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BUILDING AN ECOSYSTEM FOR ECONOMIC GROWTH

Summary. Paper describes mutually beneficial industry university partnership aim to promote and stimulate economic growth. Students and faculty from four different majors at Penn State Hazleton are involved in industry university projects focusing on commercialization of inventions or new technologies. Paper describes the details of that industry university cooperation as well as the benefits to all the partners involved.

Keywords: Business Incubator, innovations, technology transfer, student projects

BUDOWA EKOSYSTEMU DLA EKONOMICZNEGO WZROSTU

Streszczenie. Artykuł opisuje wzajemnie korzystne partnerstwo pomiędzy uczelnią a biznesem w celu promowania i stymulowania wzrostu ekonomicznego. Studenci i pracownicy z 4 różnych kierunków na Penn State Hazelton są zaangażowani w projekty realizowane w partnerstwie pomiędzy biznesem i uczelnią w celu komercjalizacji nowych innowacji i technologii. Artykuł szczegółowo opisuje tę współpracę oraz korzyści wynikające z partnerstwa pomiędzy uczelnią a biznesem.

Słowa kluczowe: Inkubator Biznesu, innowacje, transfer technologii, projekty studenckie

1. Economic Background

Northeastern Pennsylvania used to be (1860-1955), a very economically prosperous region with a large number of anthracite coal mines, steel industry and even a company manufacturing

steam locomotives. The situation changes drastically in the mid-1950's when the use of oil for heating purposes caused a decrease for the demand of coal. The lower price of coal resulted in the underinvestment in the coal mining industry. This lack of funds led to compromising safety in the coal mining industry. Due to an error, deep mining was done too close to the bottom of the Susquehanna River. In 1954, a tunnel collapsed and caused the Susquehanna River to flow into the underground tunnels of the coal mines. Before the situation could be controlled most of the deep anthracite mines were flooded. The result was the end of anthracite deep mining in the region¹.

In the 1980's, a decrease in the demand for steel caused the closing of the steel industry. This very prosperous region became depressed with a high unemployment rate. Many residents left the region seeking better employment opportunities. This resulted in a decreasing population and lower real estate values. The lower real estate costs attracted a large number of immigrants to the area because they could afford to provide inexpensive housing for their families².

Presently, approximately 50% of the students in Northeastern Pennsylvania school districts attend supplementary English as a Second Language (ESL) classes³. The incoming workforce and the lower cost of operating a business have been linked to the creation of new entrepreneurial opportunities which utilize innovative technology. In order to reduce unemployment, local, state and industry leaders have created business incubator centers.

In Northeastern Pennsylvania, a business incubator center (CAN BE) has been providing significant manufacturing and office space. CAN BE is located within one mile of the Penn State-Hazleton Campus. Even though CAN BE and Penn State Hazleton are not part of the same organization, CAN BE maintains a close and mutually beneficial working relationship with the Penn State Hazleton faculty and students. This economic model has stimulated the growth of local industry and development of Penn State Hazleton.

2. Creating an ecosystem to nurture innovation

Innovativeness is part of American culture. It is part of American past, present and future. Innovativeness is part of American lives and cannot exist in on isolation. It is part of an ecosystem which provides an analogy between an innovation ecosystem and the biological

¹ Wolensky R.P. et al.: The Knox Mine Disaster: The Final Years of the northern Anthracite Industry and the Effort to Rebuild a Regional Economy. Commonwealth of Pennsylvania, Pennsylvania Historical and Museum Commission, Harrisburg, PA 1999.

² Dublin T., Licht W.: The Face of Decline: The Pennsylvania Anthracite Region in the Twentieth Century. Cornell Press, Ithaca, NY 2005.

³ Ethnic Changes in Northeastern Pennsylvania (with Special Emphasis on Recent History within the City of Hazleton. Joint Urban Studies Center, July 2006, www.urbanstudies.org.

ecosystem existing in nature. A biological ecosystem is developed through the evolution process into an equilibrium state. At some point stable conditions exist and one species produces the necessary nutrients for the other species to survive. Even though it becomes a predator-prey relationship, every part of the ecosystem is important and needed to maintain equilibrium. Economic development is part of the ecosystem as well⁴. The partners of the ecosystems are:

- our families,
- elementary and secondary Schools,
- institutions of higher education,
- local industry,
- local community,
- international cooperation,
- state and local government.

All the mentioned above partners must collaborate together in order to support and nurture a culture of innovativeness. There are two different methods to accomplish economic growth.

They are:

- a) To increase the amount of input within the current productive process (Work Harder);
- b) To develop innovative ways to increase output without increasing input (Work Smarter).

