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Studying the Application of Epidemic Theory in Transmission Cycle of Technology: A Case Study of Nanotechnology Patent

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Abstract

The aim of this study was to investigate the term Nano in subject categories of patents and to analyze the conceptual relationship between them. The method of this study is based on the study of mathematical models of the disease outbreaks. Population composed of published patents which used the words of “Nano" or "Nanotechnology” in the title or abstract. The patents retrieved from the Institute of Patent and Trademark of United States of America (USPTO). The findings showed that the patents trend had an exponential relationship and an incremental growth. So that the absolute number of patents has increased from 2 in 1995 to 1474 patents in 2013. The cumulative growth of subclasses has been involved in Nano subject over time that has an S state logistics, which is reached from 2 in 1995 to 3032 in 2014. The results showed that the USPTO patents at this time confirm the theory of Goffman (1971) that transmits of an idea as the dissemination of influenza are reversible.

Keywords: Epidemic Theory, Information Epidemic, Co-word analyses, Nanotechnology patent.

Introduction

There are many different theories among experts about information transfer and the use of it, one of these theories is the epidemic theory of Goffman and Neville. According to them, many similarities can be drawn between the process of thought and the transmission of the disease (Goffman and Neville, 1964). Epidemic is the model for the disease over the time and place. One of the reasons for modeling is interpreting the future and deciding if you need an example epidemiology and control measures at the time of the outbreak (Diekmann & Heesterbeek, 2000).

To analyze the prevalence of disease outbreaks in a community, using the mathematical models of the epidemic. Using mathematical models have a chance to bring a reliable forecast. Considering usable mathematical models in quantity guessing can be understood,

based on the prevalence of diseases (which is a mathematical model), that the process of technology transfers and scientific concepts like the stages of the growth and disease outbreak. One of the essential parameters must be considered in using the epidemiology model, only with passing the time, the number of infected people to be increased or other interactions have affected in suffering or improving or even their mortality. The aim of the epidemiology mathematical model is to identify the mechanisms of production diffusion patterns, to define these events reasonably and provide a tool to control diseases (Iannelli, 2005). William Goffman and Neville were the first pioneers who expressed their thoughts about scientific developments or according to their ideas, "scientific communication" as" information epidemic" at notices field in 1964.

Goffman argued that the distribution of scientific ideas among scientists in epidemiology as the influenza virus have been spread among people. In an epidemic of infectious disease, we are dealing with operating while in scholarly communication which is information that can be transmitted in true or false. In both cases, a person must provide the concept or infectious factors that a carrier transports and the environment gets it (Goffman, 1971).

With regard to the mathematical models are valid in quantitative guesses, based on disease outbreaks (which is a mathematical model), it could be understood that the process of transferring technology and scientific theories are like the growth and spread of a disease.
Accordingly, studying the ubiquity of threated terms in these classes of patents was the significant focus of this research. The presence of a term patent of a threated area indicates that it has found the common term in that category. It could also indirectly have realized that specialists and technicians involved with this, or in other words, what the areas of technology, what subject areas for forming technology were necessary, and which subject areas as a result of evolution have been removed.

Because unlike the book, each patent usually takes more than one category, it can be found that for an invention what categories were involved simultaneously. Moreover, the presence of a few categories on a patent which makes it possible to determine the Co-occurrence matrix, studying the relationship between categories which a term among them has been spread. These relationships can be found through clustering techniques and analyze social network. Citations, keywords, descriptors and subject classes reflect the content and ideas are recorded within a material. Thus, through the formation and evolution of them, the epidemic of ideas was studied. This shows that in implementation, the theory of Goffman and Neville requires investigating the development of citations, Keywords, descriptors and subject categories in recorded material. The main problem is that the exact position of the various thematic areas of the process of the emergence and development of nanotechnology and how they interact with each other is not clear. To solve it can be to study the epidemic of this technology in subject classes of the patent issue, and considering their relationship with each other in the process of emergence and development of the technology were mentioned.

Citations, Keywords, descriptors, and Subject classes are a reflection of the content and theories within a recorded material. Thus, the development of theories can be studied through their process of formation and evolution. This shows that in applying Goffman's theory, surveying the growth of citations, Keywords, descriptors and subject classes in recorded material has been involved. The patents are a sample of these recorded materials that can

promote technical theories through the chains of citations or the rise and fall of Keywords and subject classes in them accompany with the time of the study. These documents are an important source of information in technology in which the available information can be used for various purposes.

