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Application of h and g indices to Quantify Scientific Productivity of Physicists at JNU, India

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Abstract

Purpose– The study aims to quantify the scientific productivity of Physicists using Scientometric h-index and g-index indicators. Paper also identifies that h and g are complementary to each other and g ≥h (1.5 times of h). The most productive and highly cited physicists and their average citation per item at JNU are identified. Also the study enlists the best ten high impact papers published during 2007-2011. Questionnaire was used to know research papers published (2007-2011) by the physicists at JNU. These papers were cross checked for originality, accuracy and completeness from web of science, Scopus, and by visiting journals online. Quantification of scientific productivity of physicists states that Satyabrata Patnaik occupies best three ranks in all categories which make him the high impact and most cited author among others. There is a variation in rankings according to different order h, g and g/h. The study helps to know the research trends of past and present scientific activities of Physicists at JNU.

Keywords- h-index, g-index, Scientific Productivity, Physicists, JNU

Paper type- Research paper

1. Introduction

Scientific productivity is the quantitative and qualitative measurement of the publications of an individual in scientific domain. There are various research output indicators (Mehta 2005) and science indicators (Rao 2010) developed as standards and review criteria to measure, evaluate and compare the scientific output and performance published in different sources and their impact on scientific discipline. These indicators are basically characterized with acceptability, feasibility, reliability, sensitivity to change and validity (Bonaccorsi & Daraio 2003) which results in increase of the qualities of authors in the area of scientific field. The scientific productivity provide information on past and present activities (Parkinson 2011) and based on it there are activity indicators (Bonilla-Calero 2008) which measures the scientific output depending upon the number of documents published per year, their document types and where communicated type i.e. pre-print or post print. The activity indicators and partial indicators (Russell & Rousseau 2011) are applied in decision making regarding science policy (Aksnes 2006) and publication based evaluation in an institution or to specifically evaluate the scientific production of a scientist or a scientific journal (Franceschini & Maisano 2011).

In order to overcome the present quality metrics used for ranking, to evaluate scientific work (Sidiropoulos, Katsaros and Manolopoulos 2006), to know the value and impact of a scientist over a scientific domain, to measure the importance and to estimate the quality of a journal, Hirsch (2005 and 2007) has proposed a pioneering metric, known as h-index for ranking of scientist and ranking of a publication which disclose the trends of research in a field. h-index (Hirsch 2005 and 2007, Bornmann & Daniel 2005 and 2007) is an indicator which is structured including number of publications, the number of citations (Onyancha & Ocholla 2009) for

measurement of similarity and dissimilarity of research published and also predicting the scientific achievement of a scientist unbiasedly. Practically, a Physicist has index h "if h of his/her Np papers have at least h citations each, and the other (Np − h) papers have no more than h citations each" (Hirsch 2005). It can be used for comparing different individuals for the same resource when scientific productivity is essential evaluation crieteria. h-index has an advantage (Egghe 2006) that it can be applied for any set of papers, ranked in decreasing order of the number of citations that they received, the h-index is the (unique) single highest number (Ball 2005; Braun, Glänzel, Schubert 2006) of significant papers that received h or more citations (Hirsch 2005). It is found that h-index is robust (Egghe 2006) in the sense that it is insensitive to an accidental set of uncited (or lowly cited) papers and also to one or several outstandingly highly cited papers. It lacks sensitivity to performance changes: it can never decrease and is only weakly sensitive to the number of citations received (Rousseau and Leuven, 2008). The use of h-index as a single indicator for the assessment of the scientific career of a researcher is not adequate (Costas and Bordons 2007), because h-index is size-dependent (Van Raan 2006). In order to overcome disadvantages (Egghe 2006) developed another Scientometric indicator known as g-index as an improvement to h-index. Egghe (2006) defined it "a set of papers has a g-index g if g is the highest rank such that the top g papers have, together, at least g2 citations. This also means that the top g + 1 papers have less than (g + 1)2 papers". The g-index is gaining popularity and visibility (Woeginger 2008; Schreiber 2008; Tol 2008) in the scientific productivity.
In the current study both h-index and g-index as research indicators have been used to quantify the scientific productivity of the physicist at Jawaharlal Nehru University (JNU).