Innovativeness is an effective source for wealth generation within economy. High technology research and development industries always show high growth potential. It is very important to develop very fast and efficient method to transfer the newest technology from research sector to the commercial sector. The high growth rate in high technology industries is the reason that federal and state government are trying to develop programs that nurture innovation in a business incubator center and its ecosystem. It is very important for this innovativeness to link research and development to economic growth and the business incubator centers ecosystem. It is important that some of the profit from the startup companies in the business incubator center be reinvested into further research and development. Research and development economy and commercial economy are part of the same ecosystem and one could not exist for too long without the other. The other part of the ecosystem is that the research and development businesses must be linked geographically. A typical example of the geographical innovativeness ecosystem is the Silicon Valley in California⁵. Engineering Research Center funded by National Science Foundation (NSF) became a good example of an innovative ecosystem. Engineering Research Center integrates research and development

⁴ Costanza R.: What is ecological economics? May 11, 2010, insights.som.yale.edu/insights; Isenberg D.: What an Entrepreneurship Ecosystem Actually Is. "Harvard Business Review", May 12, 2014.

⁵ accenture.com; Stanford: Silicon Valley New Japan Project; accenture.com/_acnmedia. Silicon Valley Tech Innovation Ecosystem, 2013.

partners with educational institutions and industries. In order for an innovative ecosystem to be healthy, the research economy and commercial economy must be in balanced equilibrium.

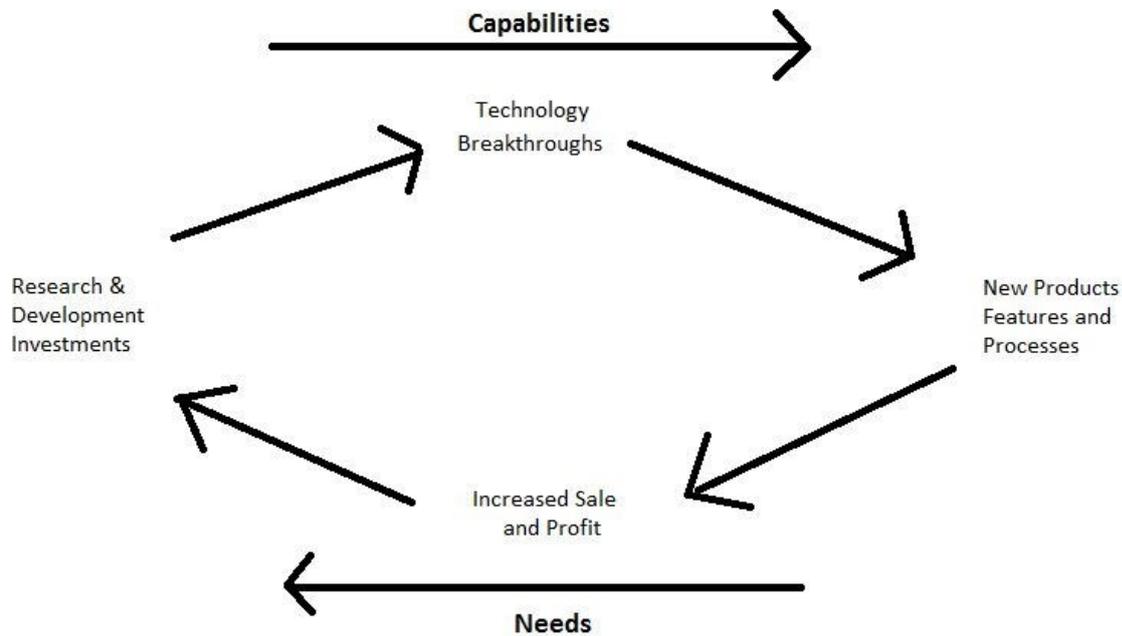


Fig. 1. Balanced equilibrium between the commercial economy and research economy

Rys. 1. Równowaga między gospodarką opartą na handlu a gospodarką opartą na badaniach

Source: Own's work on basis: Jackson D.J.: What's an innovation ecosystem? National Science Foundation, Arlington, VA, http://www.google.pl/url?url=http://erc-assoc.org/sites/default/files/topics/policy_studies/DJackson_Innovation%2520Ecosystem_03-15-11.pdf&rct=j&q=&esrc=s&sa=U&ved=0ahUKEwikz-6h2YfSAhWBjSwKHcYOBKAQFggUMAA&sig2=9rXSivTrJPVJ9BKSeiyxTQ&usg=AFQjCNHYHsorDSc9IJ83rLBSVB5WOTtiHg.