In the present study, considering to identify relevant topics and involved in the nanotechnology field which is resulted in the identification of related industrial areas and introducing them for developing and improving technology in this field. Subject classes in this study were likened as a population which a term has spread within it. The difference with other preceding studies related to the analysis of the words, which is based on mostly analyzing lexical, while this study investigated categories analysis. Using analysis on patent, we can assess a country's technological performance. In addition, it is identified the transfer of knowledge between science and technology. Also, the findings can help more policy maker's insight in the field of nanotechnology, the development of a technology and the role of studies based on the subject co-occurrence can help understand better the epidemic of a technology.

The background of study

William Goffman (2001) who has compared the information transmission in a population with a disease and analyzed the development of an idea or scientific theory in a population with using SIR model.

Meyer (2001) to assess the relationship between science and technology in the field of nanotechnology with using America's patent office database. His research was done based on a modified version of Price, showed that only a small number of references of patents are associated with the articles in this field and also registered patents by universities compared to other patents have more citations to scientific papers.

Bettoncourt and et al (2006) using SIR model to study how to develop the idea of "good power" between communities in United States of America, Japan, and the former Soviet Union after World War II. In this study, elements such as population, the level of interpersonal contact, duration of infectious period and so on, which are the basic elements of the epidemic model. It is often taken into consideration generalizing epidemic in the community to develop ideas. The results showed that there was a similarity between the spread of an idea and the spread of disease. As time goes, a lot of people had been infected and be involved in an idea or theory for a long time. The researchers also demonstrated that these conflicts can be different in different societies. The United States of America with the fastest growth rate and japan with the lowest place in an ideal epidemic paradigm, the difference is from the Political geography of the two countries.

The results of Luo & Jiang (2006) study showed achievements and scientific research for publication behave similarly to disease. The analysis of data was based on three types of models (the impact of alternative technologies, the relationships, and competitive technologies) in distributing technology has been studied. The results clarified only if the total penetration rate of IT technology is greater than the replacement rate of technology and the rate of bankruptcy, the distributing phenomenon has occurred.

Anagnostopoulos and et al. (2011) in a study argued introducing the analytical model for the dissemination of information. The results showed contrary to the epidemic classical model

where a person be infected and then infect other people then goes to immobility period time. In this model, each of nodes or infected person can begin again epidemic with more intensity alone, which is stable in the current outbreak. Researchers planned the epidemic of information with utilizing of the SIS prevalence of diseases. They concluded that the prevalence of infected nodes caused more epidemic or dumped into the production of newer information.

Liu and Xiao (2012) in their study investigated two epidemics of models: SIR, which include carriers and improved or susceptible individuals; SEARS model with carriers parameters and surveying the susceptible people. In the first stage, the epidemic models with constant conditions were studied for the spread of disease outbreak and then to prove these two models using differential equations.

Kim and Seol (2012) in a study based on words co-occurrence, investigating core technologies in recorded patents. The aim of this study is to provide a new method to identify core technologies that suggest co-occurrence with the index mutual influence for this work.
Lee and Chen (2012) in a study with reviewing 10974 articles in the field of knowledge management in 1995- 2010 year was made an intellectual structure. Analytical methods with documents, Pathfinder network, and strategic charts used in this study, providing the dynamics show of the evolutionary process in the field of knowledge management.

Borrett and et al. (2013) in an article to identify how the ecological network emerged and to study the map drawing, a variety of subjects, and the scientific cooperation in the field of ecological in the ISI database during 1900-2012 years with the aim of documenting the growth of ecology network, recognition of diversity issues in this context, and map out the structure of scientific collaboration among scientists. The results showed the great ecology network and its area is growing rapidly and is the somewhat based on communication tools, which are widely useful for ecology.

Liu and colleagues (2014) with the aim of identifying outstanding issues and the core of investigation conferencing CHI (Computer Human Interaction), considering the analysis of articles this Conference between 1994-2013 years with using words co-occurrence analysis. In general, 556 keywords in 181 relevant articles in this study were examined. Results have shown keywords such as "technology forecasting", "plan", "monitoring", "critical technologies", "scenario planning", "research and development", "Delphi method", "innovation policy", "evaluate", and "emerging technology" as important components of the backbone structure of human-computer interaction have served, as well as European countries, China, India and Brazil are the countries located in the core technology.

