PATENT INFORMATION AND ITS USEFULNESS: A PRACTICAL APPROACH

FOR: WIPO-INDIA SUMMER SCHOOL

AT: NAGPUR, INDIA

7 NOVEMBER 2017

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OVERVIEW

I. Policy Perspective
II. Basic Blocks of Patent Information
III. Stakeholders of Patent Information
IV. Common Types of Studies Based on Patents
V. Example 1: Landscape Study of Nano-technology area
VI. Example 2: Specific Problem
VII. Conclusion/Discussion

I. Policy Perspective

- **Traditional View justifying patents**
  - Quid pro quo for sharing information with the public
  - Justification: Sharing helps the society to progress
  - Valid in information age? Market forces sufficient?
  - Sector-wise analysis

I. Policy Perspective (Cont.)

- **Modern justification of patent system**
  - Will the absence preclude opportunity for innovations to reach people?
  - Incentive for investment
  - Transaction cost for ensuring innovations to reach public

- **Information based justification of patent system**
  - Not all information is equal
  - Classification crucial for meaningful measurements
  - Patents pertain to information owner thinks is important!!!
    - Owner controls filings vs. respected publications

II. Basic Blocks of Patent Information

- **Information in Patent Document**
  - Claims: What is new?
  - Supporting Disclosure: How to make and use?
  - Example 2: illustration

- **Following blocks primarily 'data' based**
  - Example 1: Illustration
  - Impact of computer implemented work-flows

II. Basic Blocks … (Cont.)

- **Information at time of filing**
  - Inventors
  - Owners/assignees
  - Nationality/incorporation/addresses
  - Real party of interest
  - Time of filing
  - Priority claims

- **Pre-examination stage information**
  - Classification
  - Controller/Examiner
  - Duty of disclosure information
    - US: Known References
    - India: Counterpart applications

II. Basic Blocks of Patent Information (Cont.)

- **Examination stage information**
  - Dates of Examination reports
  - Dates of responses
  - Citing relevant art
  - Arguments against specific references
  - narrowing or broadening amendments
  - Oppositions
- **Post Patent grant**
  - Grant Date
  - Any applicable extensions (USPTO)
  - Working information
  - Maintenance fees paid
  - Expired date
  - Post grant oppositions/litigation

III. Stakeholders of Patent Information

- **Policy makers**
  - Innovation activity commensurate with desired goals?
  - Global/country/regional measurements
- **Industry**
  - Own activity
  - Freedom to Operate
  - Competitors activity
  - State of the art
  - Hiring
- **Researchers/Academia**
  - State of the art

III. Stakeholders … (Cont.)

- **End users**
  - Work related to latest cures
  - Healthy Anti-perspirants
  - Design Patents: Massage tables
- **Watchdogs**
  - Policy concerns
  - Access concerns
  - Efficiency concerns
  - Discrimination concerns (Europe study of China prosecution)
- **How much information is exposed for analysis**
  - Varies by patent office
  - USPTO: FOIA request sufficient for flow data?
  - National laws on RTI
  - Duty to maintain/expose information?
  - How well computers designed?
  - WIPO role: define minimum standards and appropriate tags?

IV. Common Studies Using Patents

- **Landscape study**
  - Various views for a desired field of activity
- **Freedom to operate study**
- **Whitespace analysis**
  - Gaps in innovation activity
  - Basis for further efforts
- **Novelty searches against specific innovations**
  - pre-filing typically
- **Infringement searches: Claims mapping to products/services in use**
- **Invalidity studies**
  - Patent literature as unapplied prior art

V. Landscape Study: Nano-technology

IPC CLASSIFICATION: TOP LEVEL

A: HUMAN NECESSITIES

B: PERFORMING OPERATIONS; TRANSPORTING

C: CHEMISTRY; METALLURGY

D: TEXTILES; PAPER

E: FIXED CONSTRUCTIONS

F: MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

G: PHYSICS

H: ELECTRICITY

V. Landscape Study: Nano-technology (Cont.)

- B81: MICROSTRUCTURAL TECHNOLOGY [7]
- B82 - NANOTECHNOLOGY [7]
- B82B - NANOSTRUCTURES FORMED BY MANIPULATION OF INDIVIDUAL ATOMS, MOLECULES, OR LIMITED COLLECTIONS OF ATOMS OR MOLECULES AS DISCRETE UNITS; MANUFACTURE OR TREATMENT THEREOF [7]
- B82Y - SPECIFIC USES OR APPLICATIONS OF NANOSTRUCTURES; MEASUREMENT OR ANALYSIS OF NANOSTRUCTURES; MANUFACTURE OR TREATMENT OF NANOSTRUCTURES [2011.01]

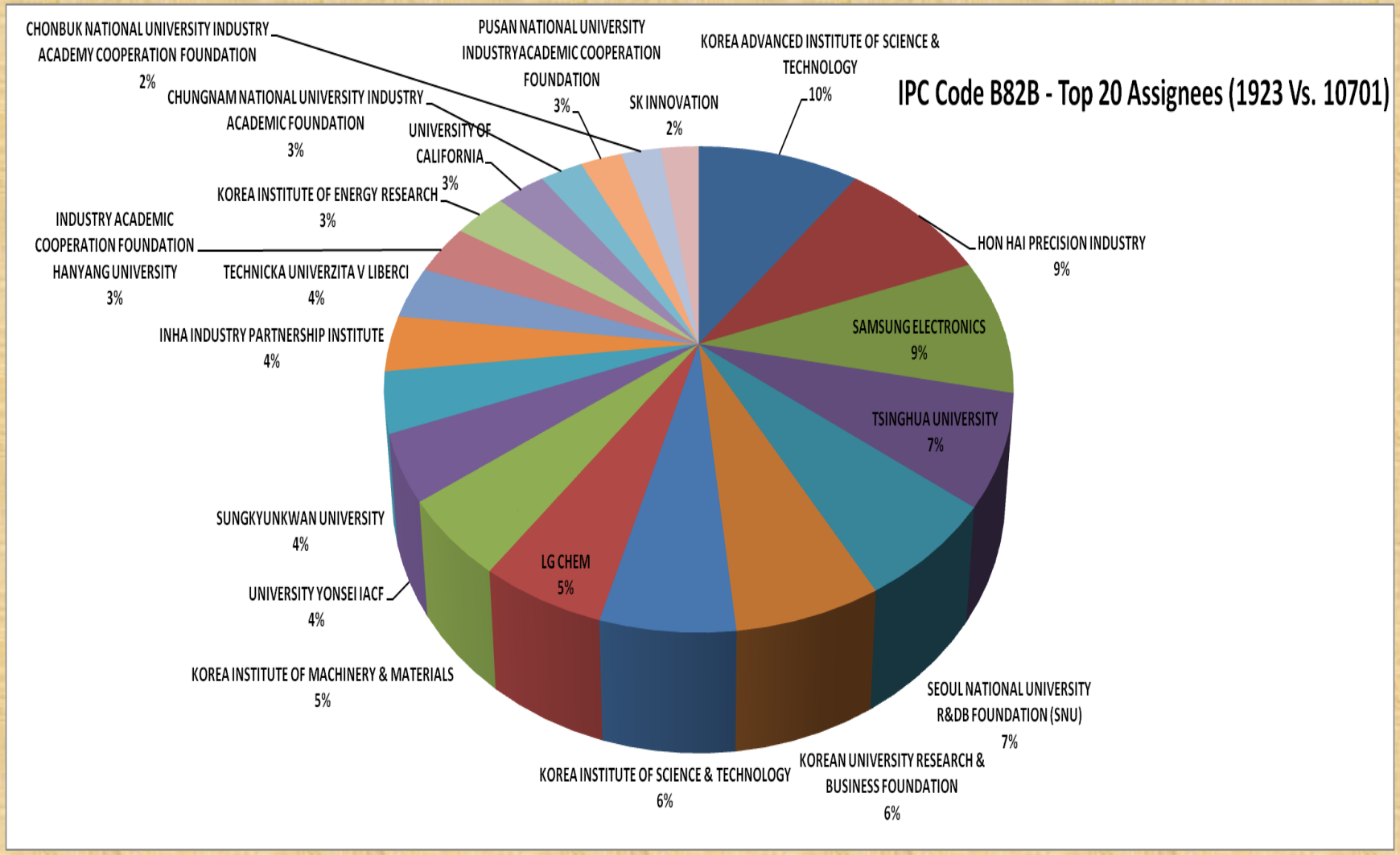
V. Landscape Study: Nano-technology (Cont.)

Patent applications under IPC B82:

IPC Code	Set size	Set size(2010-2017)
B82B	10701	9461
B82Y	38195	34504
B82B and B82Y	5207	2920

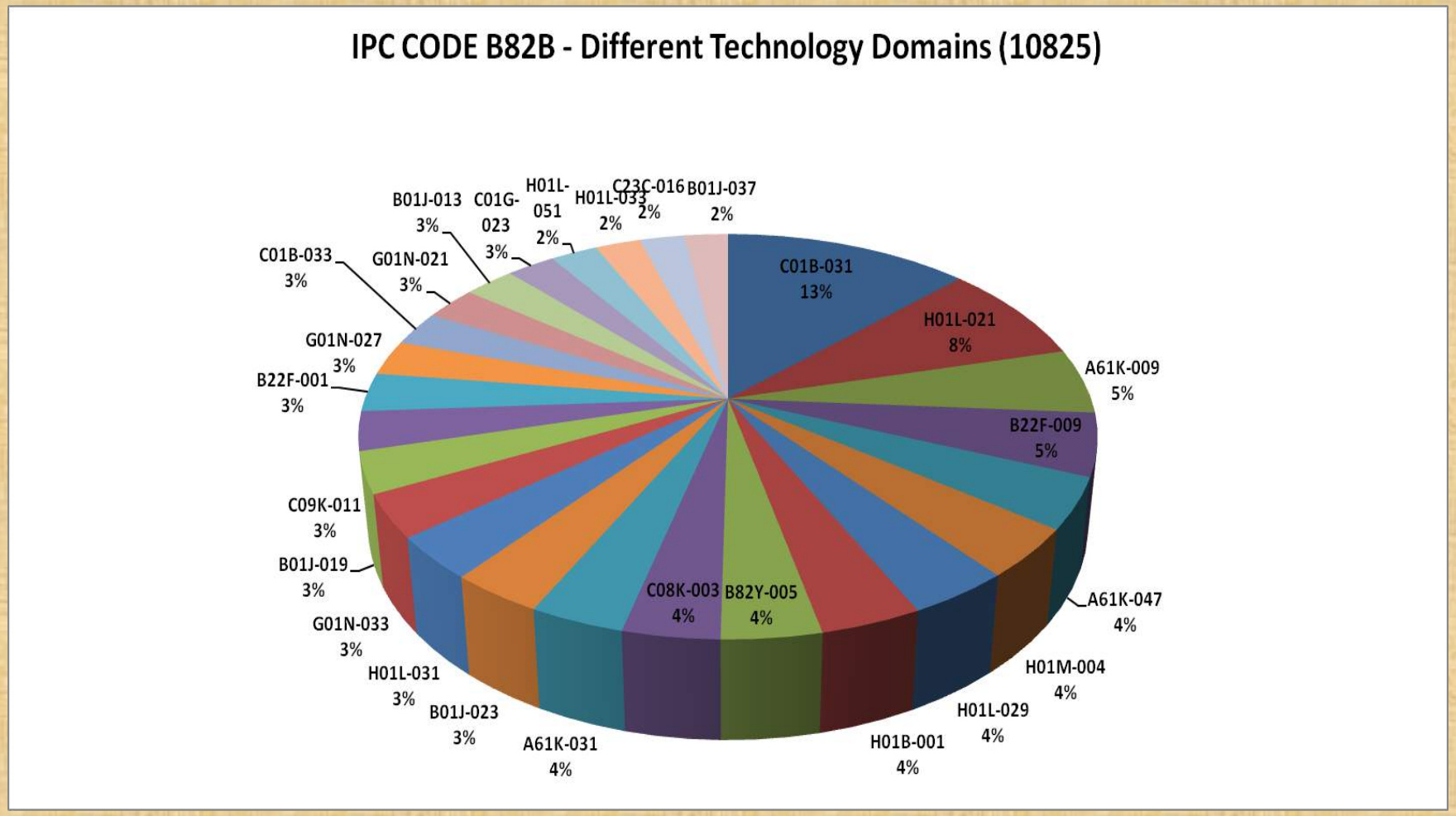
V. Example 1: Landscape Study of Nano-technology area

IPC B82B - Top 20 Assignees (1923 vs 10701)



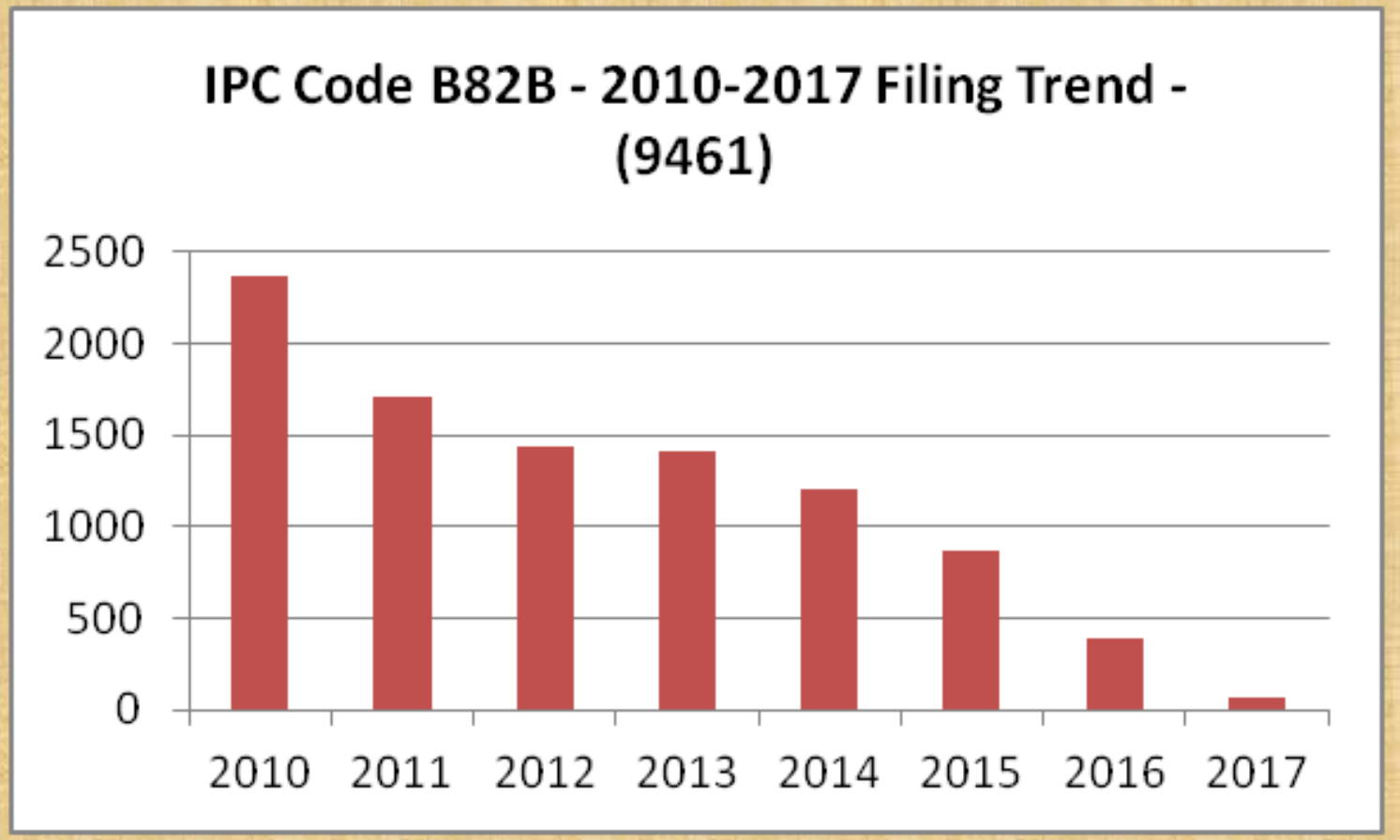
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC B82B – Overlap with Technology Domains (set size: 10825)



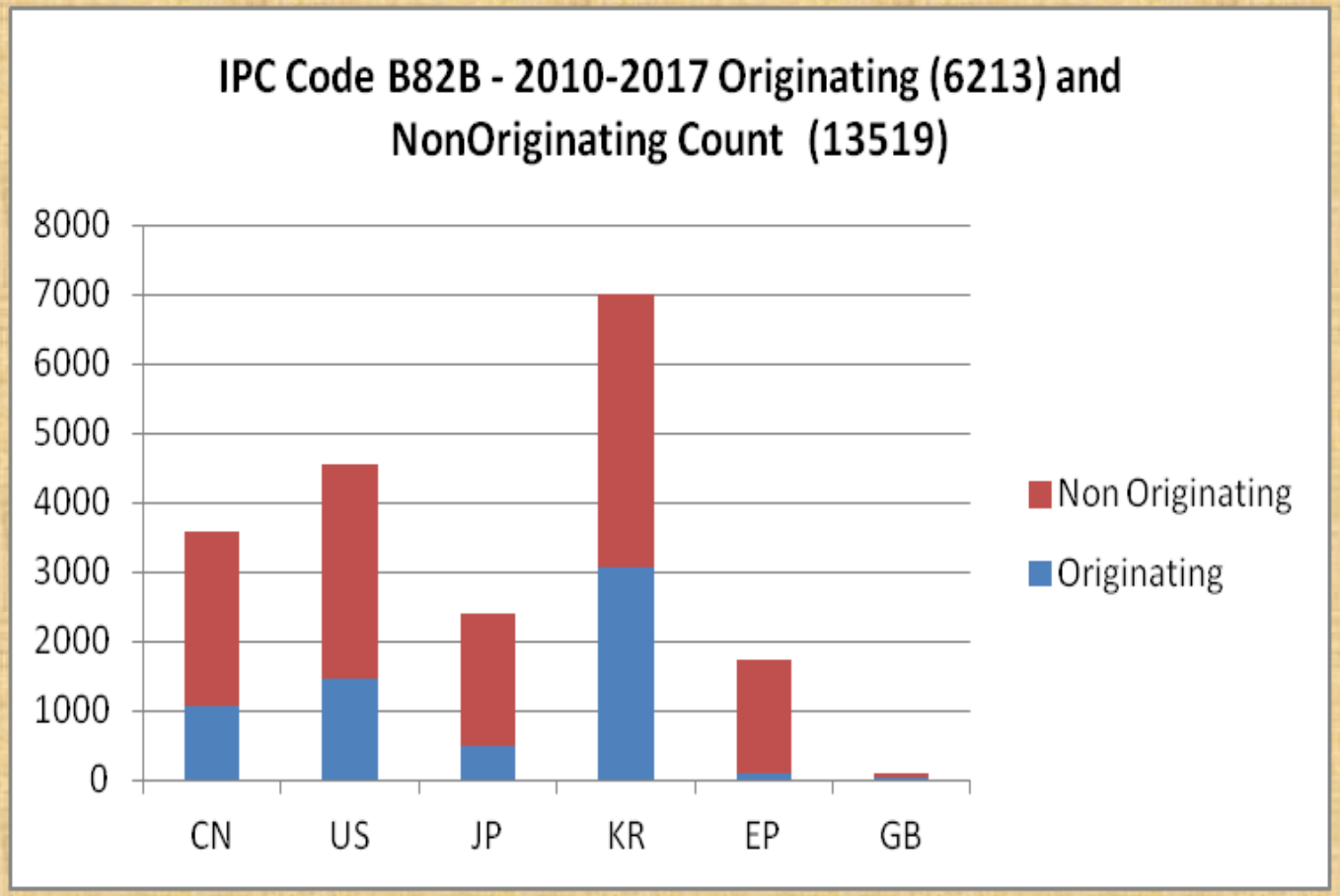
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC B82B – 2010-2017 Filing Trend (set size:9461)