Fig. 1. demonstrates the integration between research economy and commercial economy. The research and development investments are paying for themselves by increased profit in commercial economy. In a thriving innovative ecosystem research and development investments are being replenished very rapidly. It is very desirable for the innovative induced growth in profit and commercial economy to exceed the initial research and development investments. In that case the innovation ecosystem is growing.

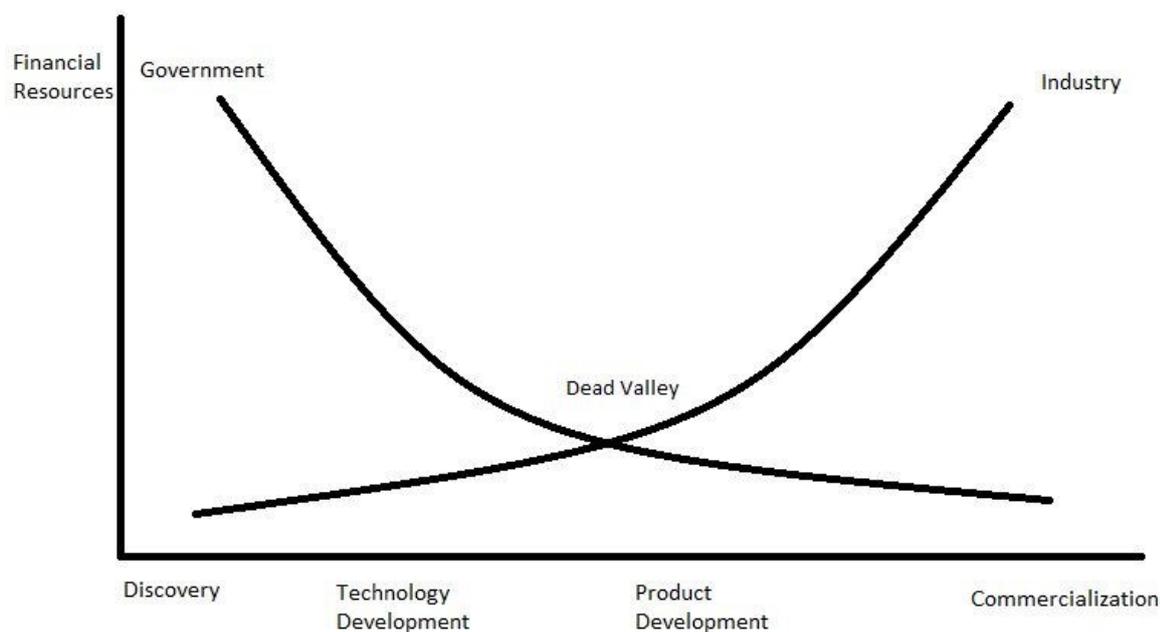


Fig. 2. Link between innovation economy and commercial economy

Rys. 2. Związek między gospodarką innowacyjną a gospodarką handlową

Source: Own's work on basis: Jackson D.J.: Whats an innovation ecosystem? National Science Foundation, Arlington, VA, http://www.google.pl/url?url=http://erc-assoc.org/sites/default/files/topics/policy_studies/DJackson_Innovation%2520Ecosystem_03-15-11.pdf&rct=j&q=&esrc=s&sa=U&ved=0ahUKEwikz-6h2YfSAhWBjSwKHcYOBKAQFggUMAA&sig2=9rXSivTrJPVJ9BKSeiyxTQ&usg=AFQjCNHYHsorDSc9IJ83rLBSVB5WOTtiHg.

It is clearly our goal to create this kind of model. The key to success is to turn innovative research and development efforts into commercial products that will bring profit. The challenges are to bring research and development economy and commercial economy into a cooperating mode. Those two economies are operating in entirely different reward systems. Very often those reward systems are discouraging the cooperating between commercial economy and research/ development economy. Often a short term profit generation overshadows long term economic growth opportunities.

Fig. 2 demonstrates the funding distribution for new discovery, technology development technology transfer and commercialization. The left side of the diagram represents funding for research and development activities with concentration on academic research. The funds for academic research often come from government agency like NSF, Department of Energy etc. Private funding is very hard to attract considering high costs as well as high risk factor. The right side of the diagram represents private industry funding. The level of funding is sufficient (risk of investment is low). The area in the middle of the graph is what is very often referred to as a dead valley. In that area, the discovery needs to be transferred into commercialization. Many potential good inventions do not survive the dead valley. After

discovery is being completed the university publishes the results and never pursues the concept for possible commercialization⁶.

