intensive universities are being distinguished and offered more funding, which leads to greater innovation (Barbaras, 2015). In order to sustain technology transfer, incentives need to be offered to each party in order to make relationships a win-win situation.

Making Relationships Last
Incentive to remain in relationships surrounding technology transfer comes from a sharing of resources to ultimately seek fruition of a project. As stated before, each
party enters the relationship with a specific motivation. As the relationship develops, and the outcome of the technology transfer is altered, the incentives offered to each party may change. One variable that remains is the desire to move innovation into the market. For this reason, it is in the best interest of each party to build long-term relationships that can withstand change.

At the EPA, which operates in a similar fashion to other federal laboratories in the United States, the incentive lies in “leveraging your research dollars and resources” (Bauer, Sarah and Graham, Kathleen, 2015). Members of the ORTA office continue to describe this benefit:

“We are able to have access to equipment that we may not normally have, some expertise, or a specific scientist. Probably one of the biggest benefits—but it doesn’t happen all the time—is that we are able to get cash under a cooperative research and development agreement. We are not allowed under the FTTA\(^5\) to give out money, but we are allowed to receive it. Many times, a partner organization will provide cash to us to help pay for a contractor to assist with the effort or to buy supplies. In exchange, the partner gets access to the government scientists, research, expertise, equipment. By sharing this, we are leveraging each other’s research dollars. We are making them go a little bit further because we are sharing resources and we are working on this collaboratively. There is also a benefit to the public, in that they are getting a technology that has been co-developed, so many times it’s geared towards a need in your neighborhood, and it’s moved faster because it is a part of an organization that can get a better technology moved into the marketplace better, faster, and cheaper” (Bauer, Sarah and Graham, Kathleen, 2015).

The FLC confirms that incentives for those entering partnerships with federal laboratories in the United States:

“are to have access to world class laboratories, world class scientists and engineers, and not have to recreate something that we may have already created. They can license technology that is already there and access folks that they can do collaborative research with. The incentives for them are market-driven, being able to do things quicker, faster, better” (Jones, 2015).

In addition, federal legislation in the United States allows for federal researchers:

“to appreciate the royalty income from a technology that they were listed as an inventor on, so there is some financial incentive there. There are some incentive programs on a lab-by-lab basis... some of our labs have entrepreneurial leave, where a researcher can create technology in the lab, the laboratory owns that technology, but under an entrepreneurial leave program, that individual can leave the lab, go out and license that technology from the lab and try to start a business around it and if things don’t work out, then he or she can return to the lab with a similar level position” (Jones, 2015).

\(^5\) “The Federal Technology Transfer Act (FTTA) was enacted by Congress in 1986 and builds on the Stevenson-Wydler Act of 1980. FTTA improves access to federal laboratories by non-federal organizations. It allows government inventors to patent their technologies and receive a share of the royalties when patents are licensed. The goal of this legislation is to more efficiently and effectively put federally-funded technology to use in real-world applications” (EPA, 2015).
Officials at Ericsson suggest that at the university level in Hungary, the incentives are that students and researchers can:

“understand the hot topics in the industry...Just getting the cooperation is an incentive because they get access to the right people and can direct them towards us” (Beskid, Vilmos and Jakab, Roland, 2015).

Ericsson asserts that on the opposite side, the company incentive is that universities are a:

“good entry point for young talents and [they] can select the best from the university. It is a good way to get recruitment into the organization. The other incentive is that they can come up with new activities in areas and that provides [Ericsson with] benefits” (Beskid, Vilmos and Jakab, Roland, 2015).

Overall, success at the university level leads to increased job growth, which fuels economic productivity. The success of the STARR Incubator has fostered:

“regional economic development, job creation, and [increased] job opportunities for locals in San Marcos, Texas...while there are many benefits from this relationship, job creation is by far the most impactful” (Venembaker, 2015).