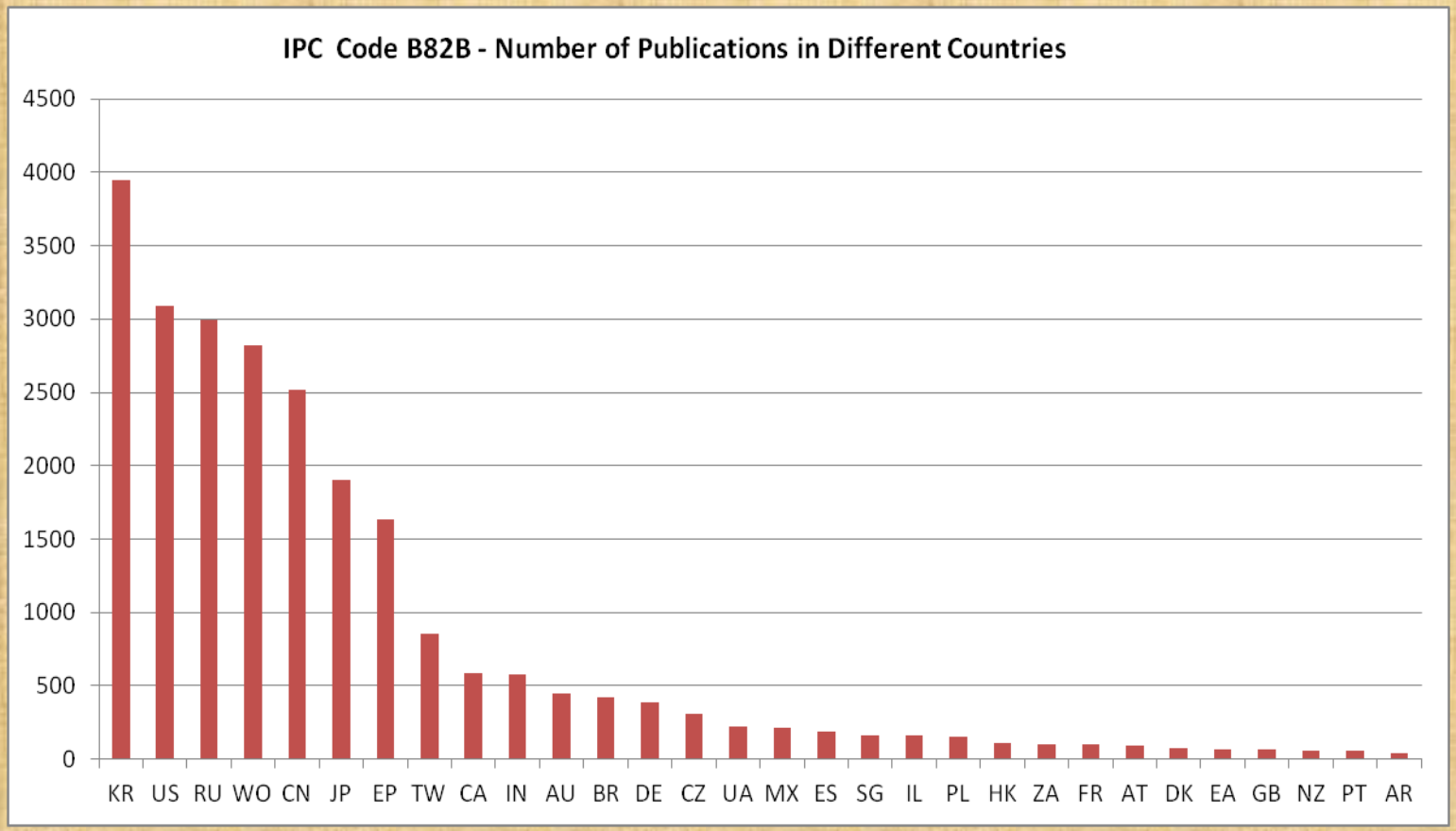
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC B82B - 2010-2017 Originating and Non Originating (Set size :9461)



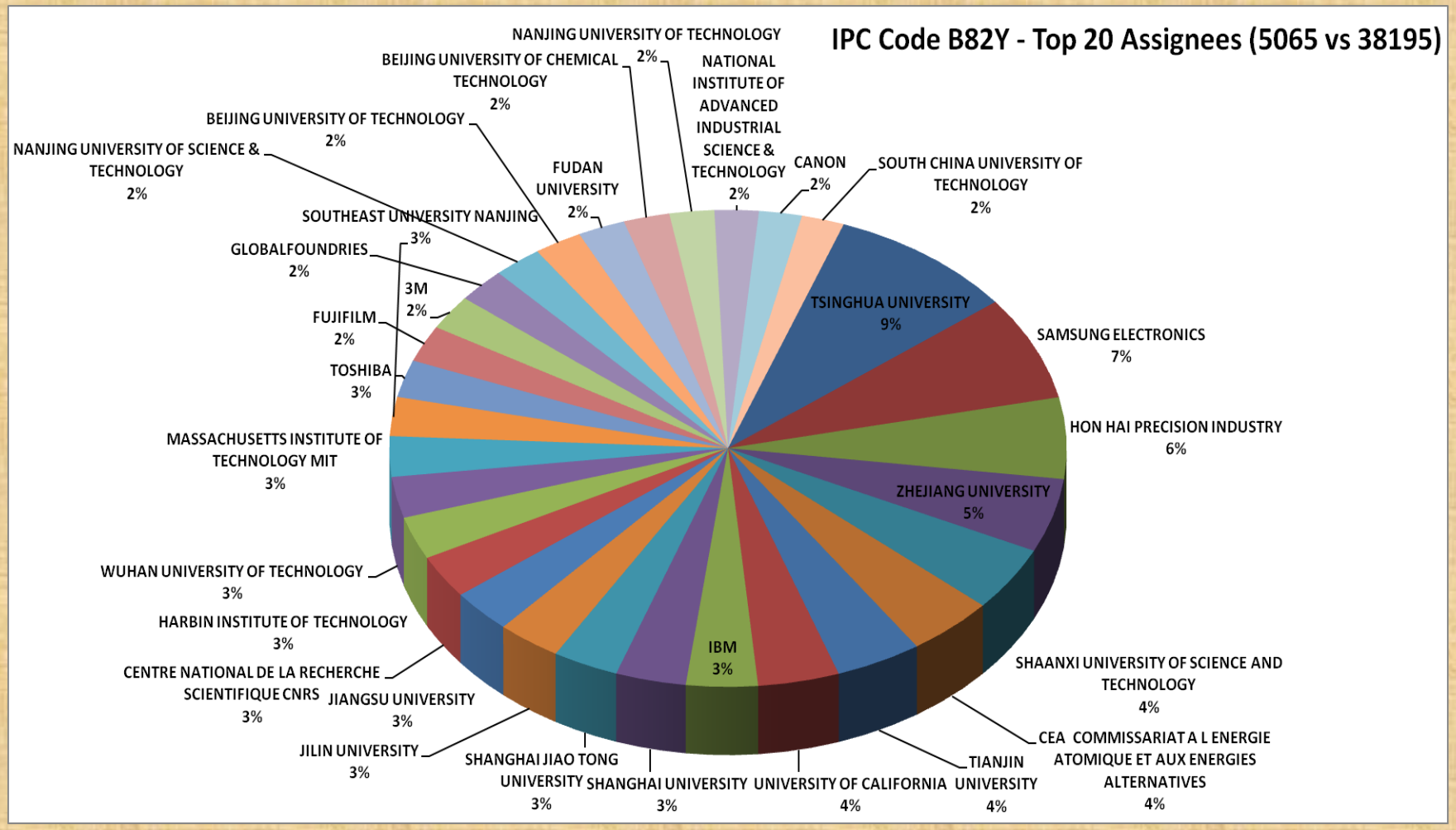
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC B82B - Number of Publications in Different Countries



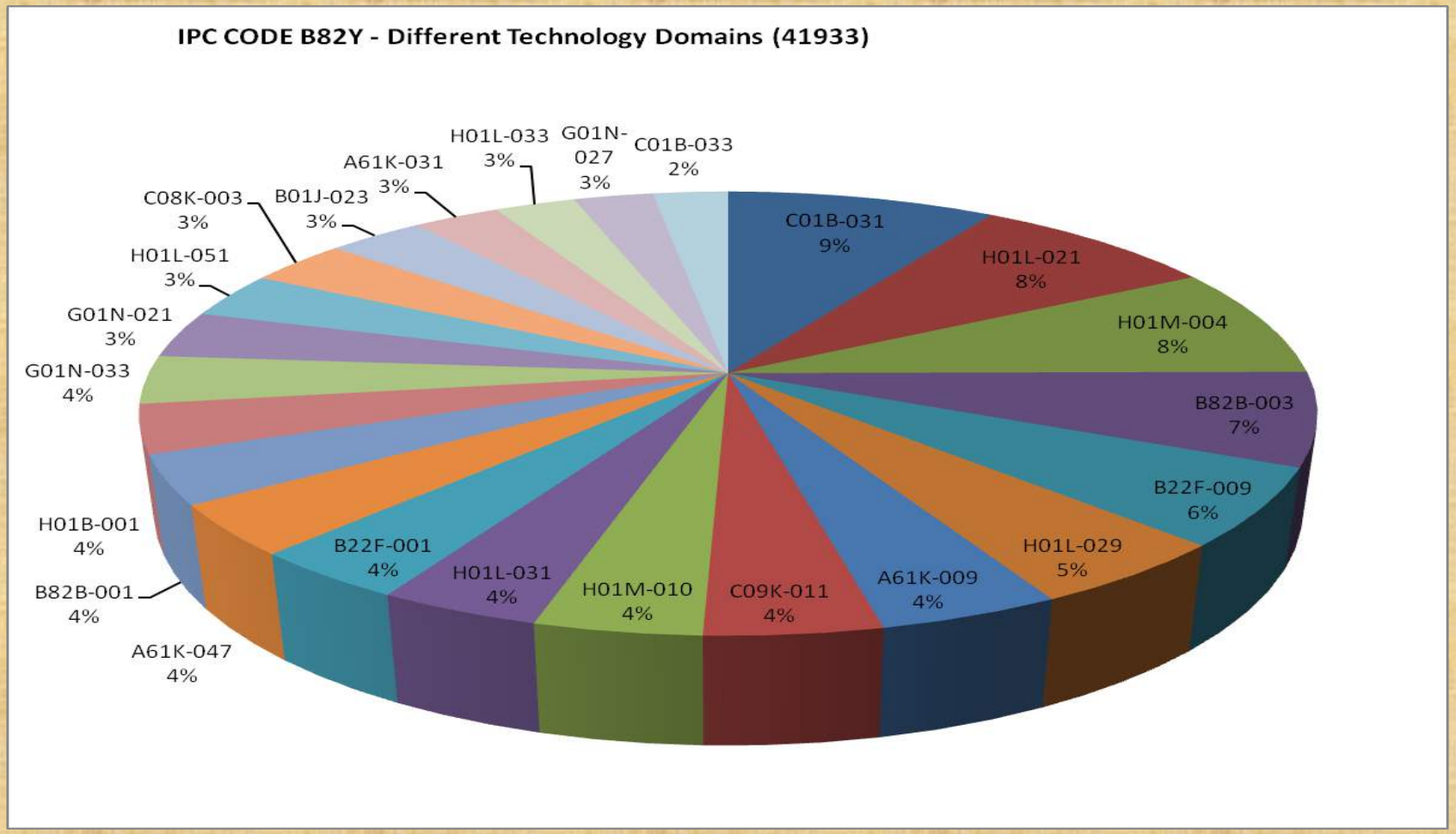
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC-B82Y- Top 20 Assignees (5065 vs 38195)



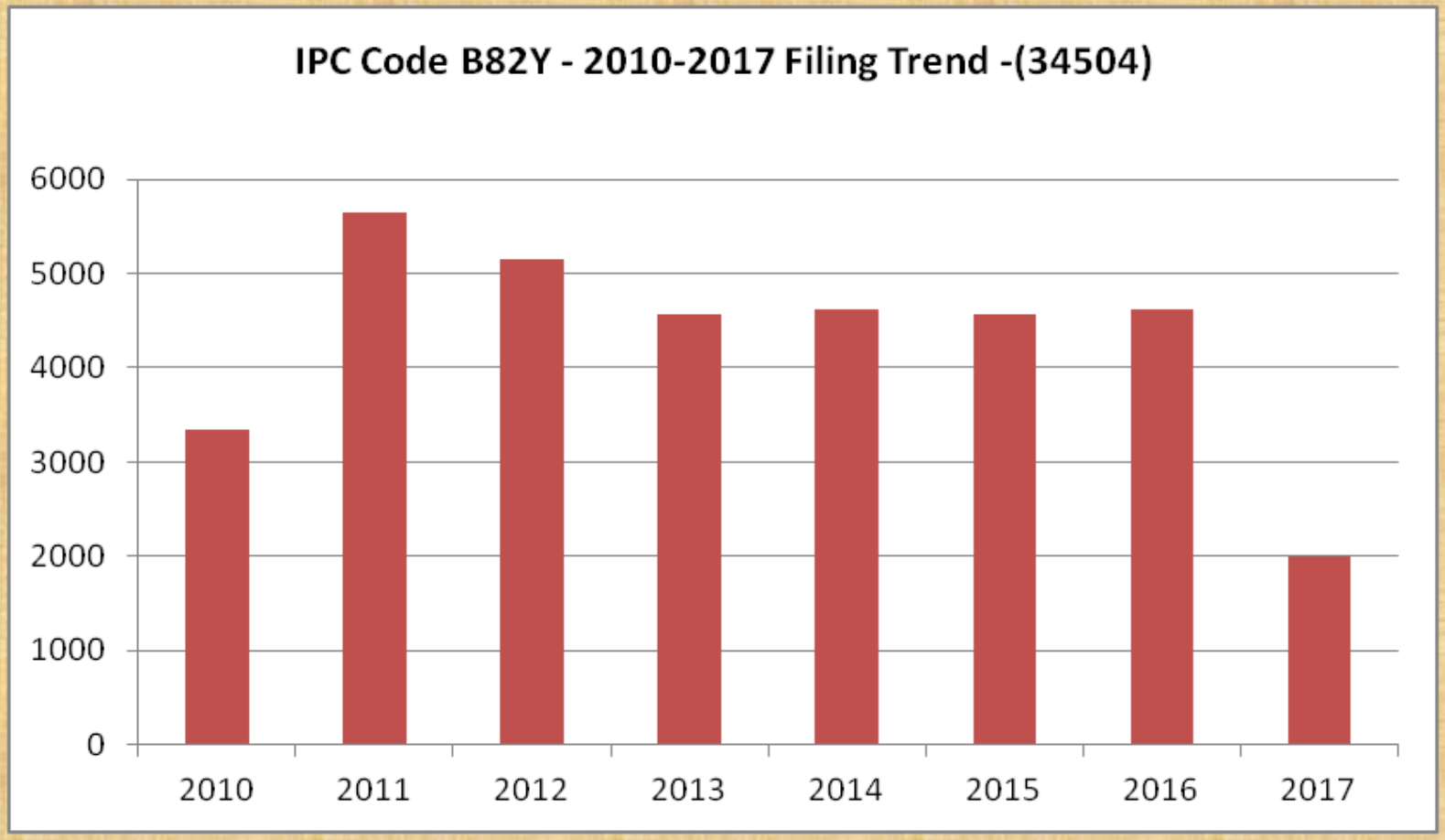
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC-B82Y – Overlap with Technology Domains (Set size-41933)



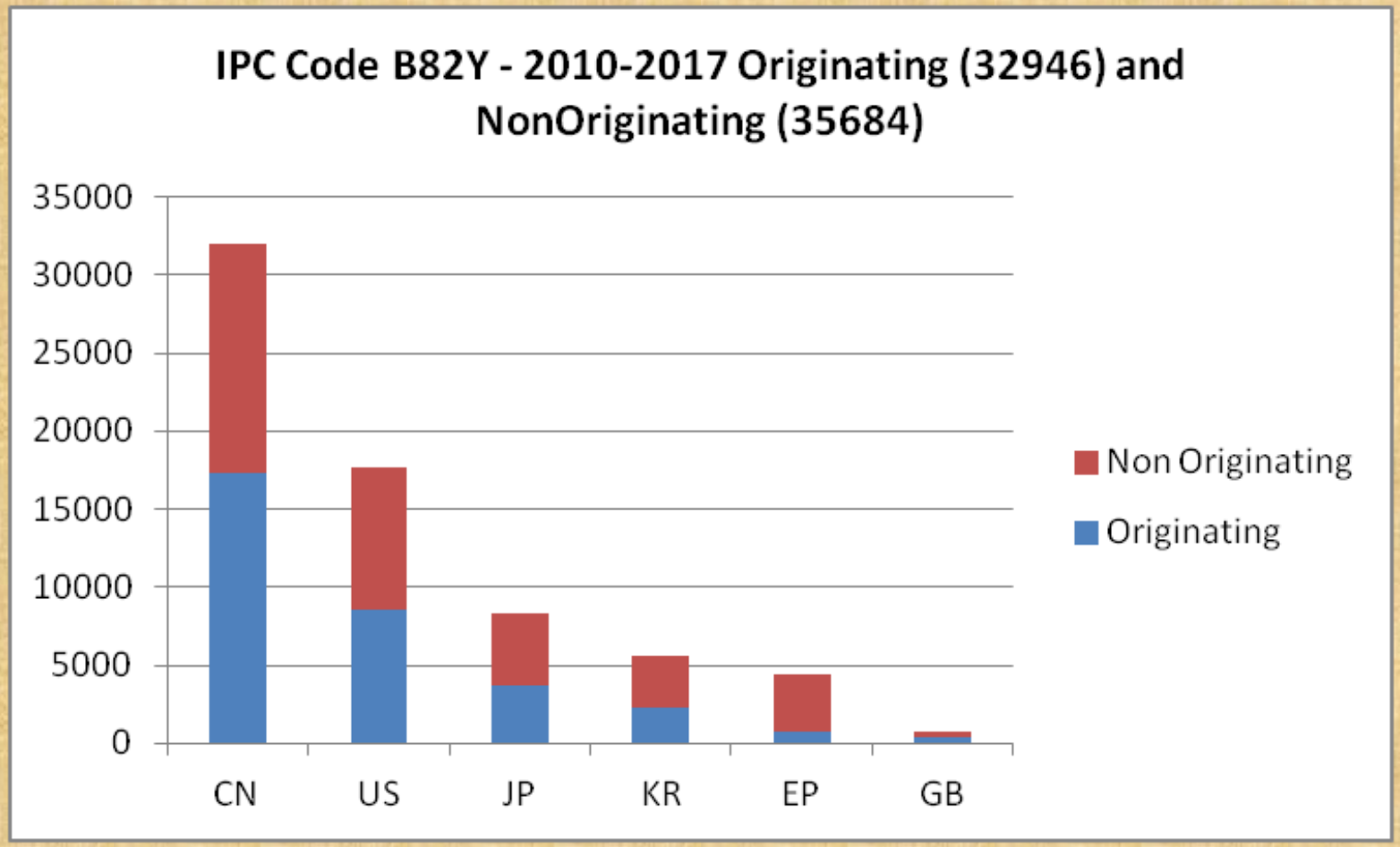
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC Code B82Y - 2010-2017 Filing Trend (Set size: 34504)