At that stage of technology development, the innovation is not appealing to commercial industry due to high risk. The commercial sector is very sensitive to high risk factors. The dead valley is the area with the least amount of funding available, since the research funding already ended and the commercialization funds are not available yet. The dead valley area is still considered high risk investment. This area is usually covered by the small business startup or private investors. Small businesses and private investors are more likely to recognize the commercialization potential of the invention, take the necessary risk and provide funding. Many inventions get stuck in dead valley for an extended period of time (sometimes until they becomes obsolete). Business incubator centers play an important role in providing assistance to small companies in transferring new inventions and technologies from the development to the commercialization stage. Business incubator centers may also provide companies with the necessary training for the commercialization of new technology as well as guidance in applying for technology transfer funds.⁷ For that purpose, the state and local authorities as well as business leaders in Hazleton, Pennsylvania provided funds to establish CAN-BE, a business incubator center.

3. CAN BE (Business Incubator Center)

The business incubator center, CAN BE, was established in 2000. It is located in the Valmont Industrial Park immediately across the street from the Penn State Hazleton Campus. The objective of CAN BE is to provide assistance and support for entrepreneurs who are developing new ventures. CAN BE nurtures start-up companies by helping them to survive and grow during the beginning stage when they are the most vulnerable. CAN BE is providing critical business, technical and engineering services to their client companies. Those client companies usually consist of one person who is the inventor and receives family support. Most of the time, these people are extremely enthusiastic and are willing to devote their entire time and energy to convert their dreams and ideas into reality.

Penn State Hazleton had a very positive experience with involving students in providing assistance to this type of individual. Most of the time, students adopted the idea of the inventor and became as enthusiastic as the inventor. There was a lot of positive energy transferred to the students from the inventor role model. This was an opportunity for Penn State Hazleton to

⁶ Maclure N.: Product Commercialization. November 1, 2011, slideshare.net/nmaclure; <https://sbir.nih.gov/sbir.gov/about/about-sttr>.

⁷ 2013-2018 Comprehensive Economic Development Strategy Five Year Plan for Northeastern Pennsylvania. Northeastern Pennsylvania Alliance (NEPA), December 2013, www.nepa-alliance.org.

develop a comprehensive entrepreneurial program with the faculty and students from the following programs.

- Engineering/Engineering Technology (Mechanical, Electrical).
- Business Administration.
- Information Science Technology (IST).
- Communication.

Faculty and students from these programs have the necessary expertise to provide comprehensive assistance to the start-up companies in a business incubator center.

CAN BE, a business incubator center, has also established a network of volunteers. Most of those volunteers are retired professionals representing the following professions.

- Different Engineering Fields.
- Business Administration.
- Accounting.
- Business and Patent Law.
- Product Marketing and Advertising.
- Legal

This network of volunteers is another extremely important asset for a business incubator center. The system of volunteers is being used by the business incubator center client companies as needed. Client companies of CAN BE can be divided into three different stages.

- Beginning Stage (before incubation).
- Incubation Stage.
- Post-Incubation Stage.

Companies at the beginning stage of operation are “walk-in” clients. CAN BE, a business incubator center, has a significant number of “walk-in” clients (50-100/year). The business incubator center is working with those individuals in evaluating the feasibility of their ideas. For that purpose, the network of volunteers works the best. Based on the nature of the idea, the appropriate volunteer is being selected by the Coordinator of the business incubator center. A face-to-face meeting is arranged between the inventor and the volunteer. The volunteer’s role is to evaluate the feasibility of the idea. Most of the ideas being evaluated are neither technically nor scientifically possible. However, some of the ideas are very valuable. The role of the evaluator (volunteer) is to explain to the inventor if the idea is either technically or scientifically valuable and if it is even possible. Those explanations are usually supported by some calculations. The inventor can ask for a second opinion if the first evaluator’s explanation is not convincing. If the inventor’s idea is proven to be valuable and technically feasible, the inventor can meet with a volunteer(s) from the legal profession to discuss the procedure for protecting intellectual property as well as establishing the company. At the same time, the inventor can meet with a volunteer from the business profession to seek help in developing

a business plan and marketing strategy. The meeting usually takes place in the conference room of the business incubator center during the evening hours to accommodate the inventors who might be employed during the day. These steps describe the beginning stage before incubation.

Table 1 lists the number of volunteers providing services to companies at CAN-BE. The volunteers are listed by the professions. The table data reflects the last 5 years.