2. Purpose and Methodology

The following study is basically conducted to evaluate scientific output and research performance of Physicists. The study is purposed to calculate total citations, self citations, average citations per item and average citation per year; to enlist ten high impact papers and most productive Physicists at Jawaharlal Nehru University (JNU). The study aims to calculate and compare scientific productivity of Physicists through h and g indices (Hirsch 2005, 2007) for 2007-2011 and to rank them accordingly.
Survey method along with questionnaire is used for data collection. The questionnaire was distributed to a total population of 18 Physicists in order to know their publications in national and international journals for the period 2007-2011. Out of the total, 14 Physicists has responded back with their list of publication works, which was further cross checked for complete bibliographical details from Web of Science, Scopus and by visiting individual journals online. Only published research papers were considered for the analysis, no article in pre-print form is included in it. After gathering complete bibliographical details, a list of citations received by individual Physicists was prepared from citation databases which include Web of Science, Scopus and Google Scholar through intranet access facility from University of Delhi. It was observed that the number of Citations vary in all the selected citation databases, which were organised and filtered to avoid duplication. Citations include research articles, books, conference proceedings and theses etc.
After the detailed study of citations received by an individual and by arranging them in descending order of their citations, h-index and g-index were calculated with the support of studies given by Hirsch (2005, 2007). Also it was made sure that best articles were only original research papers not the review articles or any other form of paper. The h-index and g-index enabled to quantify the Scientific Productivity of Physicists at Jawaharlal Nehru University, India.

The data gathered is organized and represented in tabular form and graphs. Calculations are performed with the use of Scientometric h and g indicators. Also simple percentage and Ranking method is used to achieve the qualitative and quantitative results in the study.

3. Data Analysis and Discussion

3.1 Scientometric Profile of Total Publications of Physicists

It is observed from the Table 1 that among 14 authors, Himadri B Bohidar has published highest number of papers (40) , out of the total, 22 (55%) of papers have been cited at least 1 citation for each paper. Further, it is interesting to note that Sistla Suryanaryana Murthy has published only 6 papers for the period and all of them (100%) have been cited. Most productive authors are identified with the total number of publications which are ranked accordingly.

Table 1: Profile of Total Publications of Physicists

Physicists	Total Publications (2007-2011)	2007	2008	2009	2010	2011	No. of Cited Publication (2007-2011)	Rank
Himadri B Bohidar	40	10	5	7	8	10	22 (55%)	1
Ramakrishna Ramaswamy	37	5	9	5	9	9	21(56.75%)	2
Satyabrata Patnaik	34	1	7	10	9	7	29 (85.29%)	3
Sanjay Puri	19	2	1	0	9	7	10 (52.63%)	4
Rupamanjari Ghosh	16	5	4	4	0	2	11 (68.75%)	5
Tanuja Mohanty	15	1	3	1	4	5	12 (80%)	6
Subhasis Ghosh	15	3	2	4	2	5	8 (53.33%)	6
Ashok Kumar Rastogi	14	3	4	3	2	0	8 (57.14%)	7
Kapilanjan Krishan	12	1	5	3	3	3	10 (83.33%)	8
Akhilesh Pandey	10	0	1	3	4	2	8 (80%)	9
Deepak Kumar	10	3	3	0	2	2	7(70%)	9
Brijesh Kumar	9	0	4	3	1	1	7 (77.77%)	10
Shankar Prasad Das	8	5	0	2	0	1	7 (87.5%)	11
Sistla Suryanaryana Murthy	6	0	4	2	0	0	6 (100%)	12

3.2 Citation Distribution of Scientific Productivity of Physicists

Scientific productivity is a measure of the number of highly impact papers published by an author. High impact papers gain their values with the number of citations received. More the citation rate, higher is the impact of a paper which gives significant output of an individual. If there is larger number of important papers, the higher will be the value of h in h-indices. The concept of h-index is later discussed and analysed to quantify the scientific productivity of physicists in the paper.

Table 2: Citation Distribution of Scientific Productivity of Physicists

Yr. of Publication / Author	2007	2008	2009	2010	2011	Sum of the Times Cited	Sum of Times Cited without Self-citations	Citing Articles	Citing Articles without Self citation	Average Citation Per item	Average Citation Per Year
Satyabrata Patnaik	0	2	45	74	91	212	146	171	118	212/34= 6.24	212/5 = 42.4
Himadri B Bohidar	3	9	37	54	59	162	108	138	85	162/40= 4.05	162/5 = 32.4
Ramakrishna Ramaswamy	0	20	35	48	58	161	122	130	95	161/37= 4.35	161/5 = 32.2
Rupamanjari Ghosh	6	6	16	29	36	93	70	62	45	93/16= 5.81	93/5= 18.6
Kapilanjan Krishan	2	10	18	21	23	74	67	61	54	74/12= 6.16	74/5= 14.8
Tanuja Mohanty	3	5	18	12	28	66	62	53	49	66/15= 4.4	66/5= 13.2
Brijesh Kumar	0	8	13	15	25	61	52	48	41	61/9 = 6.77	61/5= 12.2
Subhasis Ghosh	0	7	6	10	17	40	36	38	32	40/15= 2.66	40/5= 8