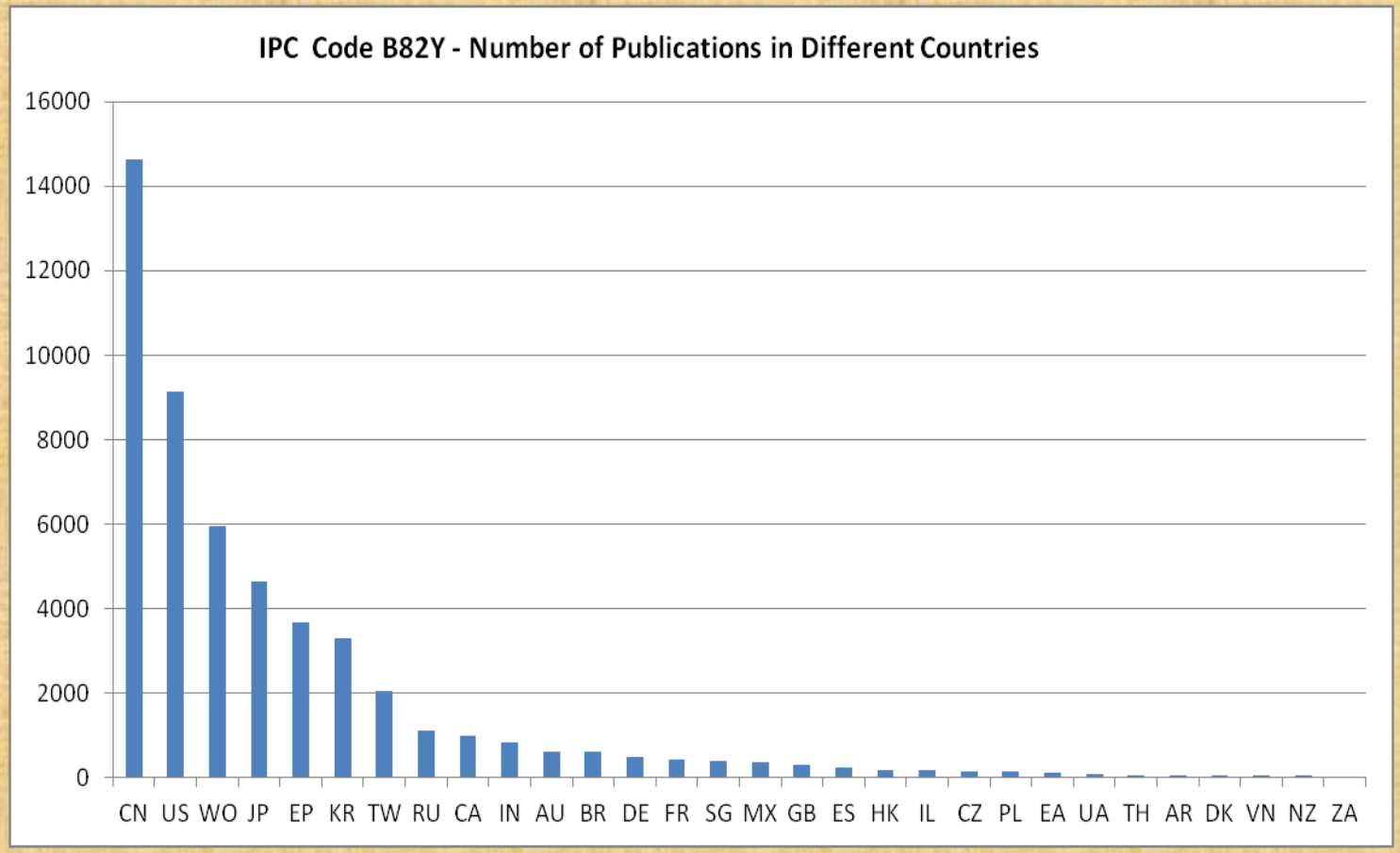
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC-B82Y- - 2010-2017 Originating and Non Originating (Set size :34504)



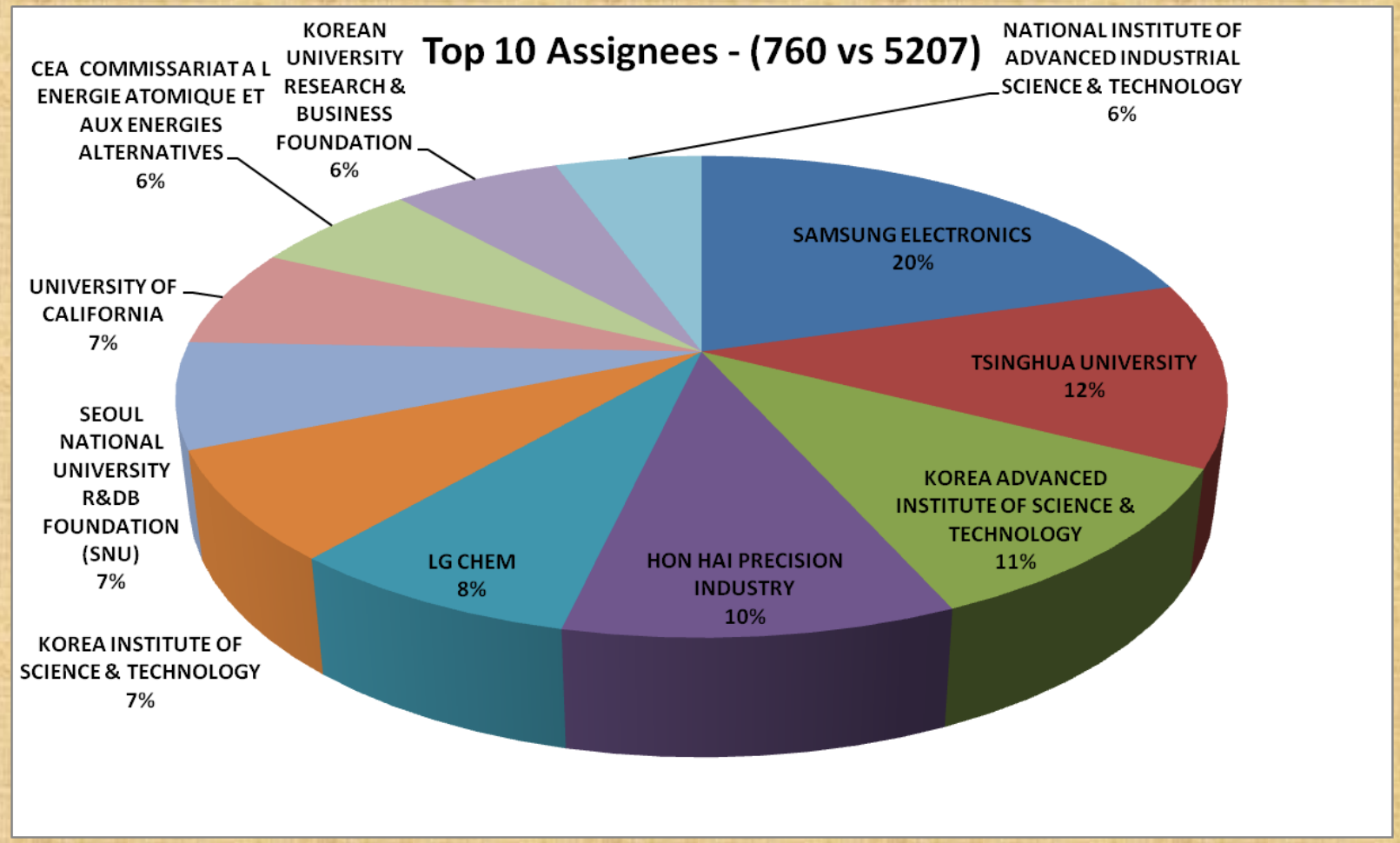
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC-B82Y- Number of Publications in Different Countries



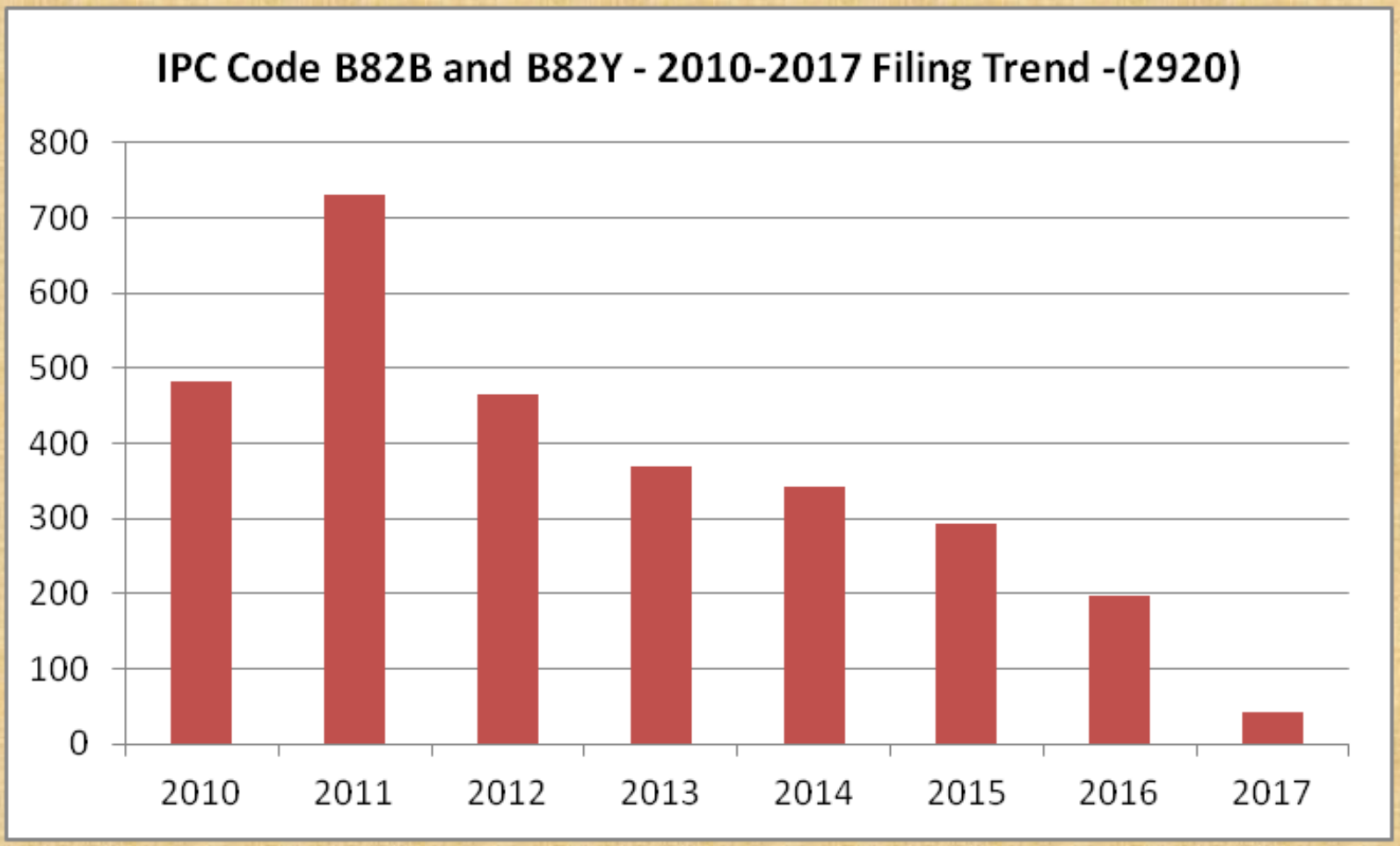
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC-B82B AND IPC-B82Y - Top 10 Assignees (760 vs 5207)



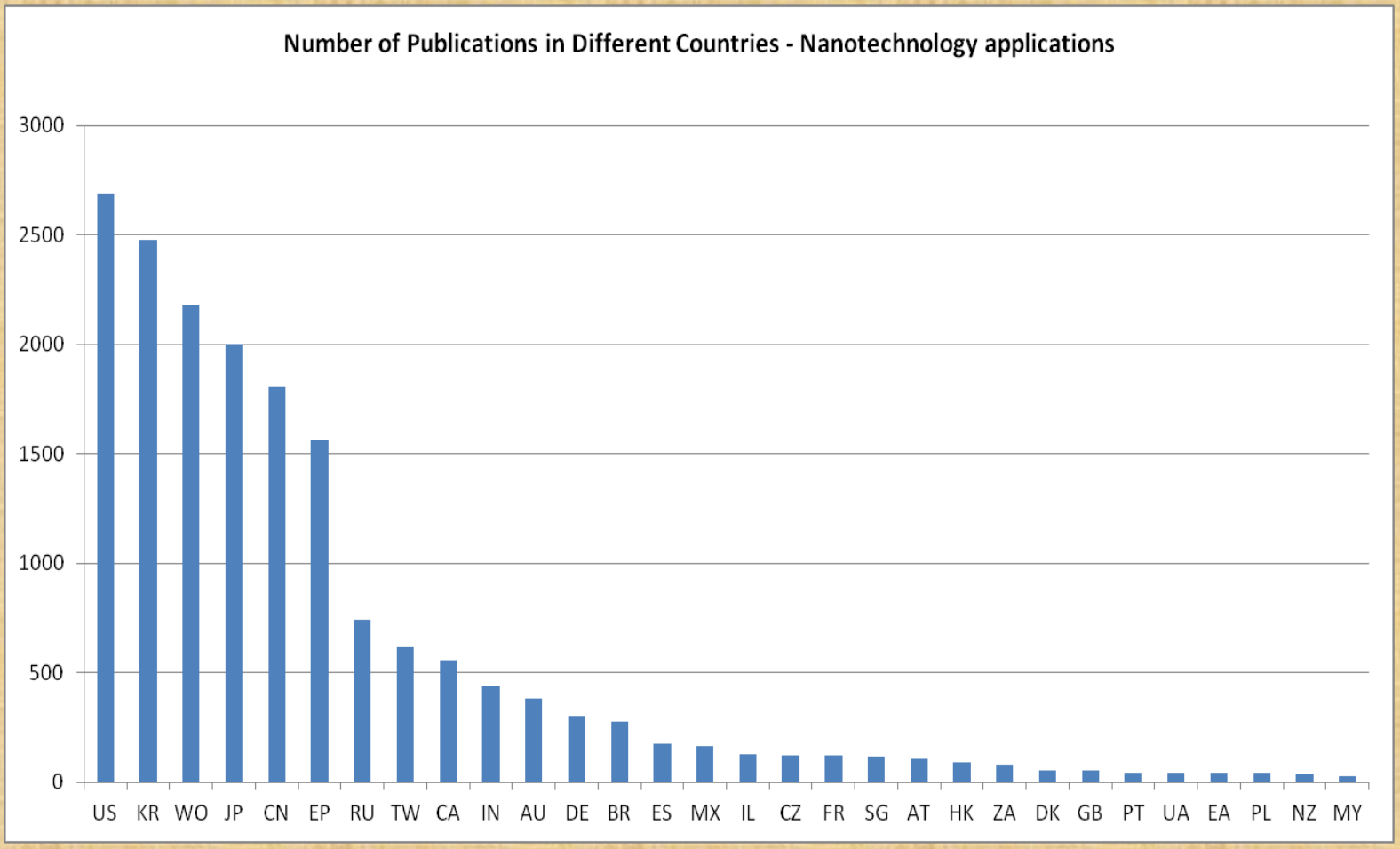
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC B82B AND IPC B82Y - 2010-2017 Filing Trend -(Set Size: 2920)



V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC B82B AND IPC B82Y- Number of Publications in Different Countries