According to reviewing literature, realizing the analysis of inventions as a useful tool in the management of research processes and development and also used in the analysis of technology. These documents include large volumes of structured data and unstructured that is requires the smart tools for analyzing and so far has been analyzed from different angles and with different purposes. Nano-technology considered as well as applicable in all fields and a growing technology. So far, surveys also suggest that research on the epidemic of Nano term "in the subject categories of patents" and have not been taken the conceptual analysis of the relations between them. And preceding studies in the field of patents analyzing citation and examining subject patents. So this study is to review the existing literature in this field of

study. To provide deeper insight to policymakers of technology field at the development of a technology. In addition, it can role-based studies for the co-occurrence of words make clear to a better understanding of the epidemic technology.

Research questions

1. What is the function of the absolute growth of patents with the subject of nanotechnology in USPTO system (United States Patent and Trademark Office) until 2014?
2. How is the trend of cumulative growth of subsets in nanotechnology at USPTO patent system over the time?
3. What is the model of epidemic nanotechnology patents in the USPTO system?
4. What are the key subclasses in USPTO system in nanotechnology?

Methodology

This study surveys and its method is based on the study of mathematical models of disease outbreaks. Research community composed of patents which used the “Nano" and "Nanotechnology” in the title or abstract. These patents retrieved related from the Institute of Patent and Trademark of United States of America (USPTO) which were under this institute at the time of employing research 30/01/2015.

With searching the word Nano and Nanotechnology in the title and abstract of patents in the database USPTO, has been retrieved a total of 13913 patent records then saved in a text file.

Since each Patent has three different categories: the US Class, CPC Class, and the International Class (IPC). A US classification was chosen because of more accurate and complete.

The process of data collection and studying the popularity of “Nano” term among Patents

Finding the Patents related to Nano: with investigating the “Nano” and “Nanotechnology” in the title and abstract of the patents in USPTO system, generally, 13,913 records patent are retrieved and then in a text file are restored.

Downloading retrieved patents: to collect necessary data from USPTO system, an application was written in the C # programming and the patents’ file saved in HTML format.

Extracting the required information from stored pages: in this phase of retrieved records in the previous step in addition to the subject classes, as well as the title and the date of the patent was obtained. To do this, due to the vast amount of data, a Plan was designed to extract information and saved in Excel format. Since each Patent has three different subclasses: the US Class (United States Patent Classification); CPC Class (Cooperative Patent Classification); and International Class (International Patent Classification). The more accurate and more complete of US classification was selected.

Searching US classes and storing them in Excel: US class is numerical. For this purpose, the numbers should be converted to understandable context. The results have 473 classes that have been saved as a text file. As regards, each of these has its own subclasses, one to one of the classes were manually entered into Excel. Since some of the secondary classes in major classes don’t have identity number, the name of main classes in Excel were

given through programming. It is worthing to mention that each subclass in its classification system can be divided into smaller categories. In this study considered only the first level of them and if subclass was lower than the first one hierarchy, its code through a program in C # converted to the first code.

Converting the classification numbers to the classes' subject: A total of 161 162 sub-categories were extracted, in which an assigned title replaced the main and secondary. To this purpose, designing a computer program in C #, classes in terms of the list of patents in the USPTO system changed to nontypical titles. In other words, the application output was replaced the number.

Calculate the first year, last year, the number of issues involved, the number of new issues, a number of old issues every year: the first year is a year when the subject matter of patents registered in that year. The first year with this formula:

= IF (A2 <> A1; C2; I2) was identified in Excel.

A column is a subject, **C** is the year, and **I** empty column that the formula is written.

To obtain the final year, the year to which the subject has lived in patents. As in the first year, they were arranged. But the formula which used for the last year was from the bottom to the top, in contrast to other formulae that were applied from top to bottom.

=IF (A93468<>A93469; F93468; C93468; F93468)

Then the frequency of each year with these two formulae:

=IF (A2=A3; G+1; G)

=IF (G3=1; G3; 0)

To sort the data by column frequencies, the frequency was calculated. Total 3032 classes were with high frequency 1.