Table 1

The network of volunteers at CAN BE (business incubator center)

| Academic Year | Engineers | Business Administration | Accounting | Legal | Marketing |
|----------------------|------------------|--------------------------------|-------------------|--------------|------------------|
| 2016 | 3 | 4 | 2 | 1 | 1 |
| 2015 | 4 | 5 | 1 | 2 | 2 |
| 2014 | 3 | 4 | 2 | 1 | 1 |
| 2013 | 2 | 4 | 1 | 2 | 1 |
| 2012 | 3 | 5 | 2 | 2 | 3 |

Source: Authors' own work.

After the company is legally established and a business plan is developed the incubation stage begins. Then the company can become a formal tenant of the business incubator center. The company can lease office and/or manufacturing space at very reasonable rates below market value. While the company is a tenant in the business incubator center, it has access to internet service, secretarial support, answering service, etc. Those services are provided by the business incubator center free of charge. In addition to that, companies in the business incubator center are released from any corporate taxes during the incubation stage. The incubation period is usually limited to three years. During that time the company needs extensive support.

The scale of this support during the incubation stage is much larger than the network of volunteers can provide. Penn State Hazleton faculty and students become involved at that point. The involvement of Penn State Hazleton faculty and students is cross-disciplinary and involves faculty and students from the following programs: Engineering/Engineering Technology, Business Administration, Information Science Technology and Communication. An average of two students from each program is selected to work on a multidisciplinary entrepreneurial team providing services to start-up companies during the incubation period. Those students work together as an entrepreneurial teams which meets with the owner on a biweekly basis. All students attend the biweekly meeting even though they are working on different tasks. Engineering/Engineering Technology students are designing the prototype for the product. They conduct structural analysis and other necessary engineering calculations. They also produce working drawings using Computer Aided Design (CAD). If needed, they also plan the manufacturing processes. Business students are working on developing a business plan and marketing strategy for the product. They are also involved in the cost analysis of the product as well as starting the accounting and bookkeeping processes. Information Science Technology

students are involved in designing, posting and updating the company's website. Communication students are working on developing promotional materials for the purpose of advertising and promoting the product. The promotional materials often include a product catalog to be posted by the Information Science Technology students on the company's website. The entrepreneurial student teams are supervised by four faculty members representing four disciplines, Engineering, Business, Information Science Technology and Communication.

The involvement in multidisciplinary entrepreneurial team projects provides students with valuable "real" world experience. Students develop valuable multidisciplinary communication skills, build up their resumes and establish professional contacts. The startup companies in the business incubator center receive very comprehensive assistance during the critical incubation period.

After a period of three years, the incubation period ends. The companies are expected to move out and pay a market value price for leasing office/manufacturing space. At that point, the post-incubation stage begins. Those companies are encouraged to maintain contact with the business incubator center as well as Penn State Hazleton. Penn State Hazleton faculty and students keep providing assistance to the companies in the post-incubation stage, but the assistance changes. The assistance is more in the nature of a paid internship for students. Very often a company in the post-incubation stage hires Penn State graduates. Most of the time, those are the former students who worked for the company during the incubation stage.

4. Role of Faculty and Students from Penn State Hazleton in the Operation of a Business Incubator Center

In recent years, manufacturing jobs have become more cross-disciplinary. As a result, there is a practical need for more cross-disciplinary training in order to better prepare students to meet the demands of the business world. The establishment of CAN BE, a business incubator center, created a great opportunity for Penn State Hazleton to develop a mutually beneficial working relationship. This was an emerging opportunity for Penn State Hazleton to establish a comprehensive entrepreneurial program involving faculty and undergraduate students. The goals of the Entrepreneurial program are as follows⁸:

- Economic Development Goal.
To provide comprehensive multidisciplinary assistance to start-up companies.
- Educational Goals.
To provide unique educational experiences to students, that is:

⁸ Costanza R.: What is ecological economics? May 11, 2010, insights.som.yale.edu/insights.

1. To gain firsthand experience in applying concepts that they are presently learning in class in a “real world” environment.
 2. To develop cross-disciplinary communication skills by working in multidisciplinary teams.
 3. To gain a better understanding of their role in the business world.
 4. To develop professional contacts and build-up their resumes.
 5. To develop an understanding of the role that different professions play in the business world.
- University Development Goal.

To create an Entrepreneurship minor at Penn State Hazleton.

Students from different majors (Fig. 3) work together in different multidisciplinary teams helping new startup companies.

