What Should You Prepare for Employment before Your Graduation

Yoke Khin Yap

Professor of Physics
Director of Engineering Physics Ph.D. program
Director of Applied Physics M.S. program
Faculty Fellow in the office of MTU Vice President for Research

Department of Physics
Michigan Technological University
ykyap@mtu.edu
Contents:

Why going for graduate study?

Job after Ph.D.?

Who is creating the new jobs and hiring?

Startups are the job creators-Are you ready?

Entrepreneurial training- Barrier between academia and startups
Recent Employment Status?

Overall unemployment rate is dropping from ~7% to ~5% from 2013 to 2015.

Average number of employment in the past 2 years is ~2.8 million per year.

Total jobs, private and public, created per year

Year

-6000  -5000  -4000  -3000  -2000  -1000  0  1000  2000  3000  4000

x 1,000


3177  1946  -1735  105  2033  2506  2085  1140  1058  2083  2236  2331  2720

MichiganTech
Why going for graduate study?

Unemployment rate is lower for those graduated with advanced degrees.

Why going for graduate study?

The unemployment rate for science, engineering, and health (SHE) doctorate recipients was 2.4% in October 2010, about 1/3 of the unemployment rate for general population aged 25 years or older (8.2%).

Contents:

Why going for graduate study?

Job after Ph.D.?

Who is creating the new jobs and hiring?

Startups are the job creators- Are you ready?

Entrepreneurial training- Barrier between academia and startups
< 30% are hired in permanent jobs (Blue)
Many are hired as postdocs (Green) or other temporally position (Red).

~ 35% are hired in permanent jobs (Blue)
Many are hired as postdocs (Green) or other temporally position (Red).

~50% are hired in permanent jobs (Blue)
Many are hired as postdocs (Green) or other temporally position (Red).

~60% are hired in permanent jobs (Blue)
Many are hired as postdocs (Green) or other temporally position (Red).

Contents:

Why going for graduate study?

Job after Ph.D.?

Who is creating the new jobs and hiring?

Startups are the job creators—Are you ready?

Entrepreneurial training—Barrier between academia and startups
Who is hiring (Example, PhD in Physics)?

You will need to work beyond your field, especially for the potentially permanent jobs.

You will need to work beyond your field, especially for the potentially permanent jobs.

Employment Type of Physics PhDs One Year After Degree, Classes of 2011 & 2012 Combined

<table>
<thead>
<tr>
<th>Employment Type</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postdoctoral Position</td>
<td>10</td>
</tr>
<tr>
<td>Other Temporary Position</td>
<td>26</td>
</tr>
<tr>
<td>Potentially Permanent Position</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

- **Engineering**: 14%
- **Computer software**: 11%
- **Business or Finance**: 7%
- **Other sciences**: 4%
- **Education**: 2%
- **Medical services**: 1%
- **Other**: 5%

Note: Employment in physics means an individual's primary or secondary employment field was in physics or astronomy. Data only include US-educated PhDs who remained in the US after earning their degrees.

http://www.aip.org/statistics
2014's Job Growth by Major Industry

thousands of jobs created in the last year

- Professional/Biz: 713
- Food Services: 289.6
- Retail: 264.4
- Health: 256.2
- Construction: 230
- Manufacturing: 161
- Transportation: 139.7
- Wholesale: 108.9
- Finance: 89
- Education: 55.3
- Mining: 49.6
- Government: 47
- Information: 17

Who is hiring?

Derek Thompson “2014: The Best Year for Job Creation This Century,” The Atlantic, Oct 3, 2014
Contents:

Why going for graduate study?

Job after Ph.D.?

Who is creating the new jobs and hiring?

Startups are the job creators- Are you ready?

Entrepreneurial training- Barrier between academia and startups
Who is hiring?

The U.S. government Business Dynamics Statistics (BDS) confirms that startups aren’t everything when it comes to job growth. They’re the only thing.

“..without startups, there would be no net job growth in the U.S…”

Source: Business Dynamics Statistics, Tim Kane
“...while older firms are the major source of employment, new and young companies are responsible for net new jobs.”