Sanjay Puri	2	1	7	9	19	38	29	33	24	38/19= 2	38/5= 7.6
Sistla Suryanaryana Murthy	0	1	10	9	11	31	24	31	24	31/6 = 5.16	31/5= 6.2
Akhilesh Pandey	0	0	5	7	12	24	8	24	8	24/10= 2.4	24/5= 4.8
Deepak Kumar	0	9	4	6	7	26	18	23	15	23/10= 2.3	23/5= 4.6
Shankar Prasad Das	0	4	5	1	5	15	11	14	10	15/8 = 1.875	15/5= 3
Ashok Kumar Rastogi	0	1	3	1	9	14	7	9	8	14/14=1	14/5= 2.8

From the table, it is clear that Satyabrata Patnaik is most cited author who has received highest number of citations (210) for his papers during 2007-2011 followed by Himadri B Bohidar (162) and then Ramakrishna Ramaswamy (161) whereas Ashok Kumar Rastogi has received least citations (14) in totality. Further Brijesh Kumar scores highest (6.77) for average citation per item followed by Satyabrata Patnaik (6.18) and then Kapilanjan Krishan (6.16) whereas Ashok Kumar Rastogi receives the lowest (1).

3.3 Calculating and comparing h and g indices to quantify Scientific Productivity

h-index (Hirsch 2005) and g-index (Egghe 2006) is scientific indicator to show the achievement of an individual over a period of time. Both h and g indices gives a single number incorporating both publication (quantity) and citation (quality or visibility) scores and provides information on productivity and influence of a physicist (Bornmann and Daniel 2007).

In table, citations are arranged in the descending year of publication so that the young articles have a large probability (Rousseau 2012) to belong to the Hirsch core than older ones. Physicists are also ranked according to h-index, g-index and g/h (i.e. relative increase of g with respect to h) ratio; with the help of the following ranking process high impact authors are identified.

The citations in the table are given in decreasing order of g/h (Egghe 2006). Also, it is noteworthy that the order changes with respect to h or g. Egghe (2006) has proved that g-index which has value g is 1.5 times higher than or equal to the h value of the h-index ($g \geq h$) and this is found almost true in the results depicted for the physicists.

Table 3: Calculating and comparing h and g indices to quantify Scientific Productivity

Author	h-index and Publication Year		Ranking of Physicists acc. to h-index	g-index and Publication Year		Ranking of Physicists acc. to g-index	g/h	Ranking of authors acc. to g/h
Ramakrishna Ramaswamy	8	2009	3	12	2008	2	1.5	1
Rupamanjari Ghosh	6	2008	4	9	2009	4	1.5	1
Subhasis Ghosh	4	2010	7	6	2008	8	1.5	1
Brijesh Kumar	5	2010	6	7	2008	6	1.4	2
Satyabrata Patnaik	9	2008	1	13	2010	1	1.44	2
Kapilanjan Krishan	6	2007	5	8	2010	5	1.33	3
Akhilesh Pandey	3	2010	10	4	2010	9	1.33	3
Sanjay Puri	4	2010	7	5	2010	9	1.25	4
Sistla Suryanaryana Murthy	4	2008	8	5	2008	10	1.25	4
Himadri B Bohidar	9	2007	2	11	2009	3	1.22	5
Tanuja Mohanty	6	2008	4	7	2007	7	1.16	6
Ashok Kumar Rastogi	2	2010	11	2	2010	13	1	7
Deepak Kumar	4	2007	9	4	2010	11	1	7
Shankar Prasad Das	3	2007	12	3	2007	12	1	7

From the Table 3 it is also observed that Ramakrishna Ramaswamy, Rupamanjari Ghosh and Subhasis Ghosh are ranked 1 whereas Ashok Kumar Rastogi, Deepak Kumar and Shankar Prasad Das are ranked 7 according to g/h ratio even though their order of values and ranks differ according to h and g indexes. Also Satyabrata Patnaik is ranked 1in both the orders of h (9) and g (13) indices.

Scientific productivity of individual Physicists with the help of h and g indicator is calculated further in paper. It is remarkable that these indexes do not substitute each other but that they are complementary.

3.4 Quantification of Scientific Productivity of Physicists

h and g indicators clearly differentiate between low and high productive authors. g-index is more sensitive and improved than h-index in the assessment of Physicists and provides a better position in g-index rankings than in the h-index ones (Costas and Bordons 2008). The authors here are arranged in the descending order of their h-index.