Due to the fact that technology transfer partnerships thrive on positive human interaction, one of the greatest incentives to continue these relationships is the recognition of a job well done. From the academic perspective, the researcher at Washington University in St. Louis explains that:

“One measure of success is whether something that came as a creative idea can be reduced to practice in a form that is actually judged by the marketplace to be worthwhile, so in the long run, it could become part of a product, or become a product, that somebody is willing to pay for, because that is a measure...In some sense, those of us in academia may be driven in part by the desire to be respected, recognized, honored and that I think really is a significant motivation and within the university there are mechanisms for that, including being promoted, being tenured, things of that sort that in the larger world out there for the recognition that comes from being able to say 'this idea, which is patented as a result of initial research in our lab or something of that sort has now become an important part of some product line of some company’” (Miller, 2015).

Overall, those involved with technology transfer seek to promote a “win-win-win” environment, where collaborations are “beneficial for the whole society, [and] the whole education system; not just for the university or the company” (Beskid, Vilmos and Jakab, Roland, 2015). While many involved in technology transfer find partnerships beneficial, significant barriers still prevent others from entering the field.

**DATA ANALYSIS: BARRIERS**

While private companies and universities find relationships surrounding technology transfer beneficial, barriers still exist that prevent more, efficient partnerships from taking place. The main barriers that exist within Hungary and the United States include: (1) lack of funding or inconsistent funding; (2) cultural perception; (3) education policies and the decrease of STEM students; (4) communication and visibility of companies and universities; and
(5) patents.

**Lack of Funding and Consistency**

In interviews conducted in both Hungary and the United States, one of the most common factors regarding failed pursuit of technology transfer was due to insufficient or inconsistent funding. In the United States, inadequate staffing of technology transfer offices, inconsistency in funding sources, and the inability of state institutions to provide technology for free are all evidence of funding concerns. A staffer at the EPA’s ORTA notes that:

“I think our problem is that there are two of us [in the office]. We seem to have an issue of more and more things coming to us—which is a good thing—but, we can’t get the staffing and we don’t have a budget” (Bauer, Sarah and Graham, Kathleen, 2015).

Federal laboratories and government agencies are not the only entities struggling to receive funding. A professor at American University’s Kogod incubator confirms that a common problem is getting:

“consistent funding from companies because when reorganization occurs or the company goes in a new direction, the department that you had a relationship with could no longer exist and the funding stops” (Bartlett, 2015).

In addition, state research institutions are privy to tax policies that prevent them from donating technology for free. In Hungary, insufficient funding occurs at both the public and private levels. An expert in the field commented that though the Hungarian government routinely advocates R&D and creates initiatives to support it, after a few years, it will be terminated or a new initiative will be started and the funding will disappear (Csonka, 2015). This inconsistency does not allow for research to attain a state of development in which it can gain support from private companies. Overall, this results in a loss of sustainable research. In addition, there is a lack of funding for small and medium enterprises (SMEs). A university researcher said that the amount of money it takes it creates to start-up a company is such a large threshold that it discourages students from pursuing it, which stipples the potential for new innovation (Farkas, 2015). Since it takes a significant amount of money to fund a start-up, it is likely that SMEs are unable to then participate in technology transfer because they cannot allocate portions of the budget to employ long-term researchers.

Yet, it is not just a lack of funding from the Hungarian government, but the inability of companies to provide as much funding as they would like. Representatives from a company that currently participates in technology transfer stated that they “would be happy to have more partnerships if their budget allowed them” (Beskid, Vilmos and Jakab, Roland, 2015). The lack of budget is also tied to the issue of taxation. A company representative explained that companies have a strong incentive to provide technology to universities and students, but current taxation policies make it nearly impossible to justify. As the representative stated:

“a company can provide technology to universities for free, since the universities usually cannot pay for it; however, the company will pay a VAT tax on the service and then will also pay their corporate taxes separately” (Barbaras, 2015).

Even though companies want to donate technology to universities, they are not incentivized to do so by the current tax
scheme.

Culture
The significance of culture inhibiting technology transfer is more prevalent in Hungary than in the United States. As a university professor in the United States noted:

“The cultural factors that spur entrepreneurship in the United States, the receptivity to risk, or the appetite to take risk and the tolerance of failure, tend to be fairly distinctive of the United States economy and not of Europe” (Bartlett, 2015).

This statement was reinforced when we asked a similar question to those based in Hungary.

