

“Inside-Out” and “Outside-In”
Academic Intellectual Properties
and Commercialization:
Perspective in the 21st century

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“A business is there to make money, ethically!”



I am deeply honored to be invited by the College of Law of National Cheng Chi University (NCCU) to say a few words about this subject

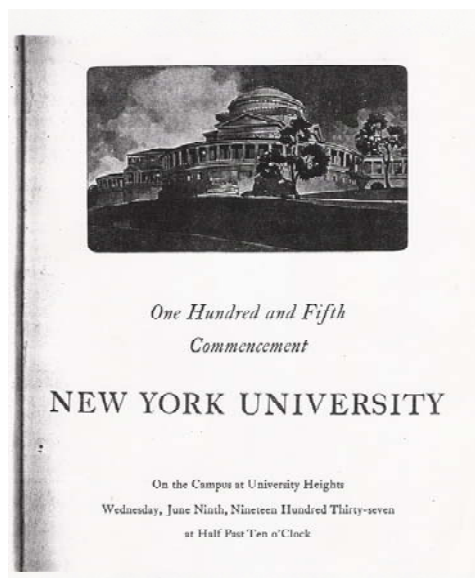
which, as you know, is dominating the academic and corporate worlds today globally.

I am very happy to make the acquaintance of one of NYU's most distinguished professors Rochelle Cooper Dreyfuss, who is Pauline Newman Professor of Law. It was quite a coincidence that even though I am a theoretical physicist, my life is "squeezed" by lawyers. My late-father, Paul Feng, and my son, Ian Feng, are both JD recipients from the same university, New York University School of Law.



NYU School of Law

Their graduation dates are separated by 72 years, 1937 and 2009 respectively!



Archibald Bromsen B.S. in S.S. 1933, City College	Joyce N. Feldman A.B. 1948, Harvard	Leonard Irwin Horwitz as of October 1936 B.S. 1933, New York
Louis Buhler as of October 1936 A.B. 1935, Columbia	Paul Kuo-Jin Feng A.B. 1932, Michigan	Reuben Itzkowitz as of October 1936 A.B. 1934, New York
George Dixon Burchell A.B. 1932, Amherst	Benjamin David Fernbach as of February 1937 A.B. 1933, New York	Rita Pearl Jasper as of October 1936 A.B. 1934, New York
Angelo J. Caico B.S. 1934, New York	Jacob Harold Fischman A.B. 1934, New York	Stephen Jaworaki as of June 1936 B.S. 1930, New York
Howard Carter, Jr. A.B. 1933, Princeton	Felice Michael Forno A.B. 1933, City College	Arthur Franklin Johnson A.B. 1931, Amherst
Michel Francis Cavallon, Jr. A.B. 1935, Colgate	Barney Abraham Ginsburg as of October 1936 A.B. 1934, New York	Joseph Sylvester Kane B.S. 1932, New York
Edwin Thomas Charriot as of October 1936 A.B. 1932, Fordham	Marvin L. Goidell as of October 1936 A.B. 1934, New York	Louis Kaplan as of June 1936 A.B. 1931, St. Thomas
David H. Cohen as of October 1936 B.S. in S.S. 1932, City College	Edward Goldin as of June 1936 B.S. 1933, New York	Albert Karpe as of October 1936 B.S. 1933, New York
Julian Jerome Cohen as of October 1936 A.B. 1935, New York	Jacob Goldner as of October 1936 B.S. 1933, New York	Mason G. Kassel A.B. 1933, Allegheny
James Randolfe Curreri as of October 1936 A.B. 1933, New York	Herman Goldstein as of October 1936 A.B. 1934, New York	Abraham Isaac Katsch as of October 1936 B.S. 1931, A.M. 1932, New York
James E. Curtiss as of October 1936 A.B. 1935, Dartmouth	Sidney Joseph Guran as of October 1936 B.S. 1934, New York	Isadore Kaufman as of October 1936 B.S. 1933, New York
Charles Grant Daley A.B. 1931, Columbia	Harold Guy Gurland as of October 1936 A.B. 1934, New York	Joseph P. Kelly as of October 1936 Ph.B. 1933, Holy Cross
Stanley Danzig as of October 1936 A.B. 1934, New York	Harry David Haber as of October 1936 A.B. 1934, New York	George Raymond Kloppenburg as of February 1937 A.B. 1931, New York
Robert Cook DeKroyft B.S. 1937, Syracuse	James Miller Hastie B.S. 1932, New York	Morris Stanley Kozinsky as of October 1936 A.B. 1934, New York
Raphael Dubrowin B.S. 1935, New York	Milton Hertz as of October 1936 A.B. 1934, New York	Daniel Arthur Leahy as of October 1936 A.B. 1932, Columbia
Louis James Dukas as of October 1936 A.B. 1935, Manhattan	Dwight Hummel Holbert A.B. 1932, Columbia	Jacob Leibman as of October 1936 A.B. 1933, New York
Nathan Eisner B.S. 1931, City College; A.M. 1934, Columbia	Eli A. Horowitz A.B. 1933, City College	
Daniel Irving Elson A.B. 1934, Yale		