To obtain a number of issues were involved every year, this formula are used:

=IF (AND ($C4=I$2; $A4<>$A3); I3+1; I3)

I is equal to a column which its year was written on top and it was empty. To avoid disorganization of the formula the $ sign was used in the following columns.

Calculate the number of annual issues has emerged through the following formula:

=IF (AND ($C4=$E4; I4<>I3); J3+1; J3)

But to get the old issues, the number of new issues was subtracted from of involved issues:

Calculated shelf life, average annual use, and useful classes: this stage as previous stages, firstly, the first and the last year of each subject class was identified. Then the lifetime use of any subject with the subtraction of the last year from the first year was calculated. The average annual use was obtained by dividing the frequency of shelf life.

Extraction main classes: First, the main and secondary classes should be separated. Due to a large amount of data, entering them manually was not possible. Thus, by writing a program in C #, the classes were separated and then entered Excel. Information obtained in this step shows that 283 classes among 473 have been involved in the nano.

The collection of data using social network analysis techniques

For mapping subject classes, classes from sub-classes were separated. The steps are as follows:

Converting data into a usable format in a matrix Raver (Ravar Matrix): provision of co-occurrence matrix

Main categories (classes): to compare with each other, co-occurrence matrix analysis (co-word analysis) was used, that is the frequency of co-occurrence of two lines together, in other words, the number of documents that have been used in the two classes.

Hierarchical clustering main categories:

After co-occurrence matrix in the previous step, in the following by using SPSS software and clustering approaches "Between-groups-linkage" the data plotted graph were drawn.

Finding

Absolute growth of patents with the subject of Nano in the USPTO system between the years 1995-2014 are showed in figure 1. A search conducted in the USPTO database has been retrieved 13913 patents associated with Nano area in the period 1995 to 2014.

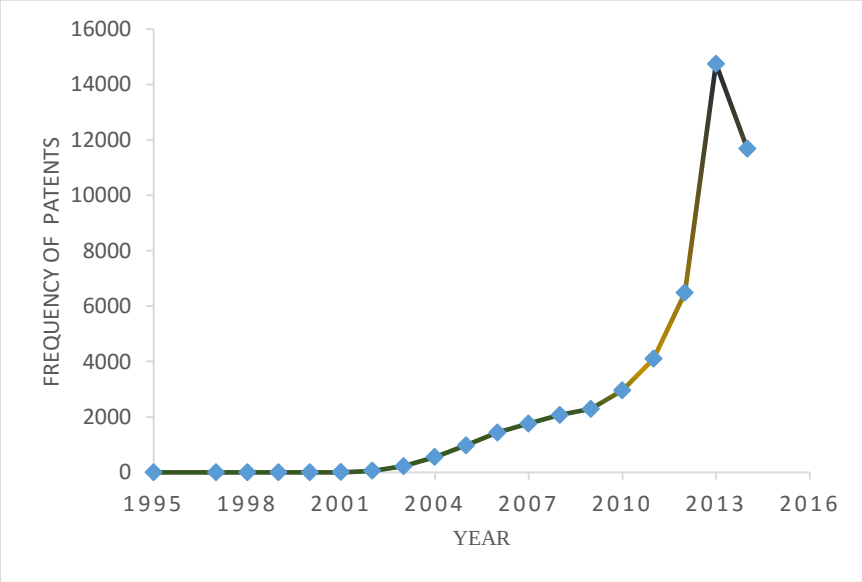


Figure 1. absolute growth of patents with Nano subject at USPTO system

This figure shows that patents in Nano area in the study period have incremental growth. Thus, in terms of absolute growth, the number of patents from 2 in 1995 to 1474 patents have been increased in 2013. Further, the results brought in two relevant groups associated with the basic subclasses and categories.

Subclasses:

Extracting available categories in 13913 patents showed that the total 473 main category and 161162 subcategories in which are in a lower level of the main categories in the USPTO system. In this section, involving (infecting) the following subcategories in Nano area are taken into consideration:

Available and new subcategories entering to Nano area

By identifying subclasses of available and new categories (new found) in Table 1, it was determined that new issues since 2000 have been a growing trend. And each year many

classes focused on nanotechnology. This growing trend has been continued considerable until 2006. However, since from 2007 to 2013, the numbers of new issues have been decreased into nanotechnology and in contrast, the number of threads available or old of this field is increasing. In other words, the arrival Nano in new subject classes is declining.