A researcher at a Hungarian university suggested that in Hungary “there is an aversion to risk, a stigma around failure” (Buzas, 2015). Further, the researcher asserted that he would also fear failure as a Hungarian, with only a Hungarian passport, because there are no bankruptcy codes to help individuals cope with failure (Farkas, 2015). It is the fear of failure in Hungary accompanied by the lack of support to those who fail that prevents Hungarians from taking more risks, even in the field of technology.

However, it is not just the fear of failure that prevents Hungarians from becoming innovators, rather it is the social stigma associated with being an entrepreneur. A company representative explained that:

“If you ever met someone very successful in Hungary and asked them what they do, they would say ‘I’m an entrepreneur,’ but you never understood what they did. An entrepreneur was someone with a lot of money, big cars, and slicked-back hair” (Barbaras, 2015).

The image that he describes as a typical Hungarian entrepreneur emphasizes why many Hungarians avoid this type of lifestyle.

Culturally, what impedes Hungarians from becoming more risk averse, or more involved with innovation, is the stigma associated with entrepreneurs. A researcher stated that Hungary still has:

“many SME’s or entrepreneurs who really established their companies to finance their living and then they are not planning ahead, in ten years or five years, so they are not focused on continuous development of their company, they are just having a secure income for their family or for their employees” (Csonka, 2015).

Some university and company representatives have suggested that changing the perceptions of entrepreneurs should be the main focus in making Hungary an R&D driven economy. They also suggested that students and children should be made aware of the positive aspects associated with entrepreneurs, in addition to educating the public. Typically, the viewpoint of Hungarians is that “they are not open or business minded and that they do not want to pursue business” and this makes technology transfer obsolete (Tibor, 2015). It is the negative image of entrepreneurs that discourages expansion into the technology sector and dampens technology transfer relationships.

Education
Another barrier that prevents both the United States and Hungary from expanding technology transfer is the current education system. A representative at Ericsson notes:

“The number of engineers is dropping in the Western world and shifting to Asian countries. This is not just a Hungarian
problem but one for the Western world” (Beskid, Vilmos and Jakab, Roland, 2015).

In his statement, he addresses the main issue in both Hungary and the United States, there are not enough people to research and invent new technology. Hungarian companies unanimously expressed that there are not enough engineers among today’s students. Most companies view technology transfer as building a long-term relationship with a university and its researchers; however, these relationships are limited by the number of students able to conduct the research. Companies worry that:

“if the education system is not fixed, and more people do not become engineers, then the market in Hungary will become less competitive” (Beskid, Vilmos and Jakab, Roland, 2015).

University leaders see this as a problem which stems from companies, as companies hire graduates without requiring advanced degrees, such as a Master’s or PhD (Tibor, 2015). Additionally, a lack of business knowhow contributes to this phenomenon, as researchers often lack business skills, which aid in developing startups or technology transfer partnerships.

Communication and Visibility of Labs

A significant problem in Hungary and the United States is the lack of communication between universities and private companies. As a researcher in the field state:

“private companies are unaware that universities do this research and companies can’t keep up with hundreds of institutions; therefore, it is possible that companies miss institutions that would work on similar projects” (Susulka, 2015).

A US government official expands on this by saying that:

“for business, there are several choices when you need a piece of technology or to help your product advance: you can build it yourself, you can buy it, you can find someone to do the research, or you can be connected to a federal laboratory doing similar research” (Jones, 2015).

The problem is not only the number of choices a private company can make when in need of a technological component, but often times, it is difficult to become aware of the resources at their disposal. A coordinator at the FLC explains that with federal laboratories:

“... the challenge for our members is making people aware of us as a possible source for that kind of resource. That is probably the biggest barrier, just making people aware that we have these wonderful capabilities and resources at the federal labs. People just don’t think of us necessarily as the first option” (Jones, 2015).

Hungarian interviewees expressed similar concerns regarding the difficulty that surrounds finding connections to work with on a project. However, a larger issue in Hungary is that many contracts go unknown to the public majority. A university professor explained that sometimes:

“contracts with private companies are kept in secret so that the company’s competition does not know what type of research they are producing and who they are working with” (Tibor, 2015).

However, this could be a negative for university researchers because they are not being exposed for the work they are producing and therefore are limited as to the
companies they can be linked with in the future.