Figure 3: Average Firm Employment by Firm Age (1990–2011)

Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author’s calculations

Kauffman Foundation Research Series: Firm Formation and Economic Growth, August 2013
Tech Starts: High-Technology Business Formation and Job Creation in the United States
“...while older firms are the major source of employment, new and young companies are responsible for net new jobs.”

Average Annual Net Job Creation at Surviving Businesses by Firm Age (1990–2011)

Kauffman Foundation Research Series: Firm Formation and Economic Growth, August 2013
Tech Starts: High-Technology Business Formation and Job Creation in the United States
Most new jobs in the U.S. are created by startups.

“Companies less than one year old with one to four employees have created more than 1 million jobs per year over the past three decades. Those with five to nine employees have added half a million jobs per year.”

Kauffman Foundation Research Series: Firm Formation and Economic Growth
The Return of Business Creation, July 2013
This means, you need to prepare yourself to work in startups

You will be engaged to do R & D (Please learn to be a good researcher)....and

Earn your salary by securing funding from federal agencies and then generating revenue by product selling.

SBIR/STTR programs are the major funding resources for startups for early product development.

Venture capitals are the investors who will come in when you have a good products and customers.

SBIR: Small Business Innovation Research
STTR: Small Business Technology Transfer Research
See www.sbir.gov
Contents:

Why going for graduate study?

Job after Ph.D.?

Who is creating the new jobs and hiring?

Startups are the job creators - Are you ready?

Entrepreneurial training - Barrier between academia and startups
Innovation drives the economy: We should accelerate technology commercialization


Presidential Memorandum -- Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

SUBJECT: Accelerating Technology Transfer and Commercialization of Federal Research in Support of High Growth Businesses

Section 1. Policy. Innovation fuels economic growth, the creation of new industries, companies, jobs, products and services, and the global competitiveness of U.S. industries. One driver of successful innovation is technology transfer, in which the private sector adapts Federal research for use in the marketplace. One of the goals of my Administration's "Startup America" initiative, which supports high growth entrepreneurship, is to foster innovation by increasing the rate of technology transfer and the economic and societal impact from Federal research and development (R&D) investments. This will be accomplished by committing each executive department and agency (agency) that conducts R&D to improve the results from its technology transfer and commercialization activities. The aim is to increase the successful outcomes of these activities significantly over the next 5 years, while simultaneously achieving excellence in our basic and mission focused research activities.
Universities challenged
The accelerating pace of change in today’s world means that universities must modify how they fulfil their function of seeking and sharing knowledge.

Universities are no longer viewed predominantly as places driven by curiosity and a thirst for knowledge. Instead, they are drivers of economic development. Success is defined by graduate employment. Research is problem-oriented. Scientists are budding entrepreneurs. Knowledge is included on the balance sheet, and policies are being introduced to produce the greatest return on investment.
Many Innovation are spun off from Universities!

**The internet** - Lawrence Roberts used the packet switching theory to connect computers to phone line, MIT 1965.

**Google** - started by two Stanford graduate students, Larry Page and Sergey Brin.

Many Innovation are spun off from Universities!

NSF Phase I & II SBIR Grantee: Promethean Power Systems

“They have developed a solar-powered system for refrigerated storage to keep fresh fruits and vegetables from spoiling. And this is a huge advance for India because lack of storage causes Indian farmers to lose approximately $10 billion in crops each year. This innovation promises farmers more income while also improving consumer’s access to fresh produce throughout the year. This partnership united different experiences and areas of expertise, and now with a little help from the endowment fund, Promethean Power and Icelings are helping solve a practical challenge that will make a real difference to people’s lives and incomes.”

-Former Secretary of State Hillary Clinton

SBIR: Small Business Innovation Research
STTR: Small Business Technology Transfer Research
See www.sbir.gov
More Innovation..

DOE Phase I & II SBIR Grantee: Natel Energy

Pioneering next generational low head power micro hydro-turbine technology. Each unit has the ability to generate megawatts of energy and perfect for smaller rivers and dams installation.

Developing a hydropower project for Apple Computer Inc.