Table 1
The following available and newcomers to the field of Nano by year

Row	Year	New categories	Available categories	Total number
1	1995	2	0	2
2	1996	0	1	0
3	1997	0	0	1
4	1998	1	0	1
5	1999	3	1	3
6	2000	2	2	3
7	2001	12	5	14
8	2002	42	30	47
9	2003	118	87	148
10	2004	191	159	278
11	2005	237	224	396
12	2006	308	300	532
13	2007	303	338	603
14	2008	287	370	625
15	2009	318	345	688
16	2010	277	403	622
17	2011	305	387	708
18	2012	328	238	715
19	2013	204	70	442
20	2014	94	70	164

What has been the detection of Nano subject in subcategories of patent USPTO system over the time?

To answer this question, considering subclasses of patents were involved in Nano between the 1985 and 2014 years. A total of 161162 subclasses in the USPTO system were involved 3032 issues in Nano.

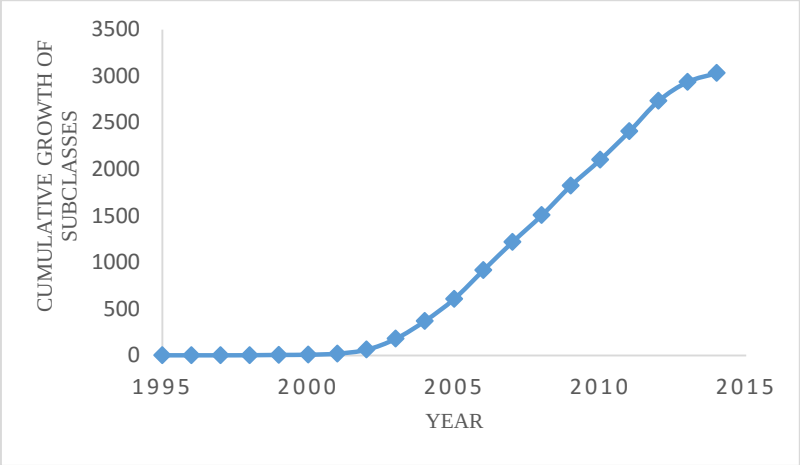


Figure2. Cumulative growth in the number of the subclasses of patents involved in the issue of Nanotechnology

Figure 2 shows the cumulative growth of subclasses has been involved in Nano subject over time that has an S state logistics, which is reached from 2 in 1995 to 3032 in 2014. If we consider only absolute population of involving categories in each year and draw a graph related to the number of categories that been involved in subject each year that has been mentioned, and as well as graph of the numbers of categories that have not been involved at that time, a graph such as figure 3 have been made.

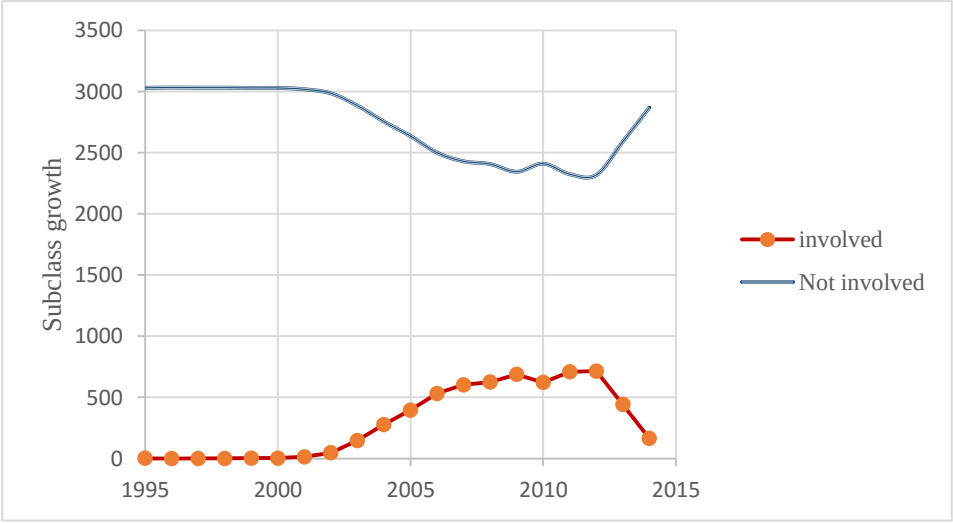


Figure 3. A growth graph of prone to contagion subcategories in nanotechnology area at patents in the USPTO system