*Patents*

From a US perspective, patents are a major barrier in technology transfer and a barrier that Hungary should be aware of as their R&D sector continues to grow. A US government official stated:

> many times, we patent to protect the intellectual property, to make sure that the technology is used and used correctly... by patenting we are making sure that they follow the proper procedure or the proper recipe to make sure that it does no harm” (Bauer, Sarah and Graham, Kathleen, 2015).

However, this causes debate in technology transfer when a university and private company complete a product together. Companies in the United States who work with international researchers are even more unlikely, because:

> trying to get a patent through the [Patent Cooperation Treaty] is very expensive—maybe it is cheaper if you are in the European Union—but that is one of the reasons that [federal labs in the United States] don’t patent internationally very often, because of cost” (Bauer, Sarah and Graham, Kathleen, 2015).

If a company or lab is unable to protect its inventions through the use of patents, it is likely that innovation will decrease. The Hungarian government should be aware of this issue as it continues to expand its technology sector, because it is an outcome that can be prevented with the correct policies in place.

This section illustrates barriers such as funding, culture, education, communication, and patents that prevent productive and abundant technology transfer relationships in Hungary and the United States. Without addressing these issues, it is likely that technology transfer will remain stifled.

### DATA ANALYSIS: NEXT STEPS TO PROMOTE SUSTAINABILITY OF TECHNOLOGY TRANSFER

Throughout the course of each interview, a majority of participants focused a considerable amount of time discussing potential steps each party could take to enhance their technology transfer role. While the different regions—Hungary and the United States—have varying priorities, their responses can still be built into a basic thematic framework. Interviews centered on: (1) suggestions for improvements to the system; (2) ideal role of the government; and (3) the sustainability and stabilization of the field. In addition, responses focused on steps participants of the “triple-helix”—collaboration of academia, government, and industry—could take, but role and perception of the government was also of particular focus.

**Improving the System**

While respondents seemed optimistic regarding the future of technology transfer, critical improvements players could make to help promote the field were also identified. The lead business development manager at the Texas State STARR Incubator expressed a need for increased and open communication between organizations within the field:

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6 The Patent Cooperation Treaty is an international patent law established in 1970 that provides a unified procedure for filing patent applications to protect inventions of each contracting state.
“It really centers on finding the right partners for the technology that we are currently developing in our labs. We might have good technologies, but it is more difficult to find the practical use for all of them, and finding the market value in the technology. Technology is good and we can patent it, but when we market it [cost is a factor]. Say we have a top notch material that works better than anything currently on the market, but cost ten times higher than other options in the market, then we cannot market that. We have to have a compatible product with competitive rates. That is the only thing is finding the right company and the right technology to match it” (Venembaker, 2015).

Labs are developing practical technology that can play a critical role in aiding economic development; the challenge lies in identifying appropriate companies who can bring this technology into the market. Private companies often need to absorb new technologies, as well as further develop the commercial application of that technology. Organizations within these technology transfer relationships are required to develop close working relationships to enable successful transfer and implementation. For this reason, universities and companies need to be more flexible when establishing working relationships, and must be open to negotiating royalty fees.

Individuals in Hungarian organizations echoed the desire for greater communication, but also challenged participants in the field to take action. For instance, a researcher from CEU, states:

“If I was a technology transfer officer, I would not wait for the government to send out a newsletter, but I would send one out myself. I would not wait for the government to do a conference every quarter highlighting a few companies here and there. I would have one regular conference that invited everyone in the field and host it on a biannual basis” (Farkas, 2015).

This also requires universities to increase funding if they are expected to have a larger role in establishing technology transfer relationships. This idea was reiterated by a researcher from Szechenyi University, who stated:

“In the article from ‘the Nature,’ there is a discussion where a university has a tech transfer office in which only 20% of their time is dedicated towards it and the rest to teaching. I would rather expand in focusing entrepreneurship in parallel with tech transfer. When we discuss with companies, it is easy to get jobs and contracts. What is currently missing in Hungary is the lack of proper funding for organizations to do this” (Tibor, 2015).

Universities and companies should foster direct communication, but will require additional funding to accomplish this. A researcher at IKU suggests that the organizations could achieve this dialogue by better communicating success stories.

“There are many good [success stories surrounding technology transfer] but you hear them from the scientists. It doesn’t make its way to the community or national media” (Csonka, 2015).