3.4.1 Scientific Productivity of Himadri B Bohidar

The Physicists Himadri B Bohidar (1st) has published highest number (40) of publications out of which 55% (22) of his papers have received 162 citations. His top two papers entitled "Mesophase separation and probe dynamics in protein-polyelectrolyte coacervates" (Soft Matter, 2007, vol.3, pp. 1064-1076) with 23 citations holds 3rd rank and paper "Structural studies of agar-gelatin complex coacervates by small angle neutron scattering, rheology and differential scanning Calorimetry" (International Journal of Biological Macromolecules. Vol.41, Iss. 3. pp. 301–307) with 17 citations is at 9th rank in list of high impact papers. He has highest h-index value (9) and third highest g-index value (11).

Table 4: Scientific Productivity of Himadri B Bohidar

Total Citations	Rank (r)	Cumulative Total Citations ∑TC	Rank Square (r^2)	Publication Year (PY)
23	**1**	**23**	**1**	**2007**
17	**2**	**40**	**4**	**2007**
15	**3**	**55**	**9**	**2007**
11	4	66	16	2008
10	5	76	25	2007
10	6	86	36	2007
9	7	95	49	2007
9	8	104	64	2007
9	9	113	81	2007
8	10	121	100	2009
7	11	128	121	2009
5	12	133	144	2010
5	13	138	169	2009
5	14	143	196	2008
4	15	147	225	2010
3	16	150	256	2009
3	17	153	289	2009
2	18	155	324	2011
2	19	157	361	2010
2	20	159	400	2007
1	21	160	441	2010
1	22	161	484	2009
1	23	162	529	2007
h-index= 9		**g-index= 11**		

3. 4.2 Scientific Productivity of Satyabrata Patnaik

Satyabrata Patnaik is most cited (1st) and highly productive authors (3rd) with 34 papers. His 85.29% (29) of papers have received 210 citations He has published largest number (5) of high impact papers among fellow physicists. Paper entitled "Substantial magnetoelectric coupling near room temperature in Bi(2)Fe(4)O(9)" (Applied Physics Letters. Vol. 92, Iss.13. 3pp. 2008) with 26 citations is at 2nd position followed by paper "Superconductivity at 11.3 K induced by cobalt doping in CeFeAsO" (Solid State Communications. Vol. 149, Iss. 5–6. pp. 181–183. 2009) with 21 citation is at 4th position and "Superconductivity in CeO1-xFxFeAs

with upper critical field of 94 T" (Physica C: Superconductivity. Vol. 469, Iss. 2–3. 2009. pp.82–85. 2009) 19 citations is at 5th position in list. With 18 citations paper, "Potassium fluoride doped LaOFeAs multi-band superconductor: Evidence of extremely high upper critical field" (Europhysics Letters. Vol. 84, Iss.5. 2008) is at 6th rank and "Magnetoelectric properties of Bi(x)Co(2-x)MnO(4) (0 <= x <= 0.3)" (Applied Physics Letters. Vol. 92, Iss. 10. pp. 02910-102910-3. 2008) with 17 citations is at 8th rank. His h (9) and g (13) index value is highest among others.

Table 5: Scientific Productivity of Satyabrata Patnaik

Total Citations	**Rank (r)**	**Cumulative Total Citations ∑TC**	**Rank Square (r^2)**	**Publication Year (PY)**
28	**1**	**28**	**1**	**2008**
21	**2**	**49**	**4**	**2009**
19	**3**	**68**	**9**	**2009**
18	**4**	**86**	**16**	**2008**
17	**5**	**103**	**25**	**2008**
15	6	118	36	2009
12	7	130	49	2009
10	8	140	64	2008
9	9	149	81	2008
8	10	157	100	2010
7	11	164	121	2010
6	12	170	144	2009
6	13	176	169	2010
5	14	181	196	2008
5	15	186	225	2008
5	16	191	256	2009
3	17	194	289	2009
3	18	197	324	2010
2	19	199	361	2009
2	20	201	400	2009
2	21	203	441	2009
2	22	205	484	2010
1	23	206	529	2007
1	24	207	576	2010
1	25	208	625	2010
1	26	209	676	2010
1	27	210	676	2010
1	28	211	784	2011
1	29	212	841	2011
h-index= 9		**g-index= 13**		

3.4.3 Scientific Productivity of Ramakrishna Ramaswamy

It is observed that Ramakrishna Ramaswamy is the second most productive author with 37 papers, out of which 56.75% (21) has received a total of 162 citations. Paper entitled "Amplitude death in the absence of time delays in identical coupled oscillators" (Physical Review E. Vol. 76, Iss.3. 2007) with 40 citations is at 1st position in list of high impact papers. Also his paper entitled "Recurrence analysis of strange nonchaotic dynamics" (Physical Review E. Vol.75, Iss.3. 8pp. 2007) is at 10th position with 16 citations. He has third highest h-index (8) and second highest g-index (12) value.