A bunch of NYU new lawyers

At this point I can think of many “lawyers’ jokes” but since I am surrounded by so many world class legal experts in Taiwan and United States, decorum tells me that I better control myself.

I am here at NCCU’s outstanding College of Law feeling “elated” and a little “envious.”

I am “elated” because it is good to see that there is such a robust law school in Taiwan. It is clear that a democratic society must be built on the jurisprudence. So having good law schools should and must be the first step to achieve this goal.

I am “envious” because as one of the two comprehensive universities of Taiwan, and the only one in the southern part of the island, my university has only a small “law department.” While we do have some outstanding faculty members in the department, and a few are represented in this conference, the department is very far from being a robust law school. I suspect because of our “smallness,” our contribution to the democratic system of Taiwan is only minimal. This is not only a responsibility not carried by NCKU, but in a way, because of our sheer size as a comprehensive university

Pearl S. Buck, the world renowned author said that *“If you want to understand today, you have to search yesterday.”*

To understand the current situation of academic technology transfer and commercialization, we need to pay attention to history. The transformation of universities from purely “centers for knowledge pursue” to become “intellectual and economic engines” took place primarily in the United States, which is also not a surprise that all the foreign experts here today are from the US, my discussion will be primarily US-centric.

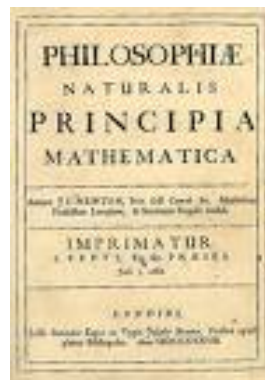
As the cliché goes, we now have entered the 21st century and the “earth is flat!”. It is interesting that for the United States, this story as the title of this speech suggests began, more or less, in the 19th century. I should mention that universities existed well before that period. Some of you who watched the recent TV Series about the second president of the United States John Adams, noticed that he and his son, John Quincy Adams, the 6th president, were both alumni of Harvard College.



However, as Harvard's website states:

"...During its early years, the College offered a classic academic course based on the English university model but consistent with the prevailing Puritan philosophy of the first colonists. Although many of its early graduates became ministers in Puritan congregations throughout New England..."

It is worth noting that by the time that John Adams attended Harvard in 1751 and John Quincy Adams graduated from Harvard in 1787, Europe's era of scientific methodology via several hundred years of the Renaissance was already in full bloom. After all, nearly a century earlier from the Adams' time, in 1688, Sir Isaac Newton already published his monumental, profound and ageless scientific epic PRINCIPIA.



As you all know, PRINCIPIA contains one of the most important body of human knowledge. It literally lifted humanity into a scientific methodological era which is still operative today.

However, it appears that in North America this great intellectual

revolution that was in full rage in Europe did not affect North America significantly until much later. Indeed it came in the 19th century.

19th century, the age of academic and industrial awakening in United States

I have to say that 19th century was really an exciting century for North America. It was indeed the century where academia and industry relations began, but only began, to rear their heads. Let me bring in a few giant names for our discussion, they are Alexander Graham Bell, Henry Ford and Thomas Edison.