V. Landscape Study: Nano-technology (Cont.)

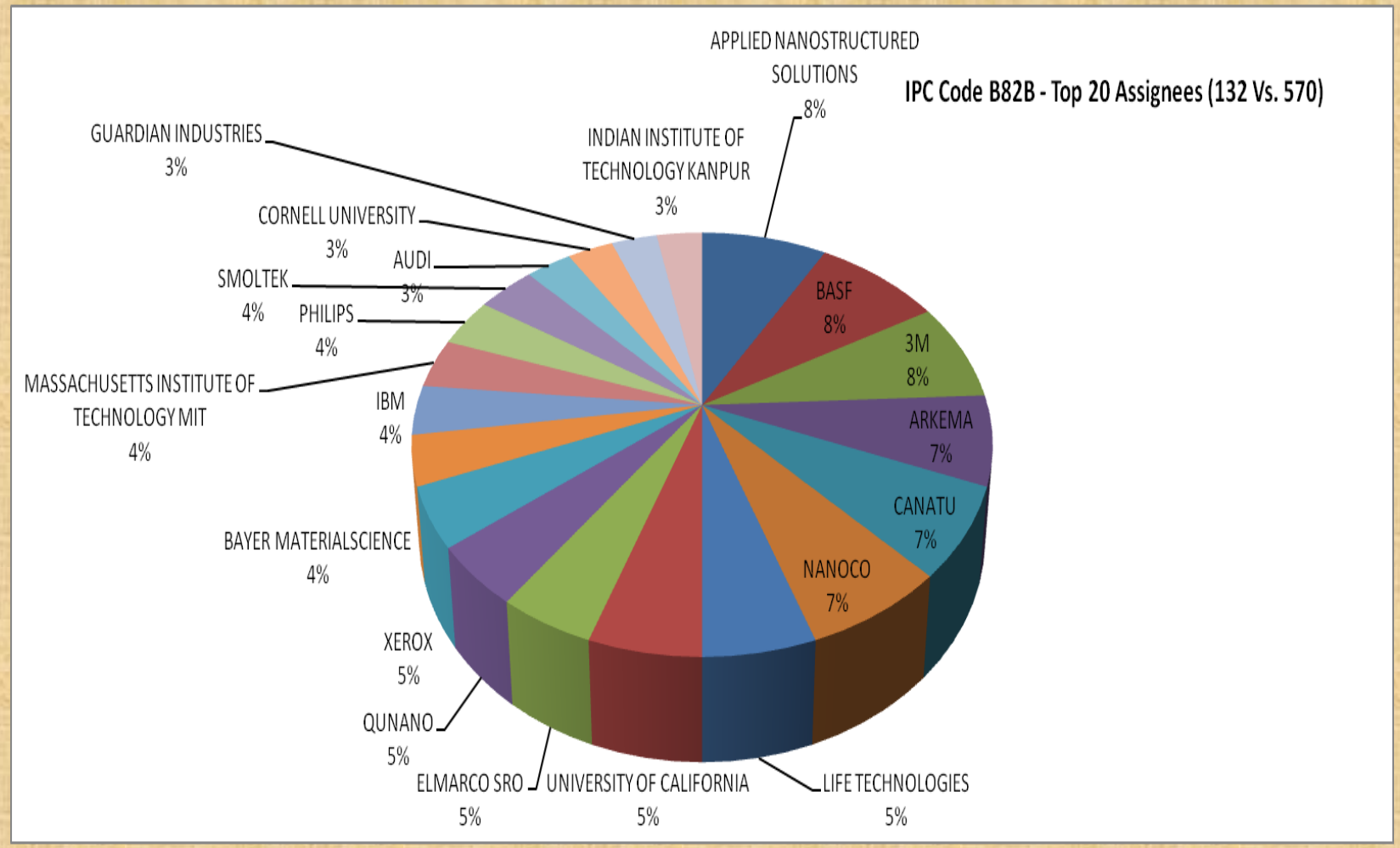
Patent applications under IPC B82 in India:

IPC Code	Set size	Set size(2010-2017)
B82B	570	258
B82Y	2125	1456
B82B and B82Y	438	160


India Data

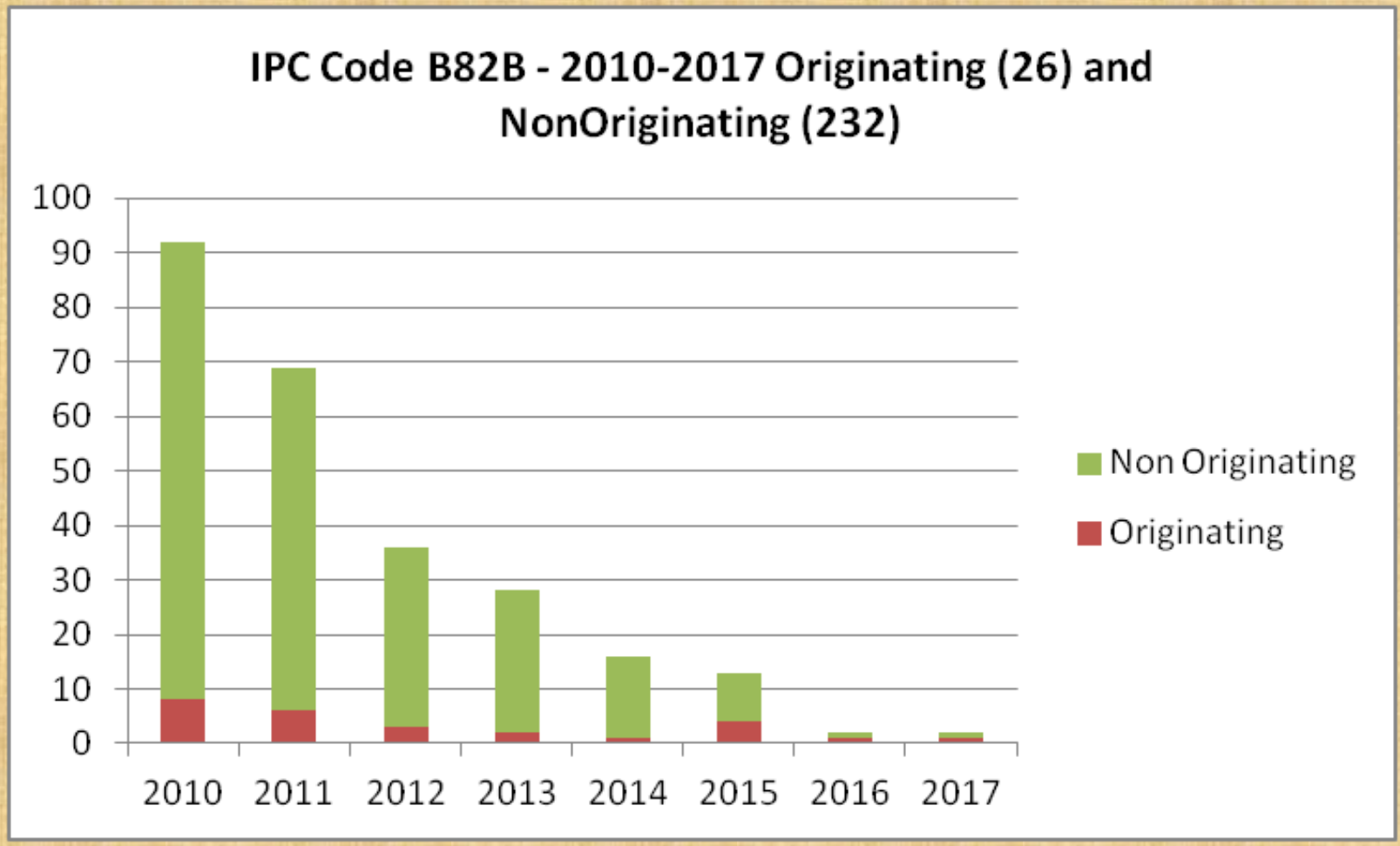
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC B82B India- Top 20 Assignees (132 vs 570)



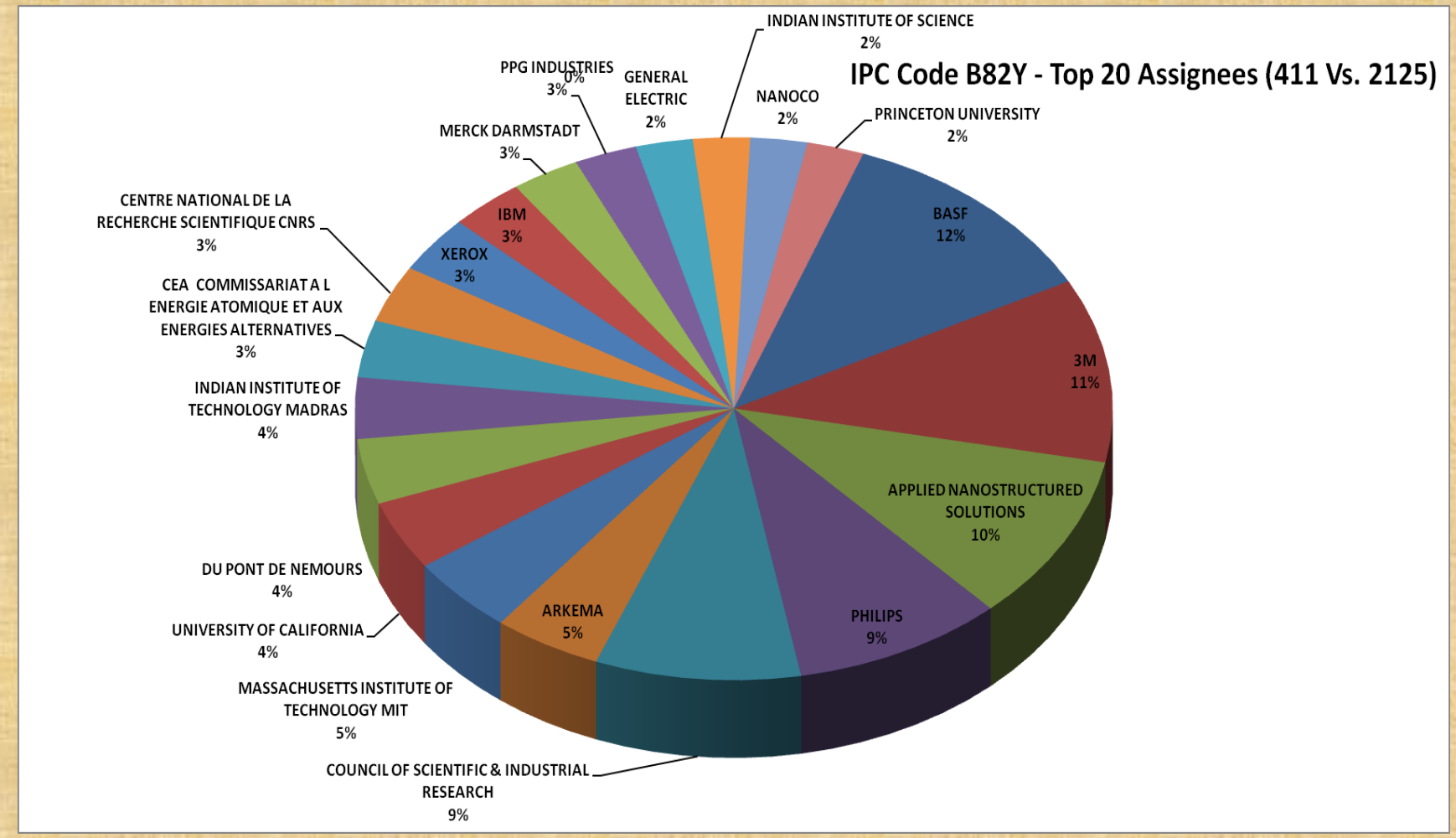
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC B82B India-2010-2017 Originating and Non Originating (Set Size: 258)



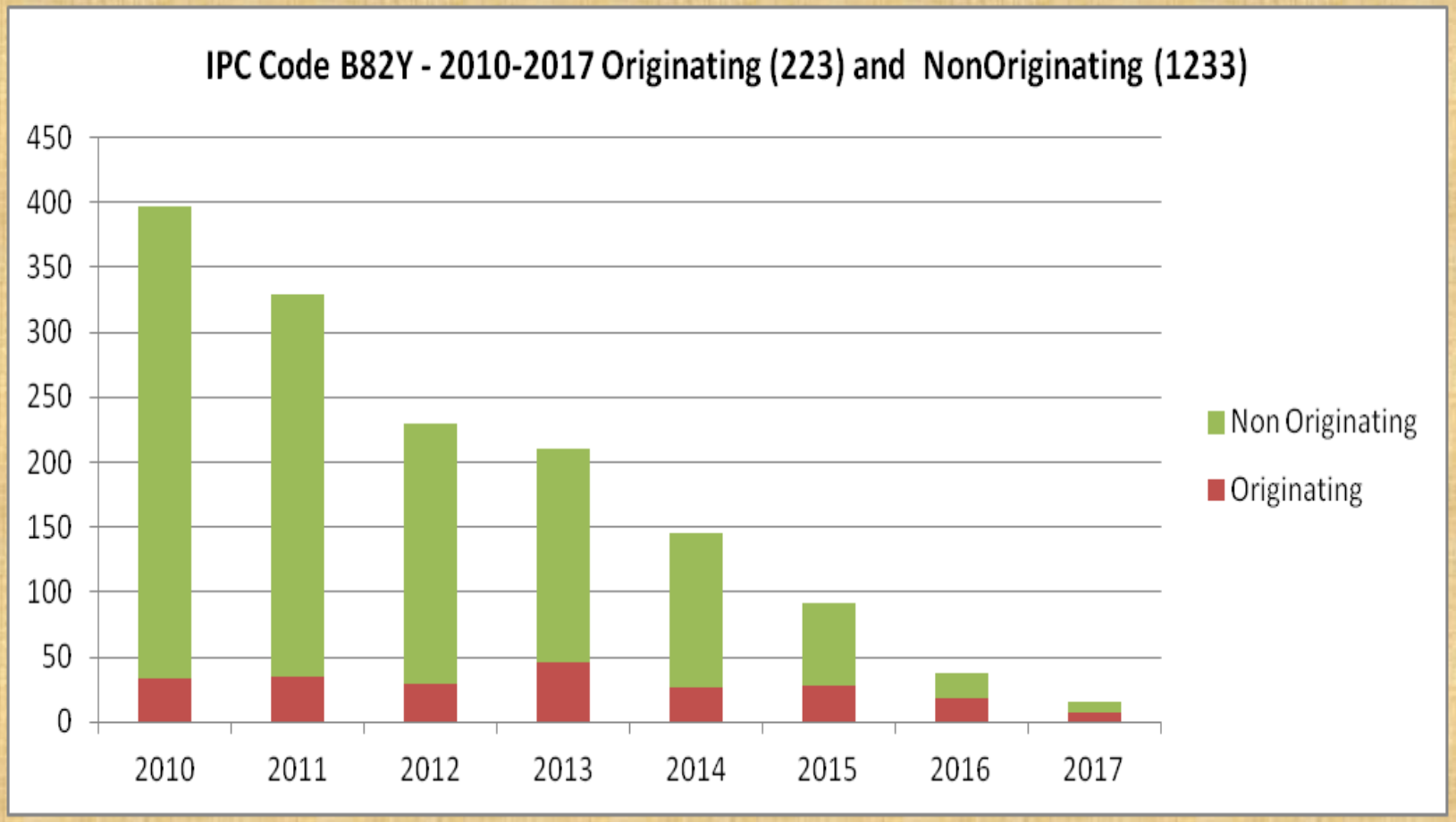
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC-B82Y India - Top 20 Assignees (411 vs 2125)



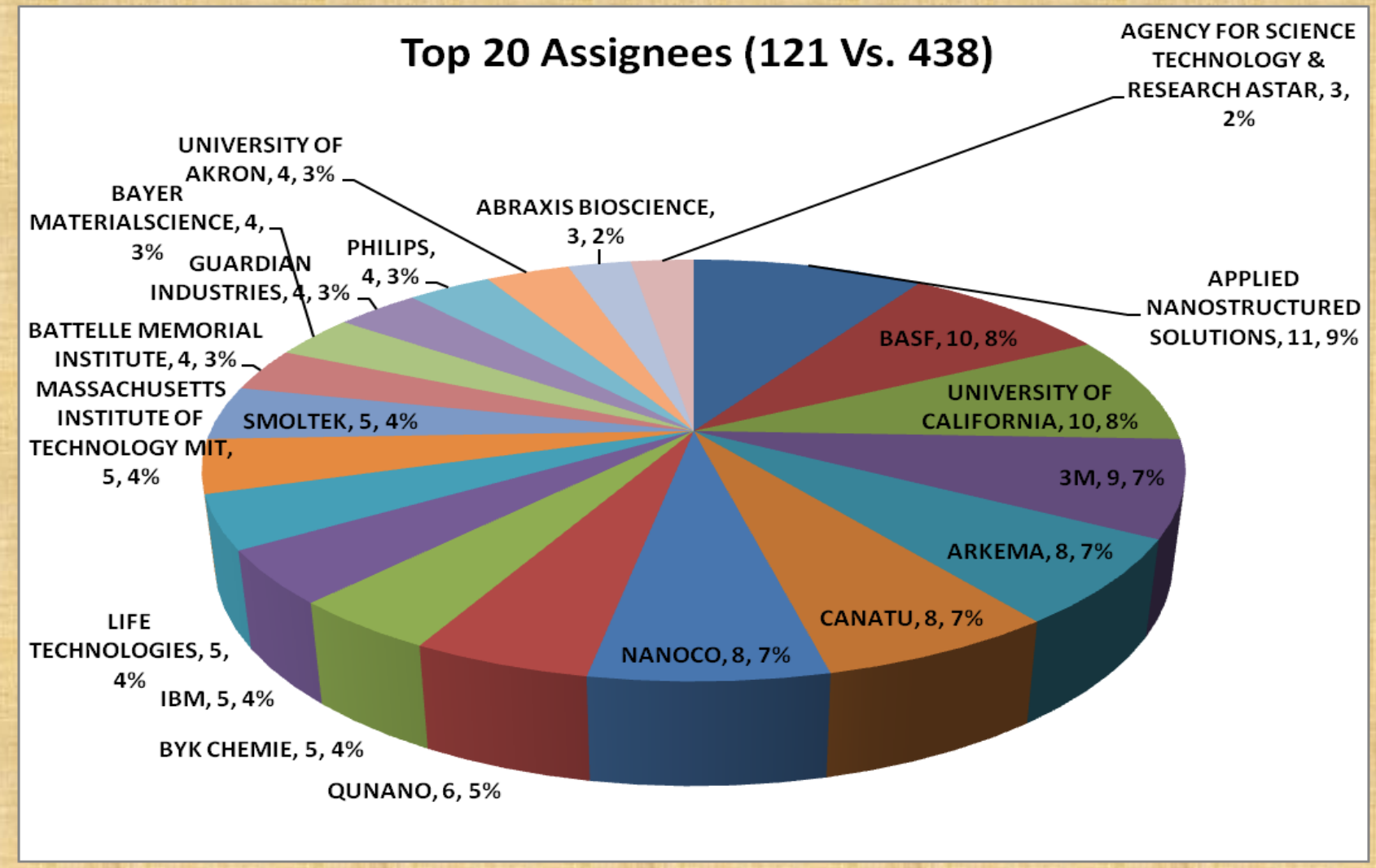
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC Code B82Y India - 2010-2017 Originating and Non Originating (set size:1456)