Table 6: Scientific Productivity of Ramakrishna Ramaswamy

Total Citations	Rank (r)	Cumulative Total Citations ∑TC	Rank Square (r^2)	Publication Year (PY)
40	**1**	**40**	**1**	**2007**
16	**2**	**56**	**4**	**2007**
14	3	70	9	2008
14	4	84	16	2009
13	5	97	25	2007
10	6	107	36	2010
8	7	115	49	2007
8	8	123	64	2009
7	9	130	81	2007
6	10	136	100	2008
5	11	141	121	2008
4	12	145	144	2008
4	13	149	169	2010
4	14	153	196	2010
3	15	156	225	2010
3	16	159	256	2008
1	17	160	289	2008
1	19	161	324	2009
1	19	162	361	2010
1	20	163	400	2010
1	21	164	441	2010
h-index= 8		**g-index=12**		

3.4.4 Scientific Productivity of Rupamanjari Ghosh

Out of the total, 68.75% of her publications have received 93 citations and average citation per item is 5.81 which raise the physicist to 4th rank among others. The physicist has published two most cited papers with high impact value. Paper entitled "Observation of ultra-narrow electromagnetically induced transparency and slow light using purely electronic spins in a hot atomic vapour" ((Europhysics Letters. Vol. 82, No.5. 2008) with 19 citations at 5th rank and with 17 citations for "Analysis of electromagnetically induced transparency and slow light in a hot vapor of atoms undergoing collisions" (Physical Review A. Vol. 80, Iss.2. 14pp. 2009) is at 7th. Physicist have 4th highest h(6) and g(9) index value.

Table 7: Scientific Productivity of Rupamanjari Ghosh

Total Citations	Rank (r)	Cumulative Total Citations ∑TC	Rank Square (r^2)	Publication Year (PY)
19	**1**	**19**	**1**	**2008**
17	**2**	**36**	**4**	**2009**
13	3	49	9	2010
9	4	58	16	2007
9	5	67	25	2007
6	6	73	36	2008
6	7	79	49	2009
5	8	84	64	2007
5	9	89	81	2009
3	10	92	100	2009
1	11	93	121	2011
h-index= 6		**g-index=9**		

3.4.5 Scientific Productivity of Kapilanjan Krishan

Kapilanjan Krishan has a total of 12 papers out of which 83.33% (10) papers have been cited. Physicist ranks fifth after being cited 74 times and third with 6.16 average citations per item. He has published a high impact paper entitled "Lateral stress relaxation and collapse in lipid monolayers" (Soft Matter. Vol.4. pp. 2019-2029. 2008) with 17 citations which attains 8th position in the list. Author attains 4th rank with h index value 6 and 5th rank with g-index value 8.

Table 8: Scientific Productivity of Kapilanjan Krishan

Total Citations	Rank (r)	Cumulative Total Citations ∑TC	Rank Square (r^2)	Publication Year (PY)
17	**1**	**17**	**1**	**2008**
15	2	32	4	2008
9	3	41	9	2007
9	4	50	16	2007
8	5	58	25	2008
6	6	64	36	2007
5	7	69	49	2009
3	8	72	64	2010
1	9	73	81	2010
1	10	74	100	2009
h-index= 6		**g-index=8**		

3.4.6 Scientific Productivity of Tanuja Mohanty

Tanuja Mohanty is at 6th rank both by publishing 15 articles and receiving 66 citations in totality for 80% of her papers. Physicist ranks 4th with h-index value 6 for year 2008 and 7th with g-index 7 for year 2007. Average citation per item is 4.4 again ranking physicist to 6th position. It is also interesting to note that author has 6th rank according to g/h.