As visibility of success surrounding technology transfers increases, additional researchers and companies will be encouraged to participate.

Ideal Role of the Government

Recently, the United States has renewed its promise to fully utilize technology
transfer to promote the growth of small business and reinvigorate the economic market place with cutting edge technological developments. There was a direct effort by individual departments within the federal government to be held accountable for their own technology transfer and to be able to reflect this increased attention. Individuals from the EPA make this evident:

“*It is up to each department or agency to establish relationships with whatever partner they want. Sometimes, there will be an effort that involves more than one federal agency or there will be another agency that wants to use another agency’s patent or intellectual property on an effort or CRADA they are involved with. We can go to the Interagency Working Group on Tech Transfer and exchange questions or ideas that we may have*” (Bauer, 2015).

As each individual agency attempts to establish and develop their own relationships surrounding technology transfer, direct collaboration and a deeper understanding of the field can be promoted. Subsequently, departments are able to devote more time and energy to research that may be directly related to projects that they are currently pursuing. A coordinator at the FLC further developed this point:

“The person in the ORTA position is responsible for knowing what is going on in the lab behind them, what kinds of technologies are being worked on, what kinds of research is being done, what is ready for patent protection, putting some sort of intellectual property protection on it, and then at the same time they are the gateway or the conduit to the external world. They are supposed to be out looking for opportunities for their lab to collaborate with private sector, with industry, with academia, non-profits, what have you, so they are looking to find collaborating partners for their lab” (Jones, 2015).

While individuals did express some frustration with the current government system, they thought this resurgence of prioritizing technology transfer was a positive step.

Participants in Hungary felt that the government could reprioritize their efforts to be more effective in promoting technology transfer. They stated that the most critical role the government could play is to facilitate relationships between parties. Ericsson officials stated that the government:

“...can facilitate the establishment of co-operations. Creating an attractive environment that would encourage these co-operations. Additionally, when we talk about high-value added activities, the government should support the higher value add activities such as PhD and MSCs and they could give more incentives to companies and universities to encourage engineers” (Beskid, Vilmos and Jakab, Roland, 2015).

Governments can establish initial communication between parties by acting as a central hub to help disseminate critical information. A coordinator at the FLC provides an example of this role:

“We exist to support our members through communication efforts, we do newsletters and information sharing, we provide meetings and opportunities to share best practices, we have lots of resources on our website to help them do their job better, but we don’t do tech transfer, our members do” (Jones, 2015).

Individuals also stated the need for serious attention to be directed toward current business policies, as well as startup
costs. The cost associated with starting any company in Hungary is astronomical compared to other markets in Central Europe. One interviewee mentioned that:

“The marketing campaign can’t just be ‘come to Hungary for cheap talent.’ You may know that a top BME engineering graduate, from the top university here makes around $1,000 Euros a month. That is around 300,000 Forints to start a company here is 3 million Forints or ten months gross salary. That is crazy. It costs you another 200,000 [Forints] in legal and filing fees, or another month’s salary. That is almost a year’s salary, to start a company here.”

The implication for charging a young, engineering student a large amount to establish a (potentially) lucrative company is simple; they will either (1) transfer the business license to another country that has more favorable business trends, such as the United Kingdom, which results in a lack of potential tax revenue that could be collected by the local government; or (2) physically relocate to a country that requires a lower cost barrier for small startup companies.

Participants also suggest that the Hungarian government could play a critical role in the funding of technology transfer relationships, as well as in providing funding at critical stages of the technology’s development. Due to the fact that some technology that comes out of university research is not ready for direct sale in the market, private companies are apprehensive to further fund a product or concept that does not have a direct market application. The government could play a critical role at this stage of technology transfer by providing additional funding to the university in order to help fill the “vacuum.” This would enable a university to further develop technology to the point at which a company could distinguish the market application. A researcher from CEU suggests that this can be achieved through regional offices that have access to their own funding and can become more familiar with ongoing research.

“Given EU’s preference for subsidiary and pushing grassroots, if I were in the government position, I would put some money into these technology transfer offices, allocating them some budget, rather than try to centralize it all through one single office” (Farkas, 2015).