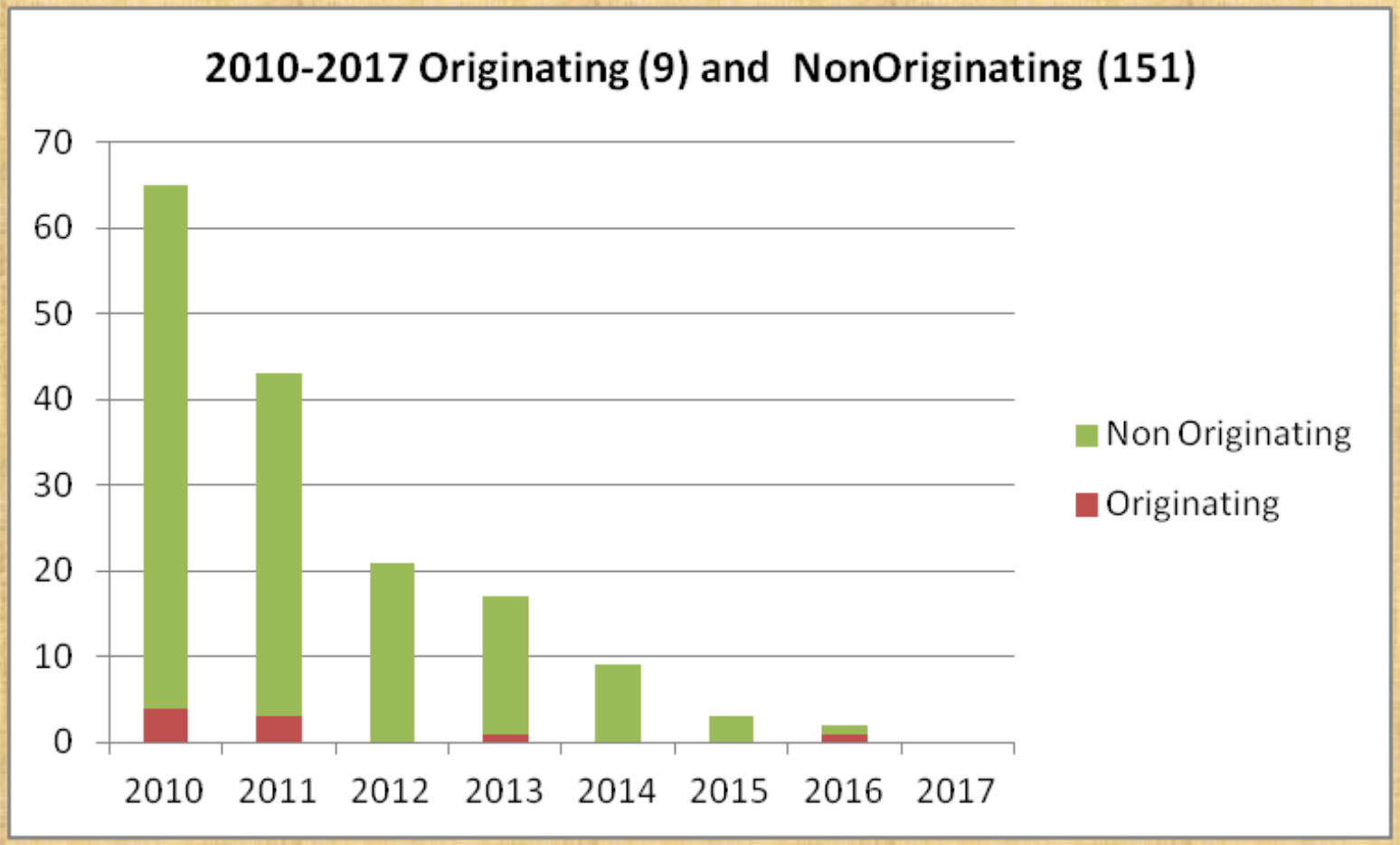
V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC-B82B AND IPC-B82Y India - Top 20 Assignees (121 vs 438)



V. Example 1: Landscape Study of Nano-technology area (Cont.)

IPC-B82B AND IPC-B82Y India - 2010-2017 Originating and Non Originating (Set size:160)



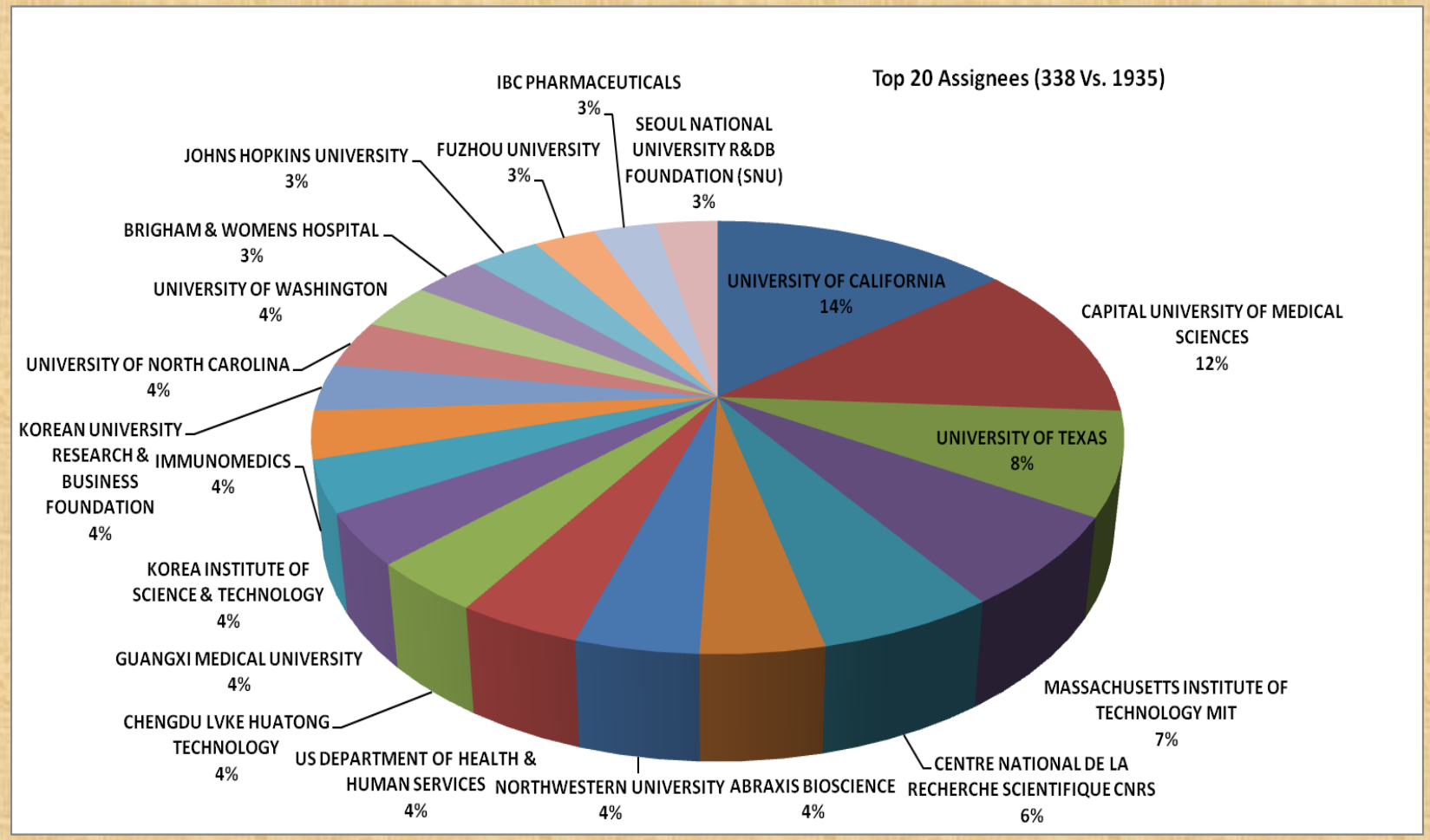
VI. Example 2: Specific Problem- Nano-technology for Cancer

Patent applications under Nano-technology for Cancer :

	Set size(full text)	Set size(title abstract and claims)	Set size 2010-2017(title abstract and claims)
All countries	34662	1935	1232
India	809	304	140

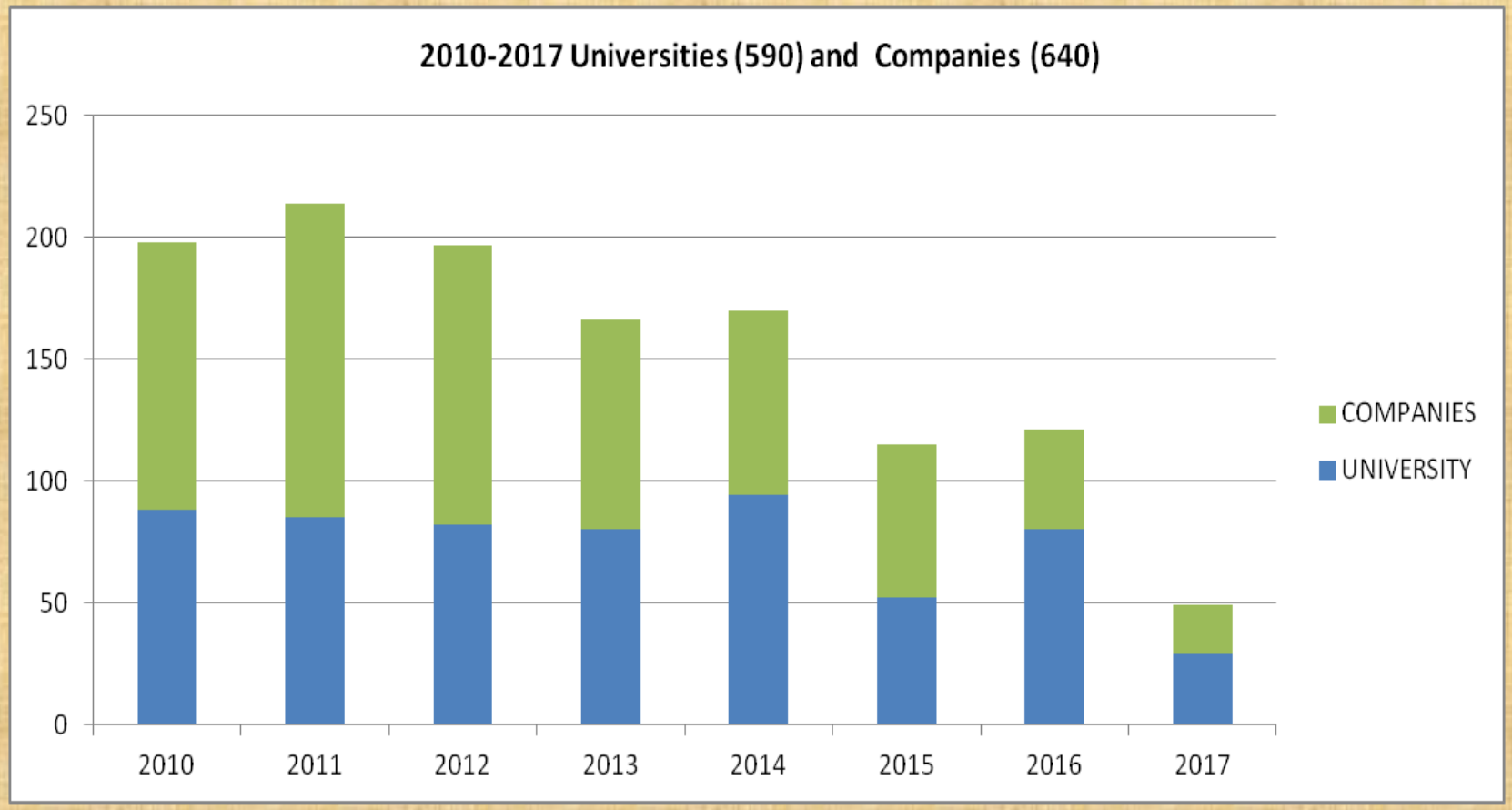
VI. Example 2: Specific Problem- Nano-technology for Cancer

NANO + CANCER: Top 20 Assignees (338 Vs. 1935) (Searched in - Abstract/title/claims)



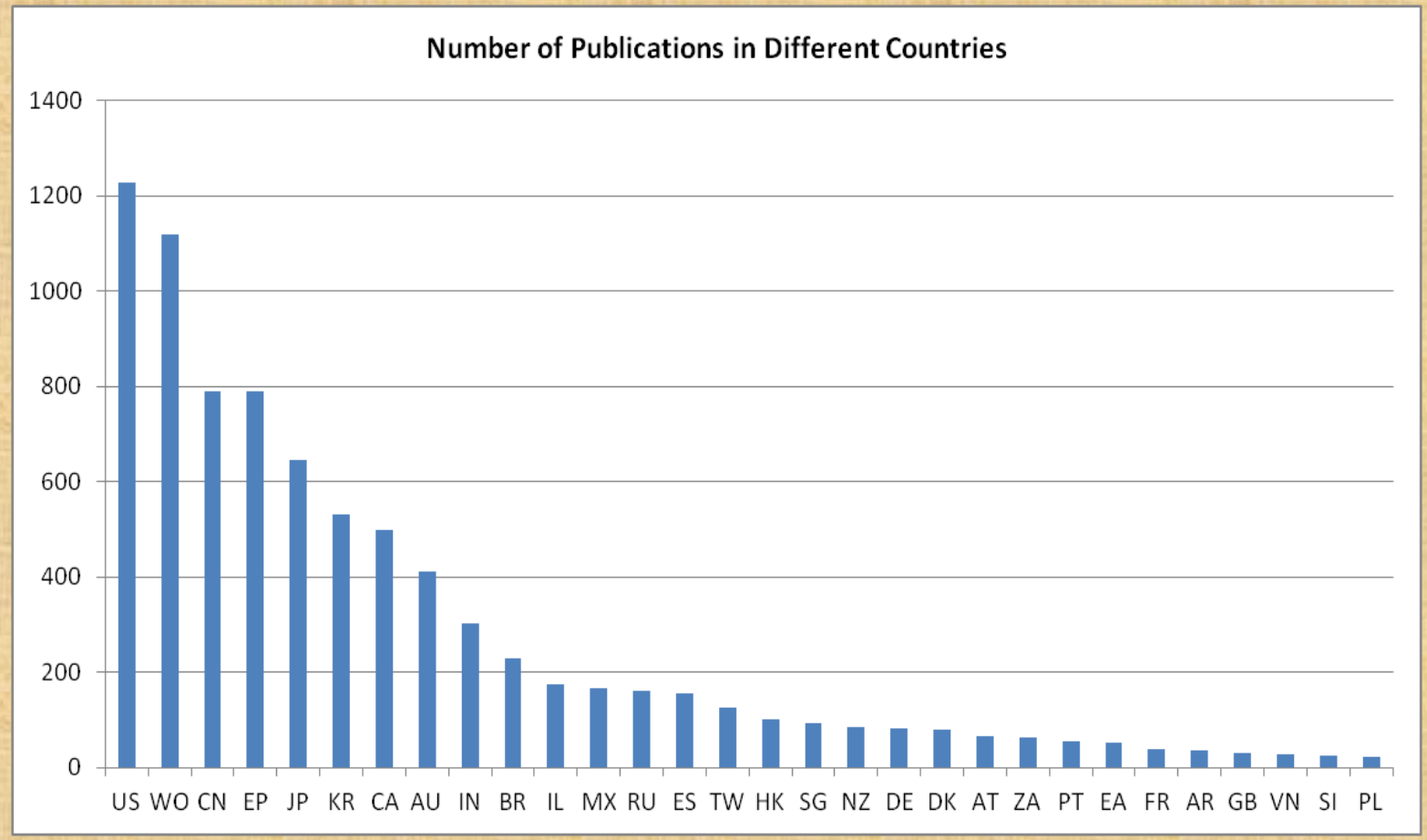
VI. Example 2: Specific Problem- Nano-technology for Cancer (Cont.)

NANO + CANCER: Filing Trend 2010-2017 Universities and Companies (Set size: 1230)
(Searched in- Abstract/Title/Claims)



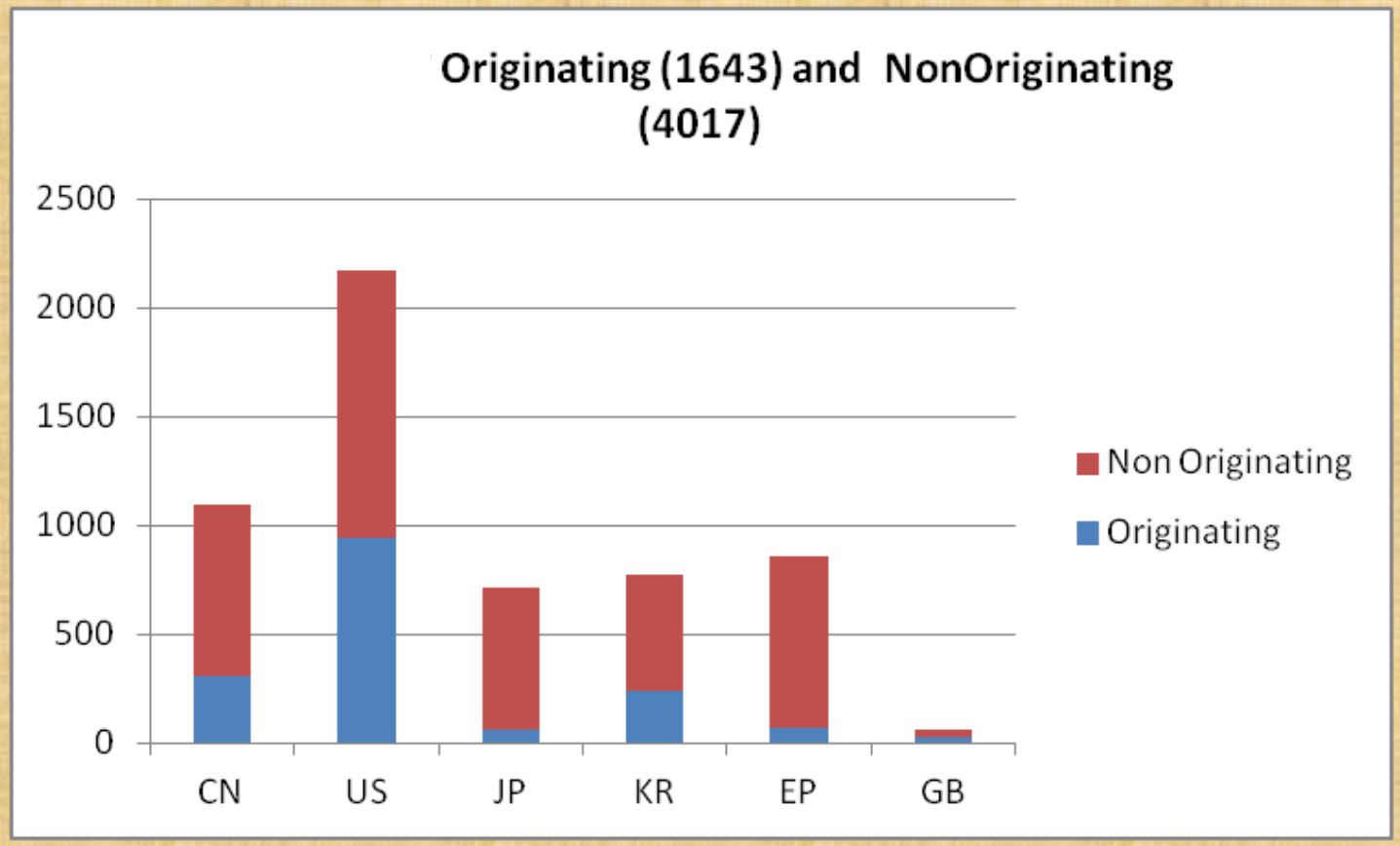
VI. Example 2: Specific Problem- Nano-technology for Cancer (Cont.)