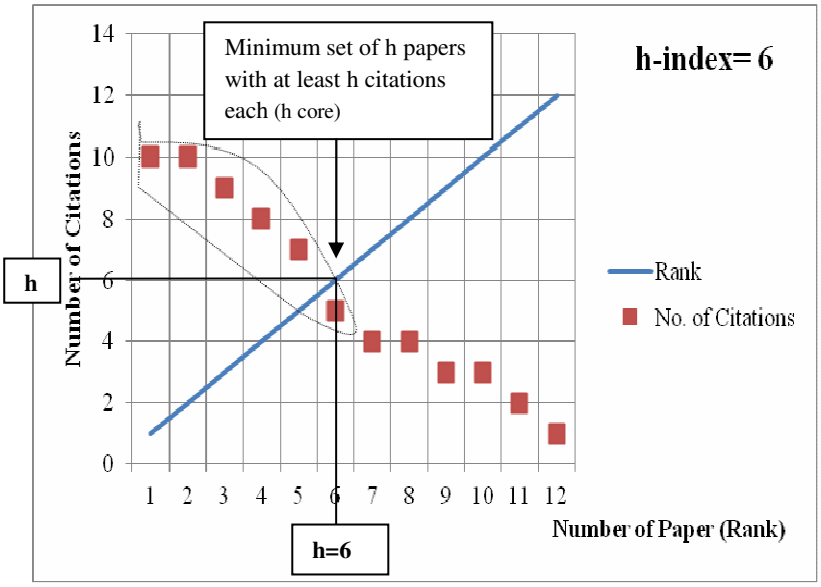

Figure 1: Graph of h-index for Tanuja Mohanty

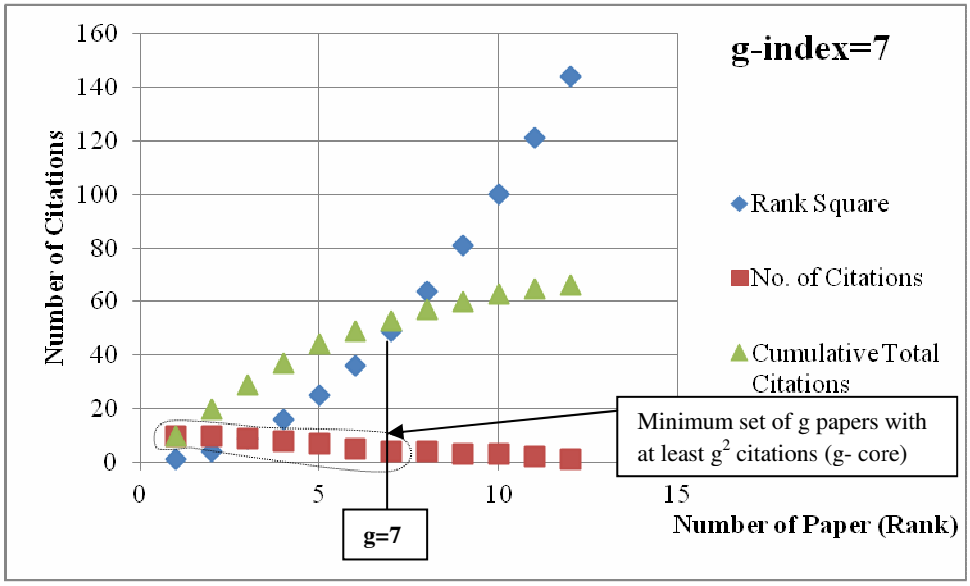

Figure 2: Graph of g-index for Tanuja Mohanty

3.4.7 Scientific Productivity of Brijesh Kumar

Out of the total, 77.77% of Brijesh Kumar's papers have been cited 61 times and ranks to 7th position. He has ranks 1st in average citations per item i.e. 6.77 which is highest among other authors. He has published a high impact paper with second rank entitled "Substantial magnetoelectric coupling near room temperature in Bi (2) Fe (4) O (9)" (Applied Physics Letters. Vol. 92, Iss.13. 3pp. 2008) with 28 citations. He has 5th rank with h-index 5 and 6th rank with g-index 7.

Table 9: Scientific Productivity of Brijesh Kumar

Total Citations	Rank (r)	Cumulative Total Citations ∑TC	Rank Square (r^2)	Publication Year (PY)
28	**1**	**28**	**1**	**2008**
10	2	38	4	2008
7	3	45	9	2009
7	4	52	16	2008
4	5	56	25	2010
3	6	59	36	2009
2	7	61	49	2008
h-index=5		**g-index=7**		

3.4.8 Scientific Productivity of Subhasis Ghosh

It is remarkable to understand that ranking varies for all authors according to different aspects. Physicist has published a total of 15 papers which ranks him 6th among others. With 53.33% of his papers receiving 40 citations raise him to 8th rank and 9th rank according to average citations per item with a value of 2.66. His h-index value (4) leads him to 7th rank and g-index value (6) to 8th rank but according to g/h he is at first rank.