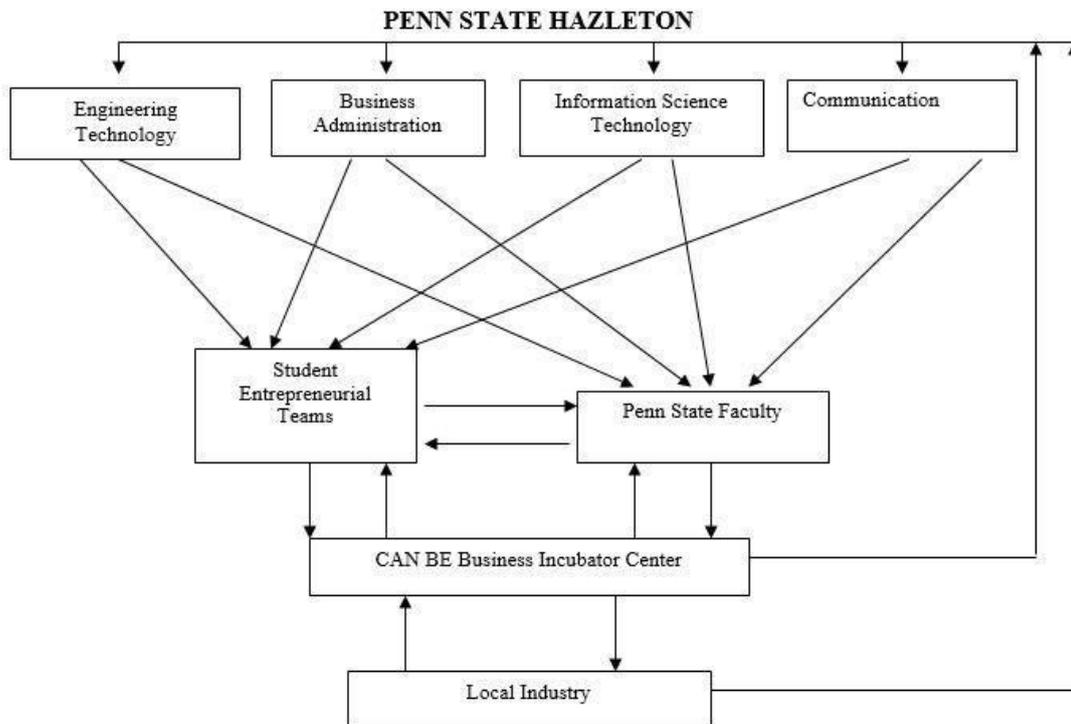


Fig. 3. Flowchart describing the entrepreneurial program

Rys. 3. Schemat blokowy opisujący program przedsiębiorczości

Source: Author's own work.

The entrepreneurial program is described on the Fig. 3. The arrows indicate the collaboration between students, faculty and industry. Students from four different majors are the focal point of the business incubator center projects.

In summary, the multidisciplinary entrepreneurial teams provide very comprehensive assistance to the new startup or existing companies. At the same time, students gain very

valuable experience learning the complexity of the entrepreneurial ventures. Students are also developing the ability and appreciation for working in multidisciplinary teams while developing the ability for cross-disciplinary oral and written communication. Observing a new startup or existing company as a role model, students are encouraged to pursue their own ideas and business ventures. This multidisciplinary Entrepreneurial program helps Penn State Hazleton to provide students and graduates with actual entrepreneurial experience which could not be accomplished in the classroom itself. This program also allows Penn State Hazleton to enhance the economic develop and life in the area⁹.

The following courses are linked to the Entrepreneurial program. The courses listed below consolidate the cross-disciplinary knowledge into the entrepreneurial project. These are also required courses for the Engineering/Engineering Technology, Business Administration, Information Science Technology and Communications majors.

- **Engineering /Engineering Technology Courses**
 - EGT 201 – Advanced CAD.
 - MET 210W – Machine Design.
 - MET 297A – Capstone Design Project ENGR 490W – Design Project.
 - ENGR 491W – Capstone Design Project.
- **Technical Writing Course** ENGL 202C – Technical Writing.
- **Business Administration Courses.**
 - MKTG 220 – Personal Selling.
 - MKTG 310 – Public Relations and Advertising.
- **Information Science Technology Courses** IST 256 – Programming for the WEB.
 - IST 257 – Advanced WEB Administration.
 - IST 331 – Organization and Design of Information Systems.
- **Communications Courses.**
 - CAS 211 – Informative Speaking.
 - CAS 214W – Speech Writing.
 - CAS 252 – Business and Professional Communication.

The entrepreneurial projects are monitored by the Penn State Hazleton faculty as well as a representative from the Pennsylvania Technical Assistance Program (PennTAP).

Five Penn State faculty members were involved in the *Multidisciplinary Entrepreneurial Team Building Project* from the start, ensuring a cross-disciplinary mix of academic involvement and commitment.