This participant suggests that as technology transfer has a similar goal across the spectrum, each industry or office might have specialized needs or desires. Allowing participants to customize the financial and logistical support they receive leads to more efficient technology transfer.

Sustainability and Stabilization

While there are frustrations and missed expectations in the field, individuals seem optimistic in regard to the future of technology transfer. In the United States, many respondents spoke at length regarding the sustainability of the field and recent developments that have helped to stabilize the field. Participants from the EPA comment that:

“[i]t has been helpful for [us] to be involved with the FLC because it brings together more than just [the] federal government and we are able to get a lot of exposure and great ideas and conversation with others. It helps us back at the EPA because we can bring a lot of that [information] back in” (Bauer, Sarah and Graham, Kathleen, 2015).

Environments that encourage collaboration are the most successful in fostering growth of innovation.
Hungary, on the other hand, relayed more concrete suggestions to improve the future sustainability of the field. Hungarian participants spoke at length regarding the imminent need of stabilization of previously discussed frustrations and barriers for the field to merely continue. A researcher at IKU stated:

“Now, we have these technology transfer offices, we have quite a few other innovation supporting organizations, there are still existing regional agencies, there are a lot of players, but we still lack a broad base of R&D intensive companies who could invest in this new knowledge or technology to collaborate with the universities. The field would have to be improved to get more and more R&D intensive companies” (Csonka, 2015).

This statement demonstrates a lack of private investment in the field of technology transfer. For technology transfer to develop in Hungary, it will require the attention of larger, international firms, while simultaneously promoting small business development. An Ericsson official suggests how this can be achieved:

“The whole point of this is to be sustainable and you hope that spin-off companies are produced from this trade-off. Being in this environment, we will be competitive in Hungary if the engineering society around us is competitive. From our point, if we work on a technology with a university and at some point they start a spin-off company, I think that is still a good investment because it is growing the competence of the country” (Beskid, Vilmos and Jakab, Roland, 2015).

For Hungary to grow their economy and still attract meaningful international corporations, they must not forsake strengthening the small business community.

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**AMERICAN UNIVERSITY REFLECTIONS**

While many barriers exist that currently prevent technology transfer actors from further collaboration, we viewed the following problems as those that needed to be addressed immediately. The Hungarian government can improve the number and sustainability of technology transfer partnerships by emphasizing the human relationship that drives technology transfer, focusing on the need for further technology transfer, and changing cultural perceptions surrounding entrepreneurs.

**Enhance the Human Relationship**

Simple, short-term solutions could be implemented to foster technology transfer relationships in Hungary. It is important to keep in mind that while technology transfer relationships seek to develop technology and innovation, their beginning—and much of the progress—stems from human interaction. NRDIO could remain a consistent presence in the field of technology transfer and serve as an initial point of contact to connect parties who might be developing technology in the same area. This would allow for a more efficient use of resources, as well as stronger personal connections between parties. Individuals who feel more invested in their partnership will develop larger quantities of innovation, often at a faster rate. Rather than requiring that parties reinvent the wheel each time they attempt to form a technology transfer partnership, NRDIO could offer a streamlined process for parties to enter the collaboration.

Another low cost suggestion is for NRDIO to facilitate monthly or quarterly
networking events for professionals in the technology transfer field. Individuals could come together to discuss their current research projects and troubleshoot any barriers that they may be encountering. Many times, researchers and companies know exactly what they need to close the innovation gap, but they don’t know how to go about finding this resource. NRDIO could serve as the initial point of contact for these inquires and then direct them to the appropriate resource. Hosting regular events might even cut out the middleman and allow parties to resolve needs as a collective group.

**Government Attitude**

If Hungary strives to become a technology hub, it will need to offer substantial support to start-up companies and entrepreneurs, rather than focusing on attracting large, international corporations. Another policy arena in need of consideration is the creation of an environment that is conducive for individuals to take risks when creating jobs and developing companies locally. One way to do this is to reevaluate the current fiscal policies surrounding business start-ups and donations. If the cost to simply start a business remains high, there is very little incentive for individuals to pursue that track. There are many examples in the market place of companies that started out as small businesses and later grew into large multinational corporations. For example, Google was operated out of a garage for several years until the start-up company expanded in 1999 (Google, 2015).