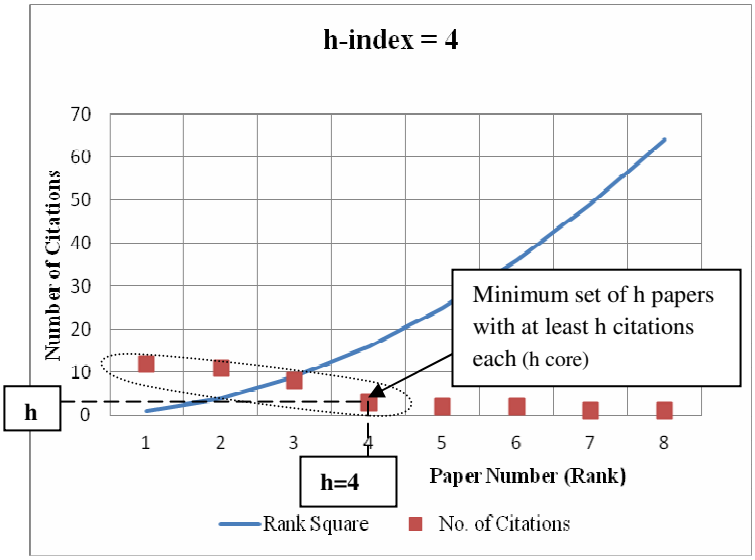

Figure 3: Graph of h-index for Subhasis Ghosh

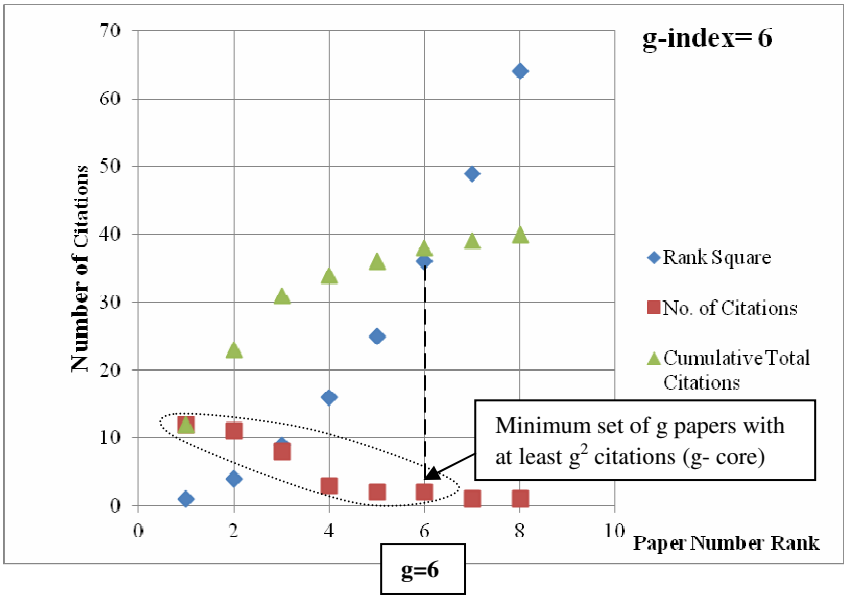

Figure 4: Graph of g-index for Subhasis Ghosh

3.4.9 Scientific Productivity of Sanjay Puri

Scientific productivity of Sanjay Puri makes him fourth highly productive author with 19 papers, out of which 52.65 % (10) receives a total citation of 38 and according to it he is at 9th rank. His average citation per item is 2, which lowers his position to 12th rank. It is clear from the graphs that Sanjay Puri has h-index of 4 (seventh rank); g-index of 5(ninth rank) and according to g/h he ranks 4th among others.