Bell



Ford



Edison

1. Alexander Graham Bell, a Scotsman, who was born in 1847 and became a professor at Boston University, was widely credited for inventing the telephone. He attended the University of Edinburgh. I suspect that without the monumental body of knowledge of his countryman Sir James Clark Maxwell (born 1831) who gave the world a complete and succinct understanding of electromagnetism, I doubt very much that Bell could have made his invention. Still, what Bell did could be considered, in modern language, as an application of basic science!
2. Henry Ford who was born in 1863 founded the Ford Motor company and introduced the so-called assembly line. Henry Ford was self taught.
3. Thomas Edison who was born in 1847, the same year as Bell, was an incredible inventor, including the phonograph. In today's language, he could be credited as a man who built "technical devices." Just as

Ford, Edison did not have formal education.

I have an interesting story about Ford and Edison which I learned from Mr. Ross Perot Sr., a great Texan which I got to know quite well during my tenure at the University of Texas at Dallas.



During one of my memorable meetings with this “maverick,” Mr. Perot said that in the beginning, Ford initiated a assembly plant where the floor workers would have to go from car to car. He was very proud of his “invention.” Edison, who was a friend of Ford, was invited to visit the plant. Ford wanted to show his friend his great invention. When Edison saw the system, his knee-jerk reaction for Ford was “have you considered moving the cars and not the workers in the assembly line?”

The rest, as one would say, is history!

This story is as amusing as it is profound. It is profound because it tells us that in any human endeavor, there are always ways to do it more efficiently, more out-of-the-box, more in the “break-through” mode. It was self-evidently true in the 19th century as it is today.

For our present discussion, you noticed that apparently neither Ford nor Edison had much interaction with universities. While Bell did have some interaction with universities in Boston, after all, he was a professor in Boston University, it was probably not deep. In many ways, all three industrial giants of the 19th century did not have academia-industrial relations, either directly or indirectly, on their radar screen.

So why was that? One of the reasons, in my opinion, was because US

universities were still “immature.” and there were only a few of them.

Let me demonstrate this fact by quoting one of my most respected higher education leaders in United States today, President Richard Levin of Yale University about a great president of Harvard University, Charles William Eliot.



R. Levin



C. Eliot

Eliot was Harvard's longest serving and most successful president whose term was between 1869 and 1909. The quote was taken from Levin’s speech delivered in the Chinese-Foreign University Presidents’ Forum in Beijing on August 4, 2004.

President Levin said that

“...Charles Eliot ...was, almost certainly, the most influential university president of his time. I believe that it is fair to say that, cumulatively, the changes he wrought at Harvard had as significant and as enduring an impact on higher education in the United States as the accomplishments of any university president before or since. He became a national figure during the second half of his tenure as a spokesman for liberal individualism and an advocate of school reform.....”

There are two things worth noting here.

First, it is incredible and magnanimous that a sitting President of Yale is willing to publicly acknowledge how great his fiercely competitive institution is!

Second, Levin is basically saying using modern vernacular that “*Harvard was not Harvard until Eliot was finished with it!*”

Another critical change in the 19th century was the proliferation of the so-called “Land-Grant-Universities.” There was a pivotal political leader in the 19th century in the United States. His name is Justin Smith Morrill. Morrill was a US congressman from (1855–1867) and a Senator (1867–1898) from Vermont.



Why do I mention him? The reason is because there was a Congressional Act that was proposed and named after him, the so-called “Morrill Land-Grant College Act.” The language of the Act is

“...without excluding other scientific and classical studies and including military tactic, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life...”

The follow up of this ACT was that the Federal Government of the United States, by bestowing a whole bunch of goodies such as land, was the primary reason for the creation of what is today commonly known as “Land Grant Universities.” Great state universities of today, such as University of Arizona, University of California Berkeley, Purdue University, Texas A and M University, Virginia Polytechnic Institute and State University, University of Wisconsin and so on are created under this Act. You can palpably imagine that if these universities did not exist today in the United States, the intellectual and economic might of the nation would surely be very different, if not significantly weaker.

It is obvious that the fundamental driving force behind the creation of these land grant universities is that just ensuring and educating students to

be fluent in Greek and Latin, however important those bodies of knowledge were to be learned, was no longer adequate for society. University education needs to align its education with the industries of the day, agriculture and mechanical arts in the mid 19th century. I think if one looks at higher education today, this vision of the Morrill Act is still very much applicable. And it has a great deal of relevance to the vision of TxIS.