In addition, if the government wants to utilize funding at full capacity, it will need to require individuals in the field to become more intimately familiar with what research they are funding, and how it will directly impact the market. The government must stray from funding research that has not proven viability in the market place.

**Cultural Perception**

One of the greatest barriers to further innovation in Hungary is cultural perception of the entrepreneurial field. As seen in our interviews, most Hungarians have expressed distrust and dislike for entrepreneurs due to the poor social image they have produced in the past. However, entrepreneurs are essential to expand the technology sector of any economy.

Improvement surrounding this perception can be found in supporting initiatives that re-brand entrepreneurship. This could be achieved through incorporating positive business practices and success sortsies into the curriculum at all grade levels. Moving beyond academia, this change needs to occur at a social level, as well. Government led campaigns could promote entrepreneurism and recognize the lab researchers who make innovative parts for car manufacturers or medical devices. By highlighting current successes in the technology transfer field as positive examples for entrepreneurship, over time, the Hungarian mindset will begin to favor entrepreneurs. Once society is more receptive of entrepreneurs, there is a greater chance that the number of students interested in the STEM field will increase and that more individuals will attempt to produce innovative technology.

**CONCLUSION**

Technology transfer has proven itself to be a driving force of innovation within the country of Hungary and the United States. If Hungary hopes to become a hub of development within Central Europe, it will need to provide further support regarding technology transfer. Many experts within the field offered frank analysis and potential
suggestions for future collaboration. These individuals were able to articulate their viewpoints into three larger thematic views: (1) what is currently working in the field; (2) current barriers that are preventing the field from prosperity; and (3) next steps actors in the field could take to enhance relationships.

While the Hungarian government has a critical role to play in facilitating these relationships, they must be careful to not exert their efforts into a high number of responsibilities. Their success lies in being able to act as a central hub of information for actors in the field, and support relationships that develop organically between private entities and universities. This action would aid in stabilizing the field of technology transfer, so actors could continue to make investments knowing that there will be no dramatic change to the system.

Technology transfer has the capability to transform Hungary as a beacon of commerce within Central Europe, and attract talent on

the international stage; this could occur at an expedited rate if the country can lure multinational corporations. While there are certain characteristics that allow the United States to be successful in their technology transfer efforts, there is still a need for change to improve their system, as well.

Hungary has the opportunity to mirror positive practices from both the United States and other European countries; in addition, harmful regulations or practices can be avoided. Once adjustments are made, Hungary will see deeper development of technology transfer relationships and can drive innovation in the region.
BIBLIOGRAPHY


Inzlet, Annamaria (2008) ‘Strengthen and Update Regional Capabilities (Regional University Knowledge Centre Programme in Hungary)” IKU Research Centre.


APPENDIX A: INTERVIEW QUESTIONS

Introductory Questions
1. What is your name and affiliated organization?
2. What is your position within this organization?
   a. How long have you been in this position?
   b. What is your previous experience in this field?
   c. Please describe your role and function in this position.
      i. Does this include technology transfer or information sharing?
3. What do you believe are current links between the private sector and universities?

Current Experience
1. In your experience, what is the definition of technology transfer and information sharing?
2. Do organizations seek out these partnerships?
   a. Why or why not?
3. What has been your previous experience with technology transfer and information sharing?
   a. Does your organization currently utilize technology transfer and information sharing?
   b. Can you provide an example of a project?
4. Do you believe that this form of information sharing is beneficial to your company?
5. In your experience, what demonstrates a productive relationship regarding technology transfer?
   a. What has been poor practice in maintaining these relationships?
   b. What demonstrates best practice in these relationships?
6. Do you feel that you have a mutual understanding of your relationship between you and your partner?

Incentives
1. How does technology transfer help your organization to reach their mission and goals?
2. What are the current incentives for your organization to pursue these relationships?
   a. Are there other steps you or other organizations could take to promote these relationships?
   b. What could be done differently to add further incentive for you to pursue technology transfer?

Barriers
1. Based upon your experience with technology transfer, what is the biggest challenge you encounter when transferring technology?
2. What might prevent you from pursuing technology transfer?

Next Steps
1. From your previous experience, what could be done differently?
2. Does your organization currently benefit enough from these relationships to continue?