⁹ Jackson D.J.: Whats an innovation ecosystem? National Science Foundation, Arlington, VA, http://www.google.pl/url?url=http://erc-assoc.org/sites/default/files/topics/policy_studies/DJackson_Innovation%2520Ecosystem_03-15-11.pdf&rct=j&q=&esrc=s&sa=U&ved=0ahUKEwikz-6h2YfSAhWBjSwKHcYOBKAQFggUMAA&sig2=9rXS ivTrJPVJ9BKSeiyxTQ&us g=AFQjCNHYHsorDSc9IJ83rLBSVB5WOTtiHg.

- **Wes Grebski – *Project Director, Coordinator of the MET Program, Associate Professor of Engineering.***

Wes Grebski supervised engineering and engineering technology students working on entrepreneurial teams.

- **Judith O'Donnell – *Technical Writing Instructor.***

Judith O'Donnell worked with students on oral and written communication skills, and provided guidance to the student teams in all areas of technical writing.

- **Barbara Brazon – *IST Instructor.***

Barbara Brazon supervised IST student worked on entrepreneurial team building.

- **Mark Toda – *Senior Technical Specialist, PENNTAP.***

Mark Toda assisted in identifying entrepreneurial opportunities, developing the project work scope, and making connections with external resources.

Students are required to submit a final report to the faculty and the company for review. The company is asked to comment on the benefit of the project from the company's perspective.

PennTAP is also conducted a survey of the economic benefits (where appropriate).

During the Fall 2015 and Spring 2016, the Penn State Hazleton (PSU-HZ)/PennTAP team was awarded Level II Thematic Initiative Funds (TIF) in the amount of \$10,000. These funds were used and are currently allocated to several entrepreneurial ventures, where Penn State Hazleton students are providing assistance. A summary of these ventures follows:

Hideout 360

Company has conceived of a rotating, low hanging tree stand for hunters, nature lovers, etc. The tree frame was redesigned by a PSU-HZ student, and a prototype built using TIF funds. The entrepreneur agreed to cost share 25% of prototype built.

KVS Hospital Bed

A new hospital bed was conceived for preventing pressure sores for bedridden patients. A mechanical engineering technology student took the concept and developed it into a cost effective structurally sound mechanical design. The project was put on hold, as the entrepreneur is seeking funding assistance through the SBIR program. A workable mechanical design, however, was created.

Exercise Machine

An exercise machine for providing aerobic and strength exercise was conceived by a doctor from Lancaster, Pennsylvania. Three students developed mechanical designs of the invention

which were put into a real design. No prototype was built since the entrepreneur has put the project on hold.

Waterbug

A product to assist in placing spring water bottles onto water coolers was conceived by a Pittston, PA machine shop. A mechanical engineering technology student at Penn State Hazleton developed CAD drawings of each of the parts of the waterbug as well as an assembly drawing. Students from the Penn State Hazleton Marketing class performed market research and determined a potential market niche for the product. Subsequently, a team of IST students developed a website for the waterbug. The website is currently being prepared for hosting by the Northeastern Pennsylvania Industrial Resource Center (NEPIRC). TIF funds were used to support this effort.

Pillars of PA

This company has developed a collectible/bookend which incorporates a sculpted figure of Joe Paterno. The company was having trouble with retail sales. A team of marketing students developed a marketing plan which includes direct marketing to key market segments such as PSU alumni, football players and fans, PSU Blue and White Society, PSU library donors, etc. Subsequently a team of IST students developed a website for marketing the collectible. The website is currently being prepared for hosting by a Williamsport-based web developer.

Wood Coping Machine

A machine was conceived to assist trim carpenters in cutting angled corners on wood trim. A Penn State Hazleton student took the product concept and developed a mechanical design which could manufacture the product and also includes selected mechanical components for ease of operation. Building of a prototype is currently being considered with the entrepreneurial team and the client.

CI Precision

This machine shop in Hazleton was in need of assistance with marketing materials. Penn State Hazleton IST students developed a website for them and a printed marketing brochure was created by Communications students.

Global Dimension Stone

This company had conceived a machine to level the material that is laid down under stone. The leveling arm was designed by a mechanical engineering technology student and a prototype is being planned for Spring 2017.

Design projects completed by Multidisciplinary Entrepreneurial Teams in last five years are listed below.