Signed MOU with Government of Bhutan for a 6 year 2 Phased pilot project...1 MW test & 1GW scale up.

Sought new market opportunities rather than just retrofitting to old stodgy markets...

SBIR: Small Business Innovation Research
STTR: Small Business Technology Transfer Research
See www.sbir.gov
What is the barrier between academic (university) and Startups (Technology Commercialization)?
The barrier: Entrepreneurship

Integrated Research-Entrepreneurship-Commercialization (i-REC)

*i-REC model for intellectual and financial sustainability*

- **Intellectual Discovery**
  - Research
  - Identify intellectual aspects that have commercial value
- **Commercialization**
  - Funding for new research
- **Entrepreneurship**
  - Technology Transfer

*MichiganTech*
How to get started?

Step-1

Remove your psychological barrier:

Open your mind to learn about technology commercialization

There are basic science behind technology commercialization (much more demanding and target oriented)!
Step-2

Identify an idea as the theme of your project:

Be your own peer-reviewer-

What pain point will you solve?

Who cares?

Is it good to have or must have?

(For start, we do this by “Assumption” or “Hypothesis”)
Step-3

Develop your entrepreneurial skill: Identify a strategy for commercialization. Go for a training.

1) NSF Innovation Corps (I-Corps)

2) NIH I-Corps
   http://sbir.cancer.gov/resource/icorps/

3) Houghton I-Corps /Michigan I-Corps
Benefits from attending I-Corps

$50,000 grant (NSF)

Be trained with basic Entrepreneurial skill. Learn to identify the best market/research target of your idea. (In fact, this is the best thing to know for basic research too)

Free consultation from the real world (100 personnel from the industry)

Verify, falsify, and refine the best market/target of your idea.
At least, Read the book

https://youtu.be/QoAOzMTLP5s
Step 4

Funding plan that follows the strategy developed in Step 3.

Then, apply for the 1st research grant (short term):

1) Crowdsourcing (http://www.superiorideas.org/)

2) REF-TC

3) Michigan Translational Research & Commercialization Program (M-TRAC)
Step-5

Implement long-term funding plan:
Identify appropriate sources, preparing proposals, enhance networks, and refining the commercial development strategy.

For example:
Create a company and apply for SBIR/STTR Phase-I project

http://www.sbir.gov/

This is the very 1st step towards the real world of technology commercialization.
Continuous funding are then needed (Phase-II project, Industrial funding, Private/angel investment, etc.. ).
If you are strong on basic research

Or competitive in commercialization

If you are strong on both
Summary

Graduate students should learn to be an effective and productive researcher. This is NEEDED for you to secure a job in BOTH academic or private sectors.

You will open up more opportunities if you are trained for entrepreneurship.
Summary

Get training on Entrepreneurship to enhance your chances to get employed after graduation.

Integrated Research- Entrepreneurship- Commercialization (i-REC) would contribute towards this sustainability.

Research

- Intellectual Discovery
  - Identify intellectual aspects that has commercial value

Commercialization

- Funding for new research

Entrepreneurship

Technology Transfer
Resources:

NSF I-Corps Site Program - Cohorts in Spring semester and Summer contact Mary Raber (mraber@mtu.edu).

ENT 3963 - One credit Enterprise Module titled Technology Commercialization and focused on fundamentals of the Lean Startup Methodology and Customer Discovery. Fall semester.

Pavlis Honors College Innovation Center for Entrepreneurship. Program in launch phase. Contact Jim Baker (jrbaker@mtu.edu) or Mary Raber (mraber@mtu.edu) for information.

SmartStart - Business feasibility and planning program offered by MTEC SmartZone. Contact Jason Mack (jmack@mtecsz.com)

Upcoming Events
Bob Mark Elevator Pitch Competition at Michigan Tech on November 12th. Contact Andre Laplume (aolaplum@mtu.edu) for information or Karen Foltz (ksfoltz@mtu.edu) to register.
Resources:

The Office of Innovation and Industry Engagement
Jim Baker: jrbaker@mtu.edu
John Diebel: jfdiebel@mtu.edu

Yoke Khin Yap (Department of Physics, ykyap@mtu.edu)