Three metamorphosis took place in the 20th century

Three metamorphoses took place in the 20th century that made higher education in North America what it is today.

First: Two world wars in fire power and destruction of the scale never before seen in the history of man ravaged Europe and Asia in the first half of the 20th century. The end result of these two horrible wars essentially lifted, lock-stock-and-barrel, thousands and thousands of the truly great intellects in Europe and “dumped” them on American intellectual communities. People who not only were great, but truly great in the sense that their works were epoch changing, like Albert Einstein, Eugene Wigner, Enrico Fermi, Theodore von Kármán, Edward Teller and so on, in my opinion, would never had left Europe if Europe did not become the epic centers of WWI and WWII.

Indeed, if the intellectual supremacy built up from three to four centuries of the Renaissance was not so significantly disturbed, if not destroyed, there would be no such massive brain-drain from Europe to the United States. In my opinion, I dare say that such a brain-drain was never before seen in the history of man, nor will it ever happen again to that magnitude. With this as background, with the gushing in of such an intellectual Tsunami, it is no surprise that the quality of research and development in US universities’ made several quantum jumps and became the envy of the world in merely 50 years of the first half of the 20th century.

Second: Right after WWII, a great American named Vannevar Bush, a US senior science and technology administrator who was responsible for

the War Weapons program called Manhattan Project during WWII, realized that to sustain R&D for the United States, which was important for the country's education and economic well being in the post-war period, successfully convinced the administration to create what is now called the National Science Foundation.



Bush realized that in order to promote research excellence in universities, Federal Government should and must play a pivotal and fundamental role. There is a well known cliché which says that “imitation is the best form of flattery.” Well, if you look around Asia, where the National Science Council of Taiwan, Natural Science Foundation of China and National Science and Engineering Foundation of India all have the NSF flavor, you would immediately realize how fundamental the concept of having an NSF-like institution in any aspiring nation! I suspect in Europe, there is also similar outfits which have NSF flavors.

So, with the combination of a significant up-lift of quality people from Europe, and with funding from the Federal Government for research, US universities went from good to great.

But, there is still one step missing for a robust academia-industry relation.

That step is intellectual properties, or IPs!

Third: The final step finally came in 1980. With US Federal government funding research after WWII before 1980, it was sort of understood that the IPs created in universities should and did reside with the Government. Yet, the US Federal Government was not and will never be an entrepreneurial outfit. This means that all the IPs will simply be sitting on the shelf somewhere in Washington D.C., collecting dust. Two Senators, Senator Birch Bayh of Indiana and Senator Bob Dole of Kansas,

recognized this shortcoming, created probably one of the most profound Acts of the 20th century, the so-called “Bayh-Dole Act.”



Bayh-Dole Act as the basis of industry-academy collaboration

Enacted in the U.S. in 1980

(Before Bayh-Dole) : The patent of Government-funded research developments belongs to the government ->
Commercialization is difficult

(After Bayh-Dole): The patent as the research result belongs to the university

- University researches funded by government
- Patent holder university act for the research result introduction to the society

Enacted in Japan in 1999(20 years later than the U.S.)

(After Bayh-Dole): Patents funded by competitive government fund belong to universities

Instead of government owning the IPs, this Act permits a university, small business or any non-profit organizations to retain intellectual property ownerships. This fundamentally altered the landscape of university-industry relations. Universities now can take their IPs and negotiate various relations with industries, such as license, co-ownerships and so on. Much of the sweeping changes one noticed within US universities today, I dare say, had their genesis in the Bayh-Dole Act.

I should say that even with outstanding faculty, government funding for research and with the Bayh-Dole Act, the number of successful universities in capitalizing on this landscape have been few and far in between. In his recent speech at the University of Tokyo, President Levin made the following important comment regarding the lack of success of technology transfer among US universities:

“... Historically, most U.S. universities did not actively seek to participate in the translation of discoveries into new products, processes, and services. An exception was the Massachusetts Institute of Technology. By the mid-1990s, graduates of MIT had founded over 4,000 companies nationwide, and were continuing to create an additional 150 companies a year. Illustrating the impact a university can have on its local economy, more than 1,000 of those companies are based in Massachusetts, accounting for about 25 percent of all manufacturing activity in the state....”