1. Design a Zero-Utility Building to be Constructed on the Campus:
 - Structure.
 - Foundation.
2. PV Power Station for a Zero-Utility Building.
3. Alternative Energy Heating and Air Conditioning for a Zero Utility Building.
4. Solar Water Heater for a Zero-Utility Building.
5. Modify an Off-Campus Dorm to Meet Green Building Guidelines.
6. New Off-Campus Dorm Powered Partially by Alternative Energy.
7. Dog Cage for a PennTAP Client.
8. Specialized Lift for Hazleton Pumps.
9. Attachment for a Truck to Tow Heavy Equipment.
10. Drywall Lift.
11. Alternative Blades for a Wind Turbine.
12. Leveling Device for Cement Work.
13. Boat Lift to Unload a Trailer to Water.
14. Landing Gear for the Experimental Aircraft.
15. Truck Hitch Hauler for an ATV.
16. Collapsible Roof for a Utility Trailer.
17. Low Cost Portable Car Lift.
18. Power Walker/Lift for Disabled People.
19. Biodiesel Producing Station.
20. Methane Producing System for Farms.
21. Convex Mirrors to Bring Water to the Boiling Point Using Solar Energy.
22. Tray for Extension Ladder.
23. Portable Solar Power Station for Outdoor Cooking.

Table 2 lists the number of students participating in Multidisciplinary Entrepreneurial Team Building Projects in the last five years. The students are representing four different majors offered at Penn State Hazleton.

Table 2

Number of students from Penn State Hazleton involved in multidisciplinary entrepreneurial team building projects in the last five years

| Academic Year | Engineering | Business | Information Science Technology | Communication |
|---------------|-------------|----------|-----------------------------------|---------------|
| 2016/2017 | 10 | 10 | 10 | 10 |
| 2015/2016 | 10 | 10 | 10 | 10 |
| 2014/2015 | 11 | 12 | 11 | 11 |
| 2013/2014 | 9 | 9 | 9 | 9 |
| 2012/2013 | 8 | 8 | 8 | 8 |

Source: Authors' own work.

Conclusions

Cooperation between a business incubator center (CAN BE) and a university (Penn State Hazleton) have proven to be a very effective method to transfer innovative projects from development to commercialization (journey through the dead valley). A multidisciplinary approach with the involvement of faculty and students from different programs provided company with very comprehensive assistance during the critical stages of development. From the student's perspective, the involvement in multidisciplinary project was educational experience that they will never forget. Multidisciplinary practical experience could not be accomplished in the classroom. Through these multidisciplinary entrepreneurship projects and the business incubator center, students have established professional contacts and built-up their resumes. Very often involvement in the project leads to full-time employment after graduation. Involvement with the business incubator center projects allows the faculty to stay connected to new technology and manufacturing develop while they maintain ties with the business world.

Bibliography

1. 2013-2018 Comprehensive Economic Development Strategy Five Year Plan for Northeastern Pennsylvania. Northeastern Pennsylvania Alliance (NEPA), December 2013, www.nepa-alliance.org.
2. Ethnic Changes in Northeastern Pennsylvania (with Special Emphasis on Recent History within the City of Hazleton. Joint Urban Studies Center, July 2006, www.urbanstudies.org.
3. accenture.com, Stanford: Silicon Valley New Japan Project.
4. accenture.com/acnmedia, Silicon Valley Tech Innovation Ecosystem, 2013.
5. Costanza R.: What is ecological economics? May 11, 2010, insights.som.yale.edu/insights.

6. Dublin T., Licht W.: *The Face of Decline: The Pennsylvania Anthracite Region in the Twentieth Century*. Cornell Press, Ithaca, NY 2005.
7. Isenberg D.: What an Entrepreneurship Ecosystem Actually Is. “Harvard Business Review”, May 12, 2014.
8. Jackson D.J.: What's an innovation ecosystem? National Science Foundation, Arlington, VA, http://www.google.pl/url?url=http://erc-assoc.org/sites/default/files/topics/policy_studies/DJackson_Innovation%2520Ecosystem_03-15-11.pdf&rct=j&q=&esrc=s&sa=U&ved=0ahUKEwikz-6h2YfSAhWBjSwKHcYOBKAQFggUMAA&sig2=9rXSivTrJPVJ9BKSeYixTQ&usg=AFQjCNHYHsorDSc9IJ83rLBSVB5WOTtiHg.
9. Maclure N.: Product Commercialization. November 1, 2011, slideshare.net/nmaclure, <https://sbir.nih.gov>, sbir.gov/about/about-sttr.
10. Wolensky R.P. et al.: *The Knox Mine Disaster: The Final Years of the northern Anthracite Industry and the Effort to Rebuild a Regional Economy*. Commonwealth of Pennsylvania, Pennsylvania Historical and Museum Commission, Harrisburg, PA 1999.