NANO + CANCER: Number of Publications in Different Countries (Searched in- Abstract/Title/Claims)



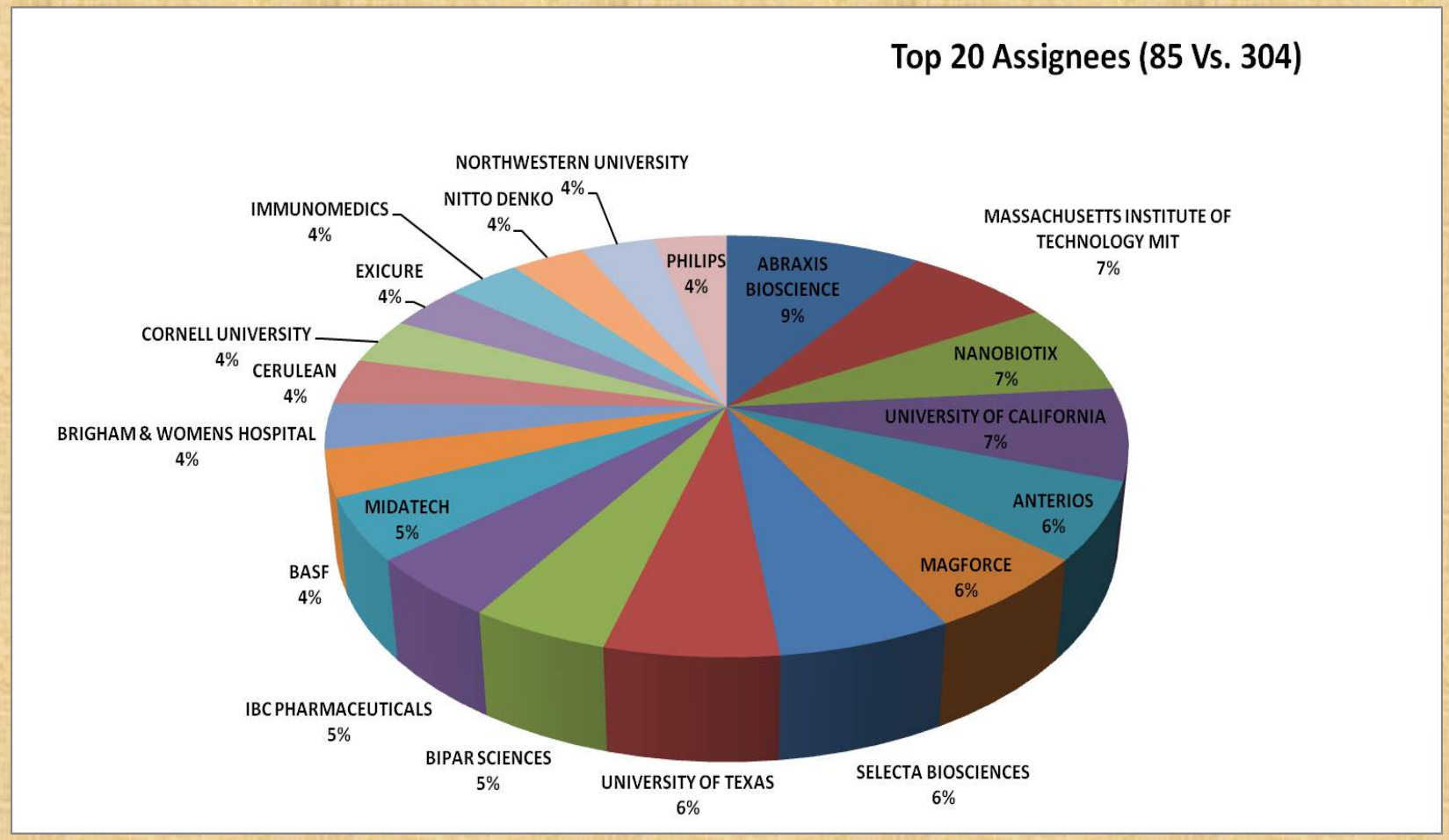
VI. Example 2: Specific Problem- Nano-technology for Cancer (Cont.)

NANO + CANCER: 2010-2017 Originating and Non Originating Count (Set size: 1935)
(Searched in- Abstract/Title/Claims)



VI. Example 2: Specific Problem- Nano-technology for Cancer

NANO + CANCER in India: Top 20 Assignees (85 vs 304)
(Searched in - Abstract/title/claims)



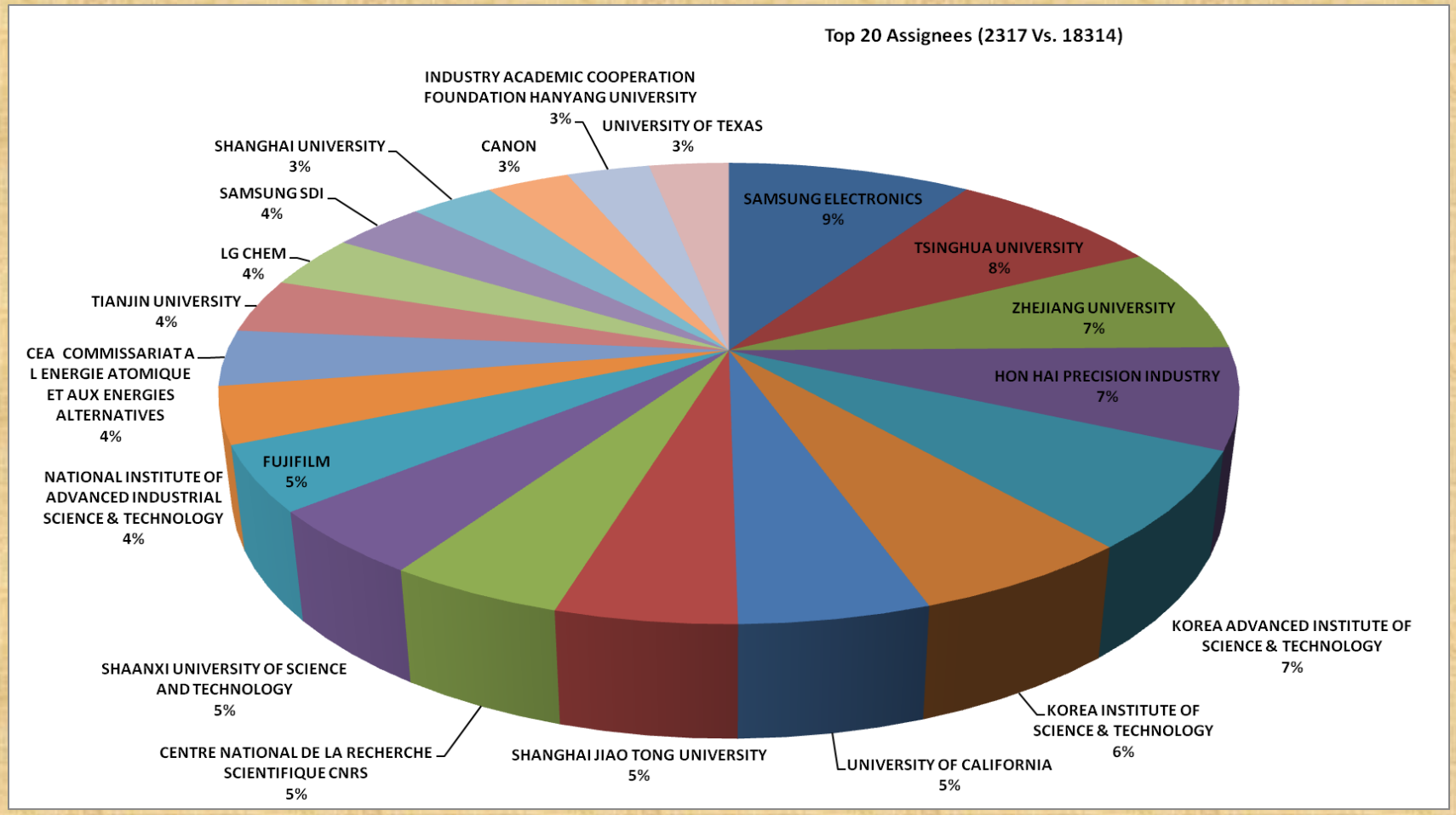
VI. Example 2: Specific Problem-Nano-technology for Drug

Patent applications under Nano-technology for Drug :

	Set size(full text)	Set size(title abstract and claims)	Set size 2010-2017(title abstract and claims)
All countries	40577	18314	11096
India	2483	1325	628

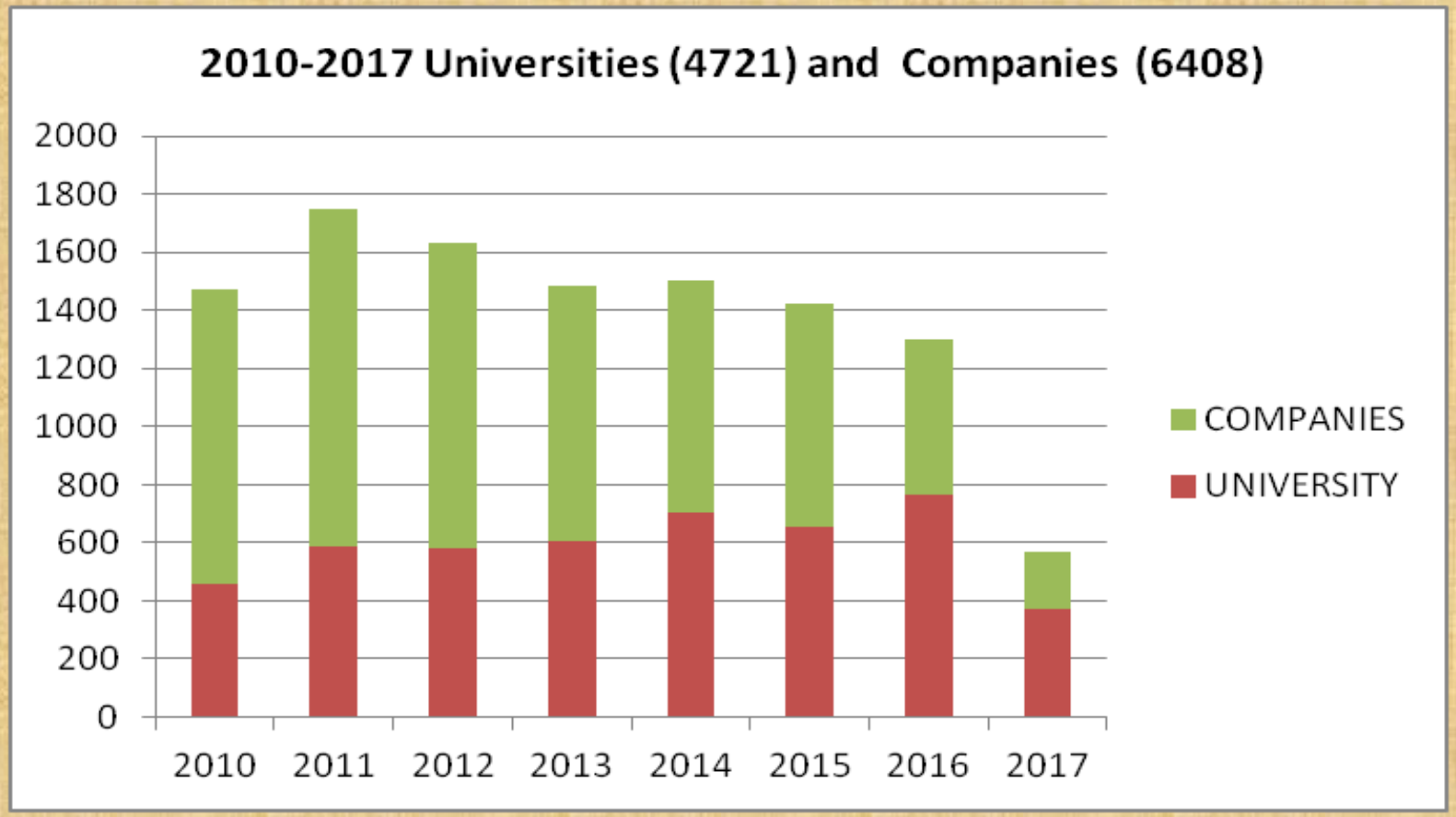
VI. Example 2: Specific Problem- Nano-technology for Drug Delivery (Cont.)

NANO + DRUG: Top 20 Assignees (2317 vs 18314)
(Searched in – Abstract/Title/Claims)



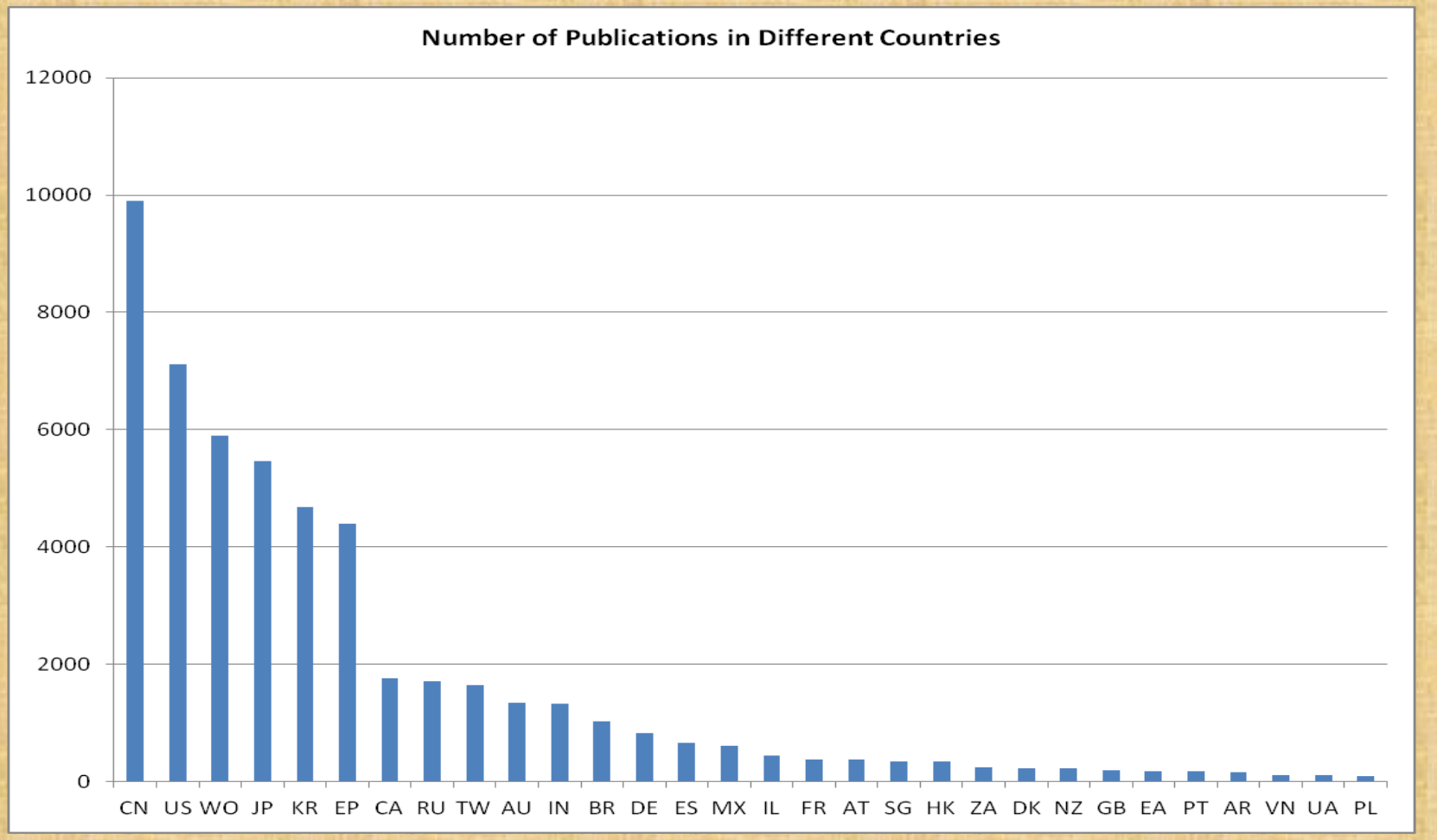
VI. Example 2: Specific Problem- Nano-technology for Drug Delivery (Cont.)