So, why is that the case? Why are there not more MIT's?

The issue is the core question reverberating in many administration corridors and conference rooms within research universities worldwide today.

Indeed, what is the mission of a 21st century research university? Well, from every corner of the globe, you would hear the chorus that it is “to be the economic and intellectual engine!” While this “sound-bite” sounds awfully good, the challenge is whether universities can put it into practice? My answer is that it can only be if we can stimulate economic and intellectual development synergistically.

So let's get into today's subject.

Let us as academics step back and view this issue from an entrepreneur's point of view. A good friend of mine who is an extremely successful entrepreneur once told me *in no uncertain terms* that “A business is there to make money, ethically!” There is no “ifs” or “buts” after this statement, he said.

What are the fundamental and generic ingredients of creating businesses, large scale ones such as Microsoft in Seattle, Google in Silicon, TSMC in Hsinchu or Chi-Mei in Tainan or a medium size MRI for breast cancer company, Aurora, in North Andover, Massachusetts?



CHIMEI



They have to have, in my friend's opinion, and I fully concur, the following components:

A good idea;

A burning desire to do business;

A way to obtain business finance;

A process to turn a prototype into products. This is a euphemism for manufacturing;

A process to sell products successfully. This is a euphemism for marketing.

With this in mind, I propose that there are two ways where academia can interact with business.

I will call them “Inside-Out” and “Outside-In”!

”Inside-Out” is when within the university, we find the best possible “prototypes” created by faculty, students or what have you, and then push it outside the university. Now let's examine inside-out from the business

ingredients I mentioned above and see how it works.

A good idea. This is certainly not in short supply within the university. After all, most research done inside the university are curiosity driven by very smart people.

A burning desire to do business. On the average, this is a little less abundant inside a university. Generally speaking, we do not adequately train and/or educate our faculty and students to be highly entrepreneurially minded.

A process to obtain business finance. This is even more difficult. Finance for business is very different from obtaining research funding from the Science Research Council of Taiwan or National Science Foundation of the United States. Here the conversation needs to be between faculty and venture capitalists, angels, investment bankers and so on. Bringing people of such different background together to have a meaningful conversation, or collaborate on business, is a highly unusual, if not unlikely scenario.

A process to turn a prototype into products is a euphemism for manufacturing. This is almost impossible task inside the university. I know of NO university that can manufacture anything in large and highly regularized manner, nor should they try. A university should never forget the only products it should “manufacture” is *knowledge* and a *work force* for the society. Therefore, seeking the right manufacturers for products is in itself a significant business enterprise which is outside the realm of a university.

A process to sell products successfully is a euphemism for marketing. Marketing takes on all forms. Although there are business or management schools within universities, to find expertise on or for a specific technology’s market, and to promote the sells through a sophisticated marketing and sales channel, is not a simple task within a university. Yet, without it, the products will simply “sit on the shelf,” a most undesirable business scenario.

These difficulties have collectively been given a very *ugly* name, and it is called the “Valley of Death!” Few universities in the US were able to

overcome it without dispensing significant internal scarce resources and hire outstanding professionals. In fact, it is often true that the ROI is negative. The glaring successes which are few and far in-between: the example of MIT as mentioned by President Levin, and the famous Vitamin B-12 of the University of Wisconsin and Gatorade of the University of Florida are some of the often mentioned, but lonely, examples.

I should also mention that there is another issue which challenges universities. It has to do with the nature of academic research. We all know that many faculty members tend to carry out the work in solitude. This has the effect that he/she can create only one or a few prototypes which have the undesirable feature that generally it/they have reduced functionalities, if not a single functionality.

However, often technological breakthroughs of today are more in the form of “internet-like,” where the “*we are smarter than me*” concept of the well known business futurist Keniche Ohmae



is more applicable than of the form of ‘semi-conductors,’ a profound and global economic transformation of three scientists from Bell laboratories.



This means that it is more likely than not that what is needed is a set of prototypes put together, as in system integration, in order to have serious commercial value. Taken to the extreme, which TxIS is confronted with, is if a large industry has a major project which needs a multitude of prototypes from different universities, and heaven forbid, from different countries, who should the industry contact?