In Figure 3, indicating the process of increasing and decreasing the frequency of categories involved in the Nano issue, the model SIS of an epidemic of infectious diseases. Because categories enter in the studied years or in other words to be involved in Nano area are equal categories have left or no be involved and there is no guarantee that a category is not involved now again to be involved in the future. Above all, after a time, that is 2010, the growth trend to come in a steady and logistics state. Of course, under this model, there is not expected to decline sharply, but since 2012 this sharp decline is the result of unexpected turns.

Like other models in the SIS outbreak, the epidemic of disease is a time-dependent phenomenon. In general, it was considered a set of N (population) and a set of states' S (susceptible). It is assumed that the population of all people are susceptible. In this state:

- Susceptible individuals (S)
- infected persons (I)

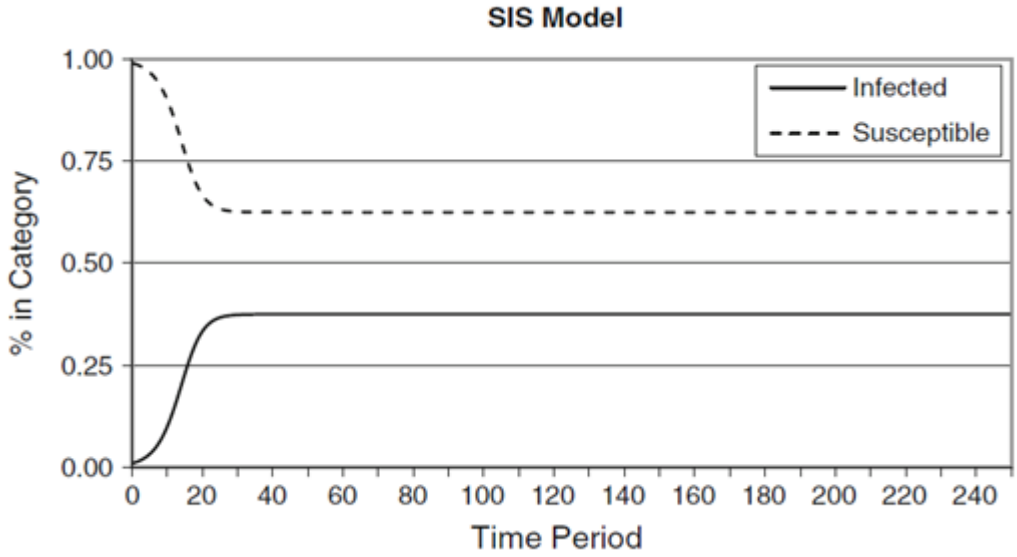
Assuming that the population is constant, the result obtained is that people who are susceptible and are in class (S), with a rate β came to class (I) and unlike people who are infected and in class (I) and with Y rate came into class (S) or in other words to be improved. Based on these assumptions we have the following equations:

$$\frac{dS}{dt} = -\frac{\beta SI}{N} + \gamma I$$

$$\frac{dI}{dt} = \frac{\beta SI}{N} - \gamma I$$

and we have:

$$\frac{dS}{dt} = -\frac{dI}{dt} \quad => \quad dI = -dS \quad I = -S$$



Epidemics and SIS Models (Tassier, 2013)

Solving these equations to conclude that the I= -S then after changes, the graph S will be a photo of changes in the graph I. In other words, where S upside, I will conduct descending and vice versa, at the maximum I, S will be the lowest. The following graph confirms this result:

Identify the usable subclasses in nanotechnology in the studied years

Table 2

The usable and important subclasses in the field of Nano (the first 20 cases)