NANO + DRUG: Filing Trend 2010-2017 Universities and Companies (Set size: 11096)
(Searched in – Abstract/Title/Claims)



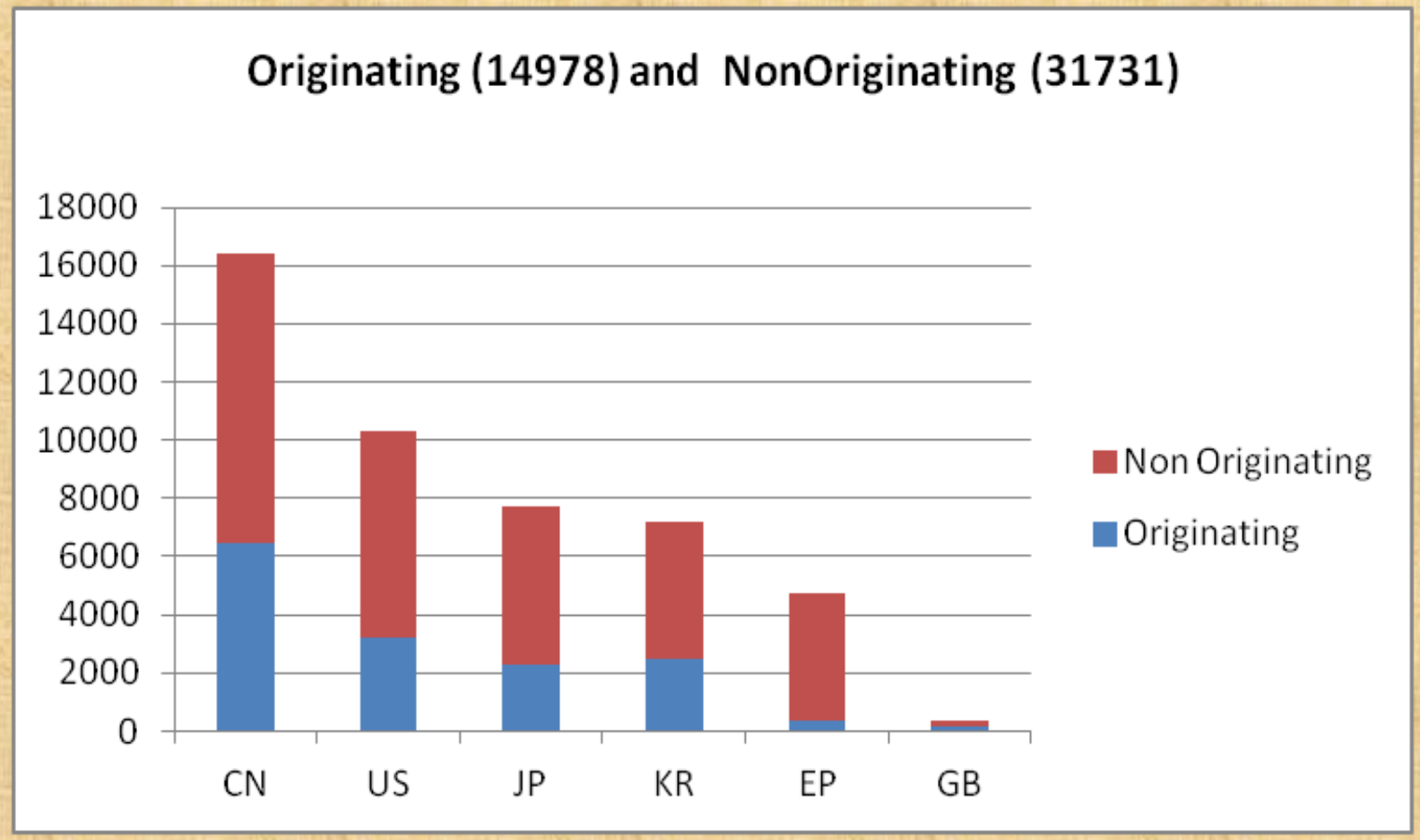
VI. Example 2: Specific Problem- Nano-technology for Drug Delivery (Cont.)

NANO + DRUG: Number of Publications in Different Countries (Searched in – Abstract/Title/Claims)



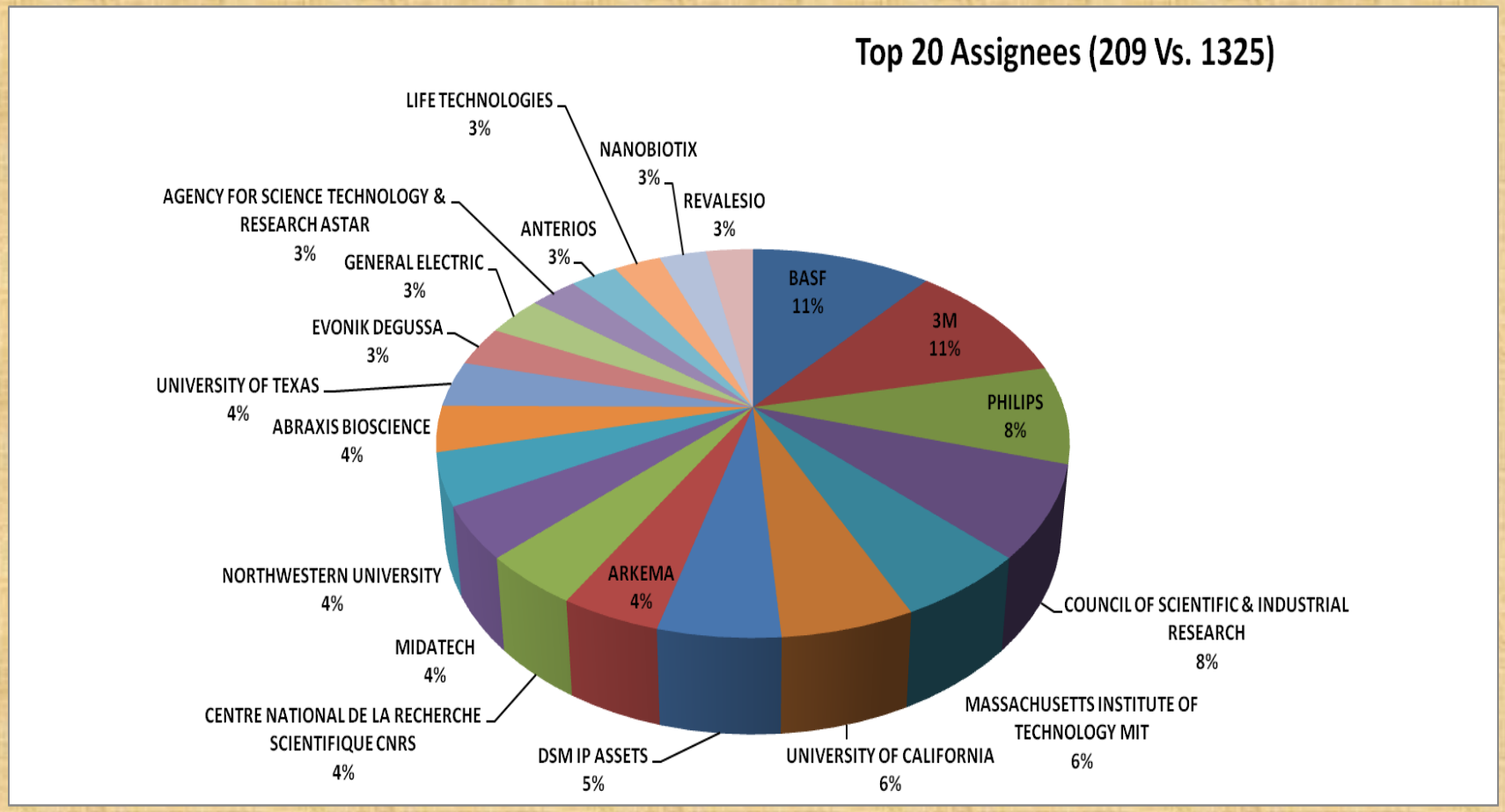
VI. Example 2: Specific Problem- Nano-technology for Drug Delivery (Cont.)

NANO + Drug: 2010-2017 Originating and Non Originating (Set size:18314)
(Searched in- Abstract/Title/Claims)



VI. Example 2: Specific Problem- Nano-technology for Drug Delivery (Cont.)

NANO + DRUG in India: Top 20 Assignees (209 vs 1325)
(Searched in – Abstract/Title/Claims)



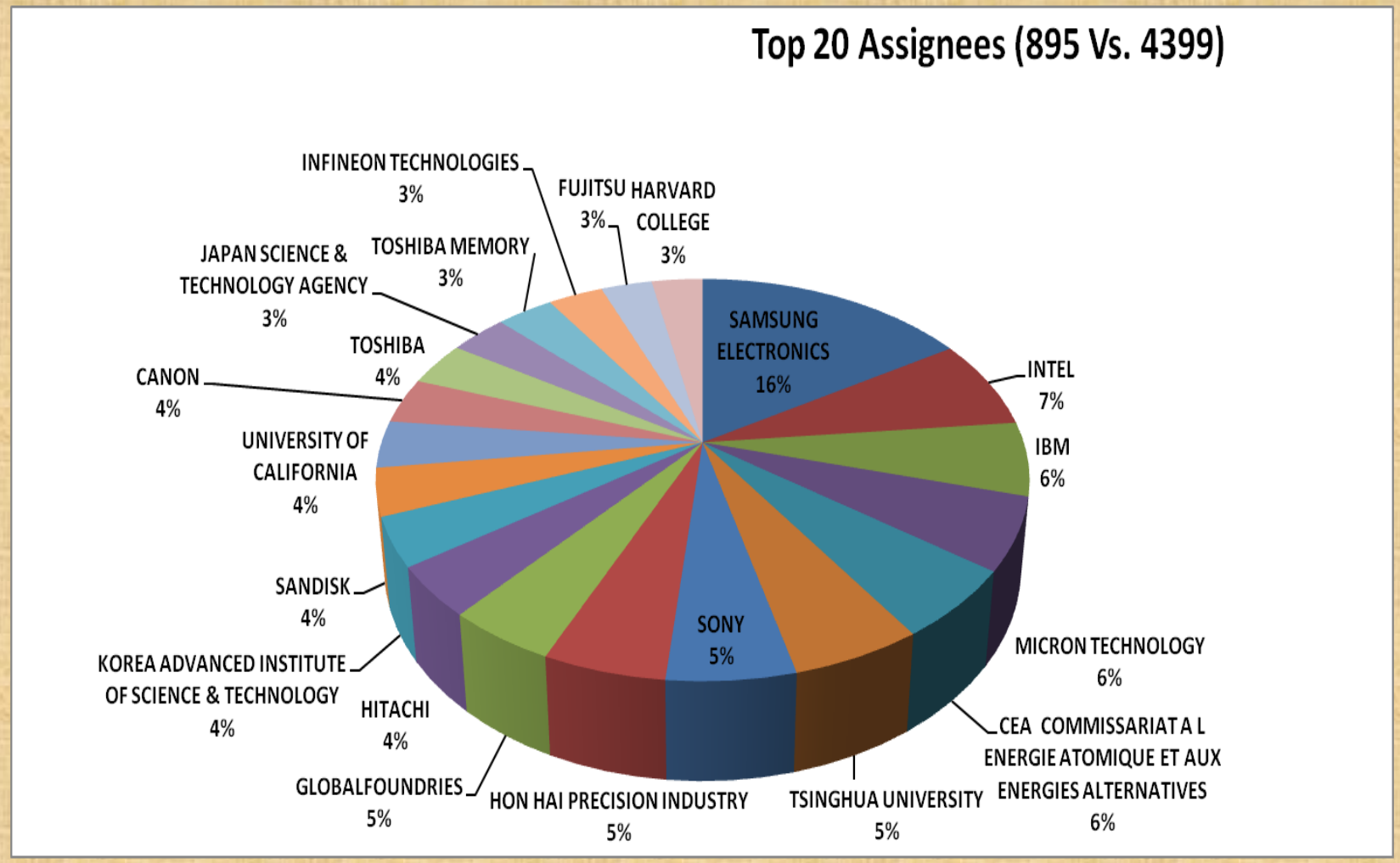
VI. Example 2: Specific Problem- Nano-technology for Computer

Patent applications under Nano-technology for Computer :

	Set size(full text)	Set size(title abstract and claims)	Set size 2010-2017(title abstract and claims)
All countries	18131	4399	2266
India	1328	286	138

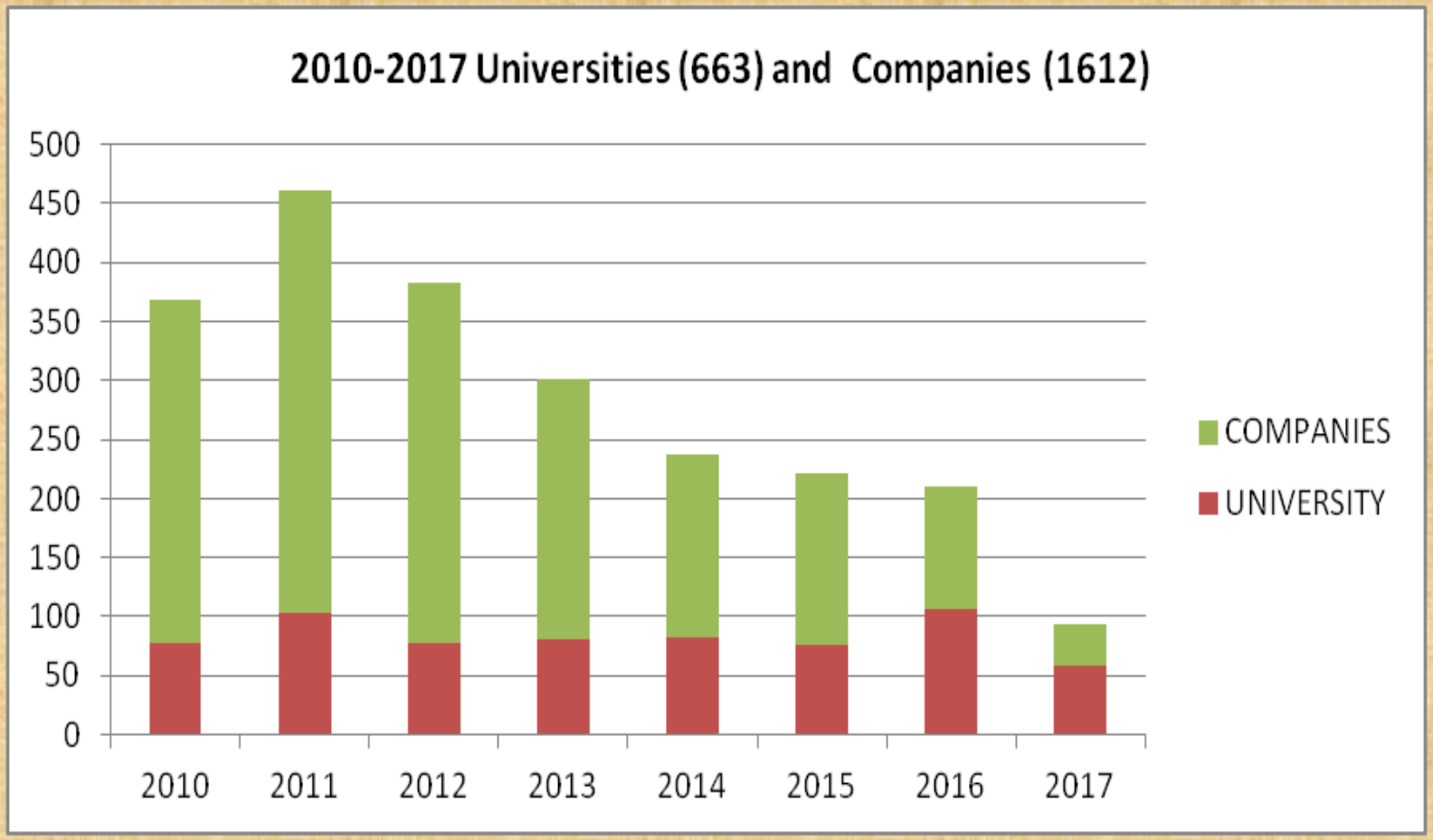
VI. Example 2: Specific Problem- Nano-technology for Computers

NANO + Computer: Top 20 Assignees (895 vs 4399)
(Searched in- Abstract/Title/Claims)



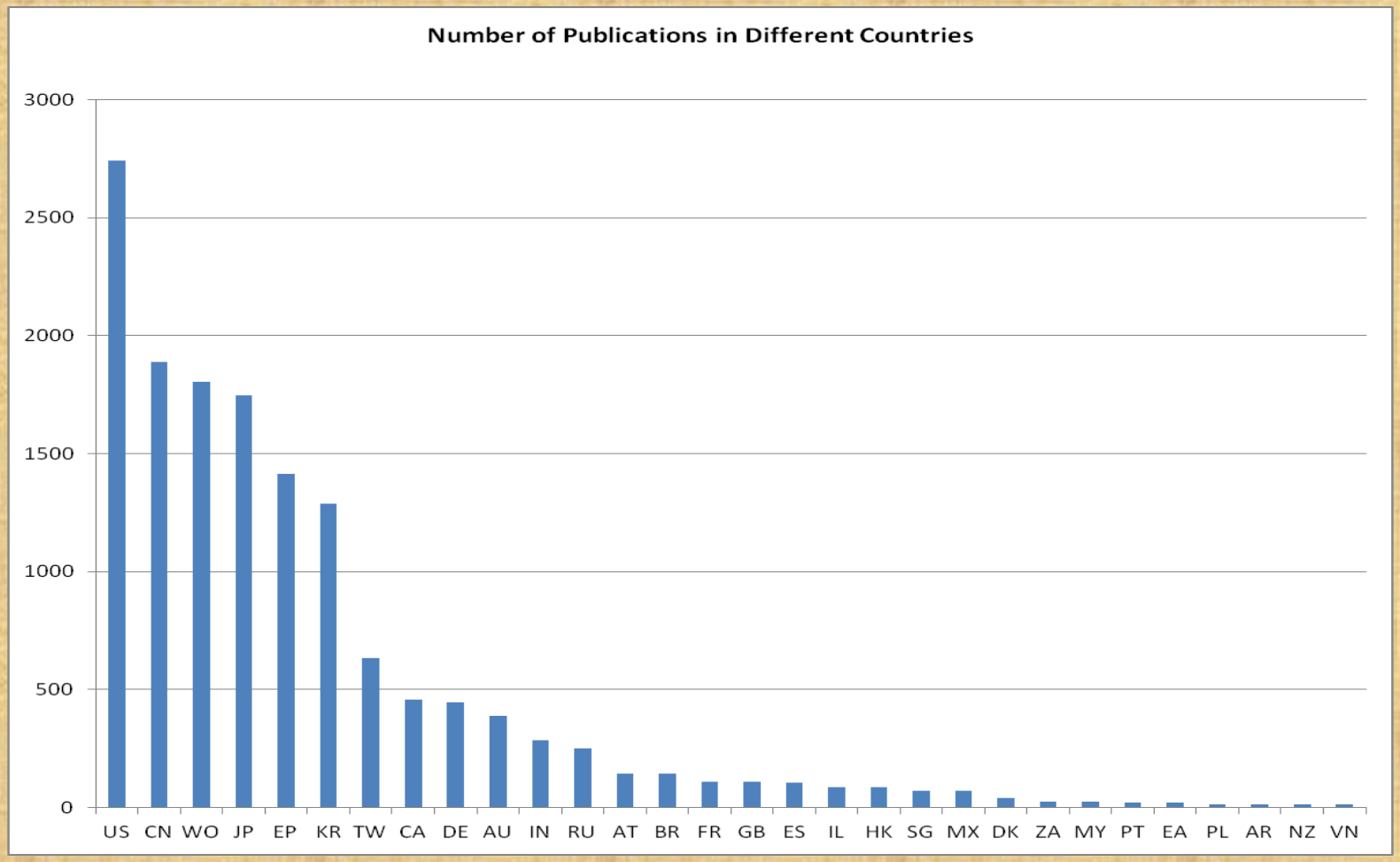
VI. Example 2: Specific Problem- Nano-technology for Computers

NANO + Computer: Filing Trend -2010-2017 Universities and Companies (Set size: 2266)
(Searched in- Abstract/Title/Claims)