What about “Outside-In”?

Now let’s examine how outside-in works.

A good idea. This is certainly not in short supply from the outsiders. Without a good idea, they do not have a business.

A burning desire to do business. Ditto.

A process to obtain business finance. For outsiders to survive, at least initially, they better know how to obtain business finance. Or else, they do not have a business.

A process to turn a prototype into products. This is a euphemism for manufacturing. They must know how to do this. Or else they do not have a business.

A process to sell products successfully. This is a euphemism for marketing. Marketing is fundamental to any business. It is the “soul” of business. Without it, outsiders do not have a business.

It is clear that if there is a way to create a platform for outsiders and insiders to interact, i.e. by synergistically linking up outsiders with insiders, I am convinced that we can go a much longer way than each doing it one its own.

Finance

Both inside-outers and outside-iners need finance. For inside-outers, this sort of funding is fundamentally different from those they compete-for in National Science Foundation in US or National Science Council in

Taiwan. They are funding in the form of venture, angel, investment bankers (the Lehman Brothers, heaven forbid!) and so on. The language deployed in negotiations to gain access for such liquidity is fundamentally different from research funding. Most faculty and students inside the university lack such training, if at all.

A year ago, in order to try to comprehend the thinking process of entrepreneurs housed in either in the incubator of my current university, National Cheng Kung University (NCKU) in Tainan, Taiwan or Southern Taiwan Science Park incubator (under contract from Minister of Economics and is operated by NCKU,) the then director of NCKU's incubator Professor Y. L. Lo, his team and I had a three hour heart-to-heart meeting with this group of about 30 CEOs.



My impressions of the meetings are as follows.

First, they are all highly sophisticated entrepreneurs. They have solid grasp of their products and the marketability.

Second, they are all frustrated with the VC communities. Perhaps the most poignant comment made by one very bright CEO is that the Taiwan VCs are highly “risk averse,” and hence there is essentially no opportunity for startups. I am not sure whether this would be an accurate blanket description of Taiwan’s VC communities, and I am equally not

sure whether US VCs, after the disastrous DOT.COM era of the last decade of the 20th century is not equally “risk averse” today. Nevertheless, I suspect that at least in southern Taiwan, VCs play little role in “kicking up an entrepreneurial storm.”

Third, some of the CEOs appear to hope to, or rely on Taiwan’s SBIR from the Government. I told them that my gut feeling is that while one should never dismiss or refuse such handouts from Governments, here or in the US, I think it is nevertheless true that such funding is a little too late and too slow. Speed, I learned when I was in industry, is one of the important ingredients of business success.

Fourth, they want to find ways to work with universities beyond merely technological collaborations.

Intellectual Properties

As I mentioned earlier, when I started to learn about IPs about twelve years ago, I was so impressed by two US senators, Senator Birch Bayh and Senator Bob Dole who had the great foresight to release ALL IPs developed from research in universities utilizing Federal government funding will be owned by the universities.

To this end, I believe that universities should and must maintain high degree of flexibility (and I suspect that most do not because of what I refer to as the Gatorade-syndrome) in its treatment of IPs. For example, we must maintain very flexible and pro-faculty in our license agreements with the inventors.

Also, I believe that all universities must have, if not already have, robust and forward looking university-wide Patent Committees? These committees must not be “pro-forma” committees, but one must have significant components from academic, legal as well, and if possible, VCs. It is important to bring to the entire university that IPs, or patents, are statements of “commercialization,” not just another line in one’s resume, as in a publication.

Summary

I hope I have convinced you that even though one sees significant transformation in academia-industry relations (and collaborations,) in the 20th century and the 21st century, where the situation went from non-existent to a relatively sophisticated interaction, the situation is still far from optimum.

For one thing, it is clear that more and more industries, because of the nature of the business, are getting out of R and do only a minimum amount of D. With the world facing the possibility of a economic downturn and/or meltdown, more and more corporations are going to be very stingy in holding on closely their liquidity to protect themselves from takeovers, friendly or hostile. Obviously, within the priority of sacrifices corporations need to make, R&D will surely be near the top, if not the top. Yet, without R&D, corporations may not be able to follow and/or lead in the fast changing world of business.

Thank you very much for your attention!