Category	The average annual usage	Useful life	Frequency	Year end	Year starting	Row
Nanotechnology/NANOSTRUCTURE	87.7	16	1404	2014	1999	1
Active solid-state devices (e.g., transistors, solid-state diodes)/PROCESSES OR APPARATUS ADAPTED FOR MANUFACTURE OR TREATMENT OF SEMICONDUCTOR OR SOLID-STATE DEVICES OR OF PARTS THEREOF (EPO)	71.06	16	1137	2014	1999	2
Synthetic resins or natural rubbers -- part of the class 520 series/SYNTHETIC RESINS (CLASS 520, SUBCLASS 1)	89.83	12	1078	2014	2003	3
Active solid-state devices (e.g., transistors, solid-state diodes)/FIELD EFFECT DEVICE	46.81	16	749	2014	1999	4
Chemical apparatus and process disinfecting, deodorizing, preserving, or sterilizing/ANALYZER, STRUCTURED INDICATOR, OR MANIPULATIVE LABORATORY DEVICE	37	20	740	2014	1995	5
Chemistry: molecular biology and microbiology/MEASURING OR TESTING PROCESS INVOLVING ENZYMES OR MICRO-ORGANISMS	48.5	14	679	2014	2001	6
Nanotechnology/NANOSTRUCTURE	47.14	14	660	2014	2001	7
Drug, bio-affecting and body treating compositions/DESIGNATED ORGANIC ACTIVE INGREDIENT CONTAINING (DOAI)	39.07	14	547	2014	2001	8
PROCESSES OF FORMING SUCH COMPOSITION OR TEST STRIP	38.92	14	545	2014	2001	9
Static information storage and retrieval/SYSTEMS USING PARTICULAR ELEMENT	40.07	13	521	2014	2002	10
Drug, bio-affecting and body treating compositions/PREPARATIONS CHARACTERIZED BY SPECIAL PHYSICAL FORM	35.57	14	498	2014	2001	11
Organic compounds -- part of the class 532-570 series/ORGANIC COMPOUNDS	36.84	13	479	2014	2002	12

Category	The average annual usage	Useful life	Frequency	Year end	Year starting	Row
Semiconductor device manufacturing: process/MAKING FIELD EFFECT DEVICE HAVING PAIR OF ACTIVE REGIONS SEPARATED BY GATE STRUCTURE BY FORMATION OR ALTERATION OF SEMICONDUCTIVE ACTIVE REGIONS	33.92	14	475	2014	2001	13
Nanotechnology/SPECIFIED USE OF NANOSTRUCTURE	39.08	12	469	2013	2002	14
Synthetic resins or natural rubbers -- part of the class 520 series/PROCESSES OF PREPARING A DESIRED OR INTENTIONAL COMPOSITION OF AT LEAST ONE NONREACTANT MATERIAL AND AT LEAST ONE SOLID POLYMER OR SPECIFIED INTERMEDIATE CONDENSATION PRODUCT, OR PRODUCT THEREOF (CLASS 523, SUBCLASS 1)	42	11	462	2013	2003	15
Chemistry of inorganic compounds/CARBON OR COMPOUND THEREOF	28.56	16	457	2014	1999	16
Chemistry: molecular biology and microbiology/APPARATUS	37.08	12	445	2014	2003	17
Scanning-probe techniques or apparatus	40	11	440	2014	2004	18
Chemistry: natural resins or derivatives	33.84	13	440	2014	2002	19
peptides or proteins	33.84	13	440	2014	2002	20

To be the most important and widely used class is known, according to function percentile was implemented within the top 67% percentile in Excel, it was determined that two conditions must be established: The first condition should have more than 7 years of useful life. The second, must be used at least 1 time per year. With these provisions, among the 3558 subject categories in Nano area were surveyed by 597 subjects as important categories were identified. Table 2. Among 597 subject categories, Categories " Nanotechnology/NANOSTRUCTURE " ،Active solid-state devices (e.g., transistors, solid-state diodes)/PROCESSES OR APPARATUS ADAPTED FOR MANUFACTURE OR TREATMENT OF SEMICONDUCTOR OR SOLID-STATE DEVICES OR OF PARTS THEREOF (EPO) & Synthetic resins or natural rubbers - part of the class 520 series/SYNTHETIC RESINS (CLASS 520, SUBCLASS 1) have the most frequency.