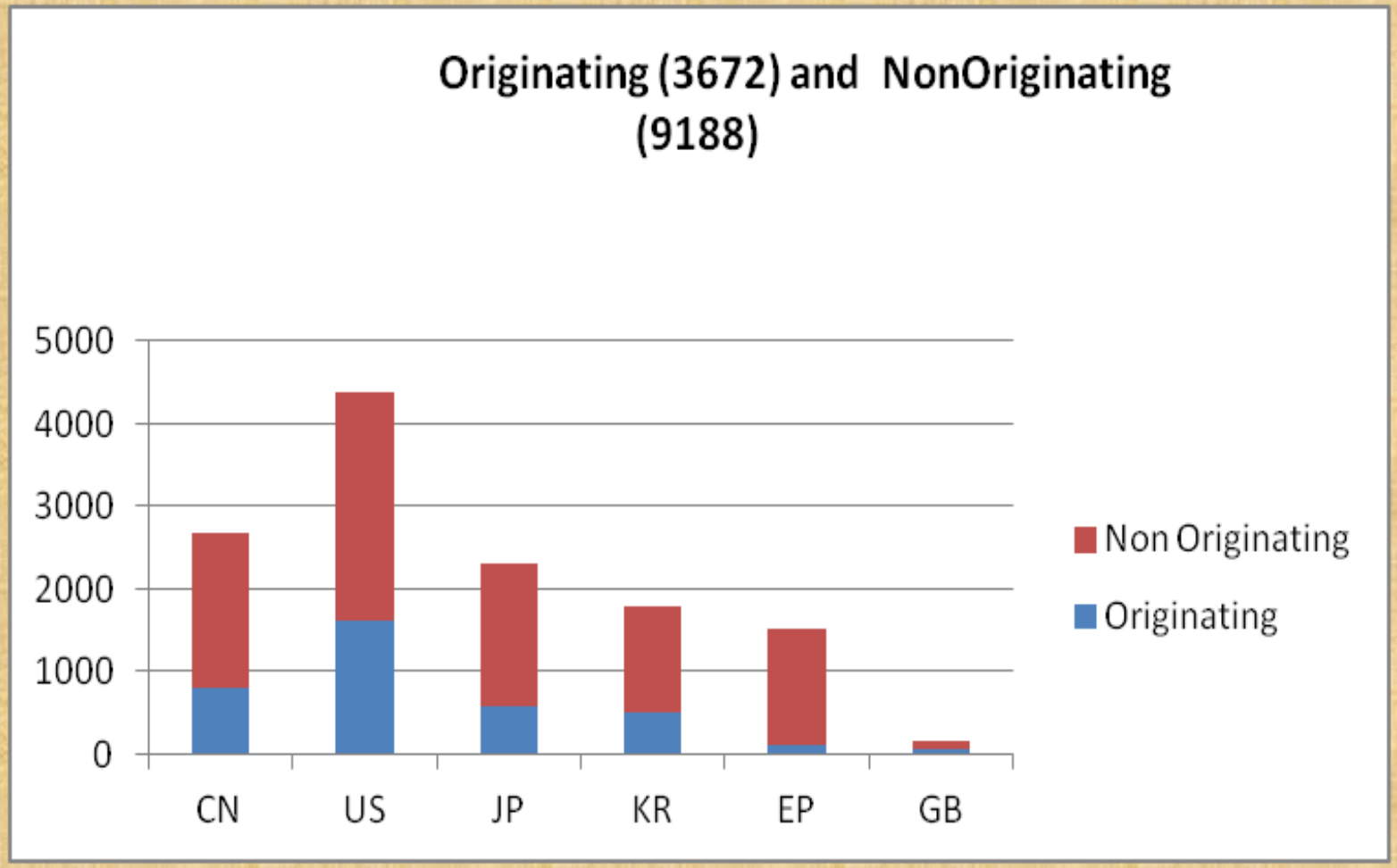
VI. Example 2: Specific Problem- Nano-technology for Computers

NANO + Computer: Number of Publications in Different Countries (Searched in- Abstract/Title/Claims)



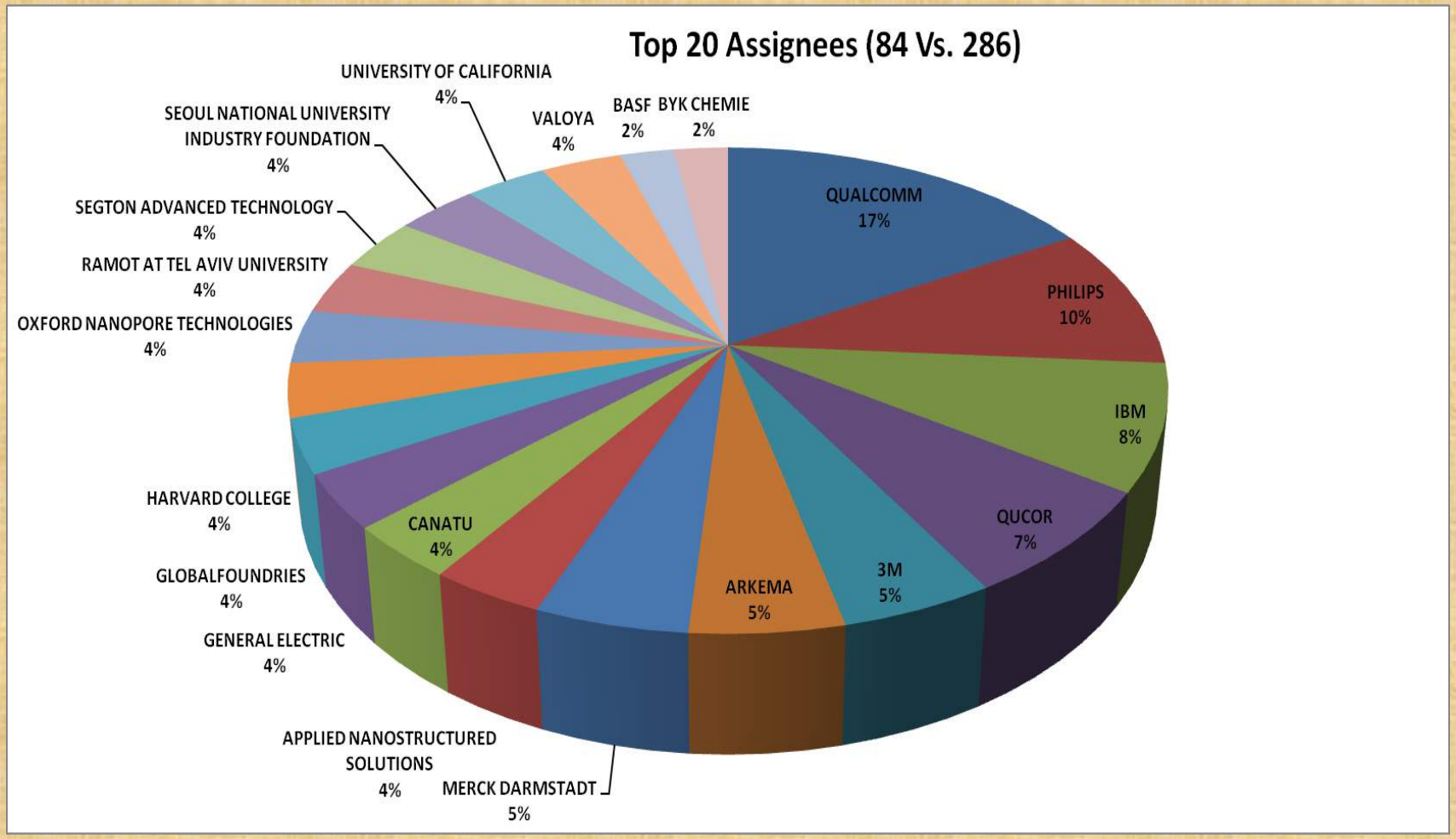
VI. Example 2: Specific Problem- Nano-technology for Computers

NANO + Computer: Originating and Non Originating (Set size: 4399)
(Searched in- Abstract/Title/Claims)



VI. Example 2: Specific Problem- Nano-technology for Computers

NANO + Computer in India: Top 20 Assignees (84 vs 286)
(Searched in- Abstract/Title/Claims)



VI. Example 2: Specific Problem

- **Title: We can hack our Immune System to Fight Cancer**
- (Link: https://www.ted.com/talks/elizabeth_wayne_we_can_hack_our_immune_cells_to_fight_cancer)

- **Abstract:** After decades of research and billions spent in clinical trials, we still have a problem with cancer drug delivery, says biomedical engineer Elizabeth Wayne. Chemotherapy kills cancer -- but it kills the rest of your body, too. Instead of using human design to fight cancer, why not use nature's? In this quick talk, Wayne explains how her lab is creating nanoparticle treatments that bind to immune cells, your body's first responders, to precisely target cancer cells without damaging healthy ones.

- This talk was presented at an official TED conference, and was featured by our editors on the home page.

- To do this special mission, we decided to deliver a nanoparticle made of lipids, which are the same materials that compose your cell membrane. And we've added two special molecules. One is called **e-selectin, which acts as a glue that binds the nanoparticle to the immune cel**l. And the second one is called trail. **Trail is a therapeutic drug that kills cancer cells but not normal cells**. Now, when you put both of these together, you have a mean killing machine on wheels.

- **Objective: Create nanoparticle treatment that binds to immune cells of your body's first responders, to precisely target cancer cells without damaging healthy ones.**

Results:

US 20160184395 A1: Method to functionalize cells in human blood, other fluids and tissues using nanoparticles

- **Publication date: 30 Jun 2016** **Filing date: Aug 4, 2014**
- **Priority date: Aug 2, 2013** **Status: Application** **IPC code: A61K9/127**
- **Original Assignee: Cornell University**
- **Inventors: Michael R. King, Michael J. Mitchell, Kuldeepsinh Rana, Elizabeth C. Wayne, Chris B. Schaffer, Siddarth Chandrasekaran**
- (**Link**: https://www.google.co.in/patents/US20160184395)
- Compositions and methods for inhibiting metastatic cancer cells. The compositions comprise ***nanoparticles which have incorporated therein leukocyte adhesion molecules and therapeutic molecules exposed on their surface***. The nanoparticles may be provided attached to leukocytes. Introduction of these compositions in to the circulation of individuals results in ***inhibition and reduction of metastatic cancer cells***. (Abstract)

- The present disclosure provides a new approach to ***functionalize cells in the blood using nanoparticles functionalized with different moieties and/or molecules***. ***One moiety or molecule comprises selectin or another molecule which recognizes a host cell, such as blood cell, such as, for example, a white blood cell.*** An optional second moiety or molecule targets a second type of cell, such as circulating tumor cell. ***A last moiety or molecule binds to the second type of cell causing an action, such as cell death***. In one embodiment, ***the cancer cells in the blood are killed by causing circulating white blood cells to present the cancer-specific apoptosis ligand TRAIL on their surface (via nanoparticles) along with E-selectin adhesion receptor. This approach occurs by using a nanoparticle functionalized with E-selectin and TRAIL. The E-selectin molecule binds to its receptor on the white blood cell. The tumor cell binds to other free E-selectin on the nanoparticle and then due to proximity, TRAIL binds to the TR receptor on the tumor cell surface***.

US 20160145348 A1: Compositions and methods to modify cells for therapeutic objectives

- **Publication date: 26 May 2016 Filing date: 14 Mar 2014**
- **Priority date: 14 Mar 2013**

  Status: Application IPC code: C07K16/4
- **Original Assignee: Fred Hutchinson Cancer Research Center**
- **Inventors: Matthias Stephan**
- (**Link**: https://www.google.co.in/patents/US20160145348)
- The present disclosure provides compositions and methods that **rapidly and selectively modify cells of the immune system to achieve therapeutic objectives**. The methods can be practiced in vivo and any cell type that expresses a known marker can be targeted for a therapeutic objective. **The present disclosure provides compositions and methods that rapidly and selectively modify cells of the immune system to achieve therapeutic objectives**. The methods can be practiced in vivo and any cell type that expresses or is associated with a known marker can be targeted for a therapeutic objective by the modified cell. (Abstract)

- In particular embodiments, porous ***nanoparticles include liposomes. Liposomes are microscopic vesicles consisting of at least one concentric lipid bilayer.*** Vesicle-forming lipids are selected to achieve a specified degree of fluidity or rigidity of the final complex. In some embodiments, liposomes provide a lipid composition that is an outer layer surrounding a porous nanoparticle.
- The disclosed methods provide the ***first implementation of nanocarriers for the genetic engineering of immune cells to selectively target cells associated with markers for various therapeutic objectives***. For example, and in relation to cancer cells as an unwanted cell type, previous nanotechnology-based clinical research has focused on particles that selectively accumulate chemotherapeutics, siRNA, or imaging agents at tumor sites while minimizing off-target toxicities. The methods described herein are different: instead of introducing therapeutics into tumor tissue, the disclosed methods introduce ***genes encoding tumor-recognizing receptors into circulating lymphocytes, which in turn bind and destroy tumor cells.*** This strategy has the advantage that***, unlike agent-loaded nanoparticles (which are quickly cleared by phagocytes), the modified lymphocytes can persist and proliferate in the subject for a long-term effect***. ***Thus, in relation to cancer treatments specifically, the current disclosure provides a new, more effective therapy. The disclosure shifts the focus from broad-impact chemotherapy or radiotherapy (which have many negative side-effects) to tumor-specific immunotherapeutics (which do not harm healthy tissue). Nanoparticle gene therapy will provide clinicians with the ability to instantly treat diagnosed patients with an off-the shelf composition that can be widely distributed at low cost, and is amenable to changes in dose and specificity as the treatment evolves***.

US20130344003A1: Immuno-therapy for cancer treatment using iron oxide nanoparticles

- **Publication date: 26 Dec 2013** **Filing date: Jun 21, 2013**
- **Priority date: Jun 25, 2012** **Status: Application IPC code: A61K49/0**
- **Original Assignee: The Board Of Trustees Of The Leland Stanford Junior University**
- **Inventors: Heike E. Daldrup-Link**
- (**Link**: https://www.google.co.in/patents/US20130344003)
- ***An immuno-therapy for treatment of a tumor is provided***. An effective dose of a composition containing a low dose of superparamagnetic iron oxide nanoparticle is administered to a tumor. Once the composition has been administered, it is recommended to avoid any means that would cause direct cytotoxic effects to the cancer cells and to normal/healthy tissue. The combination of composition-administered cancer cells with the avoidance of ***direct cytotoxic effects has been shown to be successful to inhibit the growth of the cancer cells or result in aptosis of the cancer cells***. Additional dose(s) can be administered when it is determined that: (i) the tumor starts to grow and/or (ii) the remaining composition falls below a threshold. ***The immuno-therapy method is a safe, clinically applicable, ready-to-use theranostic approach for cancer patients who are unable to start chemoradiotherapy in a timely manner, i.e. an effective interim or adjunctive treatment for patients***. (Abstract)

US 20170172932 A1: Early Cancer Detection And Enhanced Immunotherapy

- **Publication date: 22 Jun 2017 Filing date: 2 May 2016**
- **Priority date: 21 Dec 2015**

  Status: Application IPC code: A61K9/50
- **Original Assignee: Gholam A. Peyman**
- **Inventors: Gholam A. Peyman**
- (**Link**: https://www.google.co.in/patents/US20170172932)
- ***A method of therapy for a tumor or other pathology by administering a combination of thermotherapy and immunotherapy optionally combined with gene delivery. The combination therapy beneficially treats the tumor and prevents tumor recurrence, either locally or at a different site, by boosting the patient's immune response both at the time or original therapy and/or for later therapy***. With respect to gene delivery, ***the inventive method may be used in cancer therapy***, but is not limited to such use; it will be appreciated that the inventive method may be used for gene delivery in general. The controlled and precise application of thermal energy enhances gene transfer to any cell, whether the cell is a neoplastic cell, a pre-neoplastic cell, or a normal cell. (Abstract)

US 20090110739 A1: Targeted cancer chemotherapy using synthetic nanoparticles

- **Publication date: 30 Apr 2009 Filing date: 15 May 2008**
- **Priority date: 15 May 2007**

  Status: Application IPC code: A61K39/395
- **Original Assignee: University Of North Texas Health Science Center At Forth Worth**
- **Inventors: Andras G. Lacko, Walter J. McConathy**
- (**Link**: https://www.google.co.in/patents/US20090110739)
- Compositions and methods for delivery of a pharmaceutical to an individual. Delivery vehicles are provided in a formulation of a pharmaceutical that is encapsulated in a ***synthetic self assembled nanoparticle that includes a lipid binding protein and a lipid monolayer.*** The interior of the particle represents a hydrophobic core region where lipophilic highly-water insoluble drug molecules may be incorporated. ***In contrast to liposomes, that include an aqueous interior core surrounded by phospholipid bilayer, the drug carrier nanoparticle described here is composed of a monolayer and a hydrophobic interior.***

- ***The invention provides novel therapeutic formulations, their compositions, methods for their preparation, their physical chemical characteristics and their mode of uptake by cancer cells and tumors and mode of administration as a therapeutic agent. In one aspect, the invention involves the delivery of therapeutic/imaging agents as a component of a nanoparticle that is composed of three lipids and a lipid binding protein. The nanoparticle is spherical in shape with a hydrophobic interior core region that accommodates the water insoluble therapeutic agents (see FIG. 1).***

- ***In a preferred embodiment, the structural components include a phospatidylcholine, a cholesterol, and a cholesteryl ester, as well as a lipid binding protein (an apolipoprotein).***

US 9138476 B2 : Nanoparticle-assisted ultrasound for cancer therapy

- **Publication date: 22 Sep 2015** **Filing date: 16 Apr 2014**
- **Priority date: 16 Apr 2013**

  Status: Grant IPC code: A61N7/00
- **Original Assignee: Academia Sinica**
- **Inventors: Olga K. Kosheleva, Peter Lai, Nelson G. Chen, Michael Hsiao, Chung-Hsuan Chen**
- (**Link**: https://www.google.co.in/patents/US9138476)
- ***Methods for killing cancer cells and treating cancer in a subject by exposing the cells to nanoparticles,*** and irradiating with a focused, low to medium power ultrasound. The nanoparticles can be gold, iron oxide, copper, silver, polystyrene, PEG, or liposome nanoparticles***. The nanoparticles can have a cancer drug attached, such as an antibody-based cancer drug***. (Abstract)

US7521066B2: Pharmaceutical and diagnostic compositions containing nanoparticles useful for treating targeted tissues and cells

- **Publication date: 21 Apr 2009 Filing date: 30 Apr 2007**
- **Priority date: 15 Jun 2001 Status: Grant IPC code: A61K9/51**
- **Original Assignee: Cornerstone Pharmaceuticals**
- **Inventors: Robert Shorr, Robert Rodriguez**
- (**Link**: https://www.google.co.in/patents/US7521066)
- ***Nanoparticles made from a select group of lipids and optionally containing a therapeutically active agent are employed in pharmaceutical compositions for delivery to targeted tissues and/or cells for the treatment or diagnosis of such diseases as cancer***. (Abstract)

THANK YOU!

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