Discussion and conclusion

Results of the study showed that the improvement of patents having an exponential relationship and a growing trend (figure 1). So that the absolute number of patents has increased from 2 in 1995 to 1474 patents in 2013. In describing the importance of addressing the issue of Nanotechnology it can be said today, it to be remembered as an influential factor on Science and Technology and scholars and researchers also confirmed that this technology is as revolutionary impending will be influenced by economic future of states and their position in the world According to Nikkam's studies (2006), generally in different science and technology, the share of universities in the patents is about 1 percent. While at the nanotechnology this amount in recent years (2001 to 2004) was an average of 12 percent. The big difference is indicating the importance of the technology and representing special attention to it at the Universities. But since 2013, the negative growth has significantly been shown. Hence, it can be said that it takes about two to three years until the scientific and technical qualifications in a field of science or technology in the database and related resources to be collected and indexed or in other words to be completed. To achieve better results it is necessary, in research like this study, the latest evidence being discussed is related to at least three years before the current year.

The cumulative growth of categories has been involved in Nano during that time having S mode as logistics (Figure 2). So that the second category in 1995 reached 3032 in 2014. These findings indicating the natural growth so-called Nano into different categories at USPTO over the time. In many real-world problems, the growth is in S shape. This type of growth is also known as "logistic growth" and a combination of exponential growth of positive feedback and continued growth without signs of negative feedback. Such behavior in life is so common. Some examples of S-shaped growth areas including technology development, learning curve, population growth, industrial growth in the area and the spread of epidemics (Sterman, 2000). In the real world, if not indefinitely system grew, but with some limitations to the system caused by the passage of time slows down the growth. The most common behavior, the behavior of the S-shaped. In this type of behavior, the system grows exponentially at first, but after a while, the growth of the system decreases and moves towards an equilibrium value. One of the key aspects of the S-shaped structure is a nonlinear relationship between positive and negative feedback. Thus, at first, positive feedback is dominant in the system. But after a while, a dominated aspect transferred to the negative feedback. The turning point of the curve is where this transition occurs (Wittmann and Hatrrup, 2007).

In studying the third question of compliance models based on epidemic models was identified with patents that are confirmed the increased and decreased frequency of categories involved with the subject of nanotechnology and with the spread of infectious diseases to SIS (figure 3). The main aims of epidemiology model can be referred to predictions about the event and occurrence of disease in the future. Depending on the property of the model can be used to predict everything that stems spread through the community. The abstract topics such as patriotism, altruism, or religion to things like food behavior, buying books, transfers between individual thought and everything in it is an extension of payment (Baten Kurt and others, 2006). SIS model contracts with other models have not parameter R or improved people because in this model the individuals are not secure in infecting to disease again. For

example, the flu or the common cold may affect people in several times, but some people become infected each year or every few years. The USPTO patents are also such behavior in Nano categories as an example the category "Active solid-state devices" in all the years, but Category "Stoves and furnaces" from 2008 to 2009 have been presented, then in the next years of the patent in nanotechnology is not presented. And again from 2008 to 2011 to be interred or involved in this field. Results in this area are confirmed to the theory of Goffman (1971) that transmits of an idea as the dissemination of influenza are reversible. The spread of influenza virus also confirmed to SIS model.

In terms of importance, among 597 important Categories "nanotechnology", active solid-state devices" and "artificial resins or natural attractions" are the most significant and practical Categories in Nano area which each one has a relationship with many other subclasses: 1. Nanotechnology with subclass "Nanostructure", 2. Solid-state devices enabled with categories "Processes or apparatus adapted for manufacture or treatment of semiconductor or solid-state devices or of parts thereof (epos)". 3. Field effect device. 4. Synthetic resins class or subclass natural attractions "synthetic resins". These findings suggest that nanotechnology in action and in general, a combination of technologies related to enabling solid-state devices and synthetic resins or natural attractions and specifically the production or treatment based on Nano structure by using synthetic resins.

Limitations

Because of the differences of stored data in databases of patents, extracting comprehensive data was not possible, so there is no possibility of comprehensive data in nanotechnology.

As mentioned patents with differences in the structure of information of patents, the independent survey of any databases was required.

Also, with the dynamic nature of patents database, the data has changed and it will be difficult for decision-making.

Recommendations for Future Research

1. One of the issues studied by various methods in the present study is based on models predicting the improving of this technology which is spreading.

2. This point is important that what nano likely will be replaced to nanotechnology in the future. It was possible by concentrating on secondary classes related to the major categories associated with this technology.

3. Analyzing the concept of patents in the nano is based on studying the relations between the terms used in the title and abstract of patents can complete the research in the understanding of nanotechnology promoting.

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