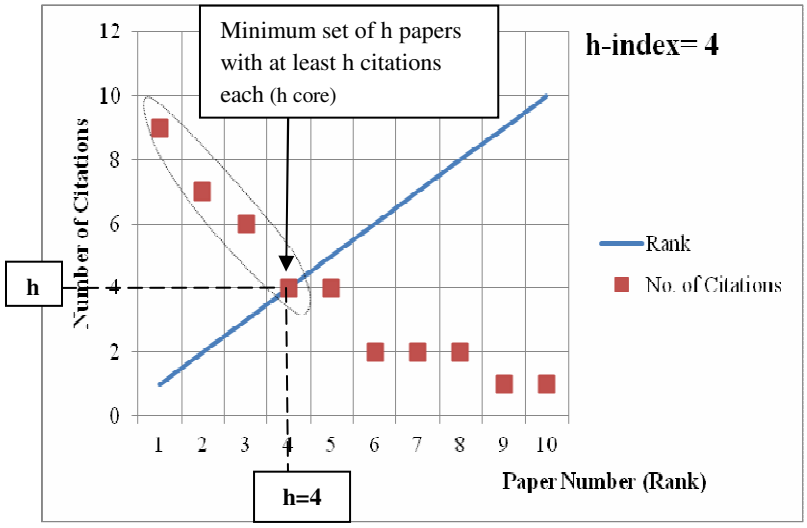

Figure 5: Graph of h-index for Sanjay Puri

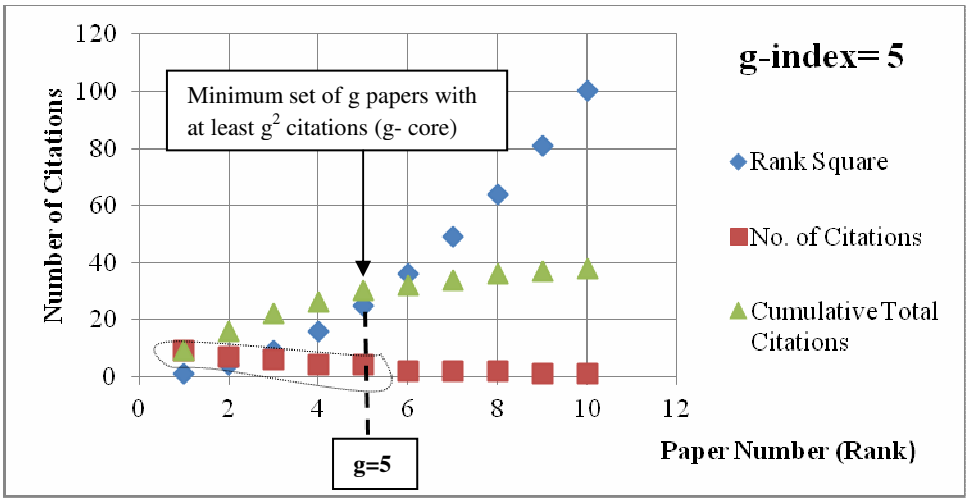

Figure 6: Graph of g-index for Sanjay Puri

3.4.10 Scientific Productivity of Sistla Suryanaryana Murthy

Sistla Suryanaryana Murthy is only physicist whose all of the paper have been cited completely i.e. he has published 6 papers in total for the period and all of his 6(100%) papers have received 31 citations making him 10th in the ranking and according to average citation per item (5.16) he ranks 5th among others.

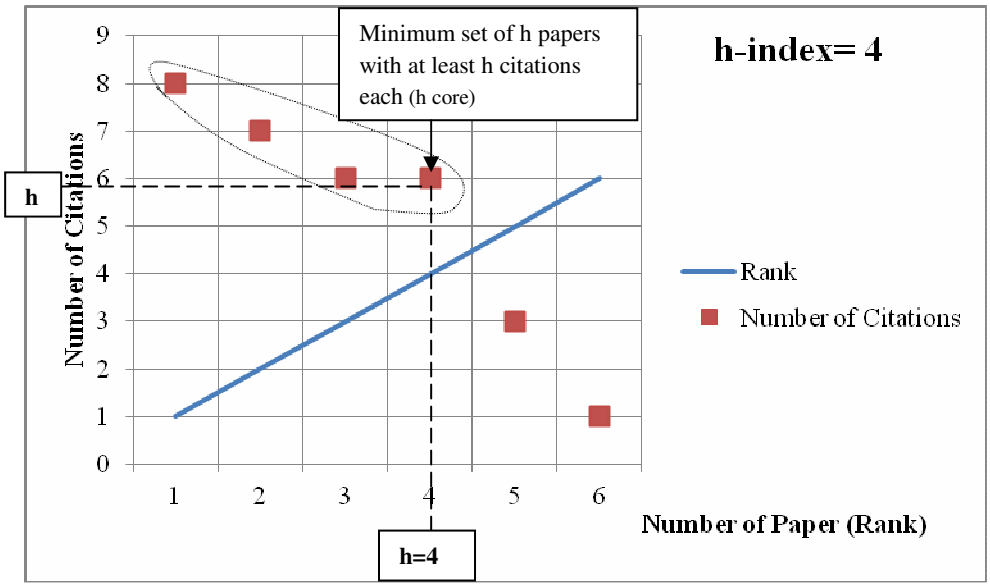

Figure 7: Graph of h-index for Sistla Suryanaryana Murthy

From the both the figures, it is clear that SS Murthy has h-index 4 and is 8th among others, whereas according to g-index value (5), rank is 10th but g/h raise him to a higher rank of 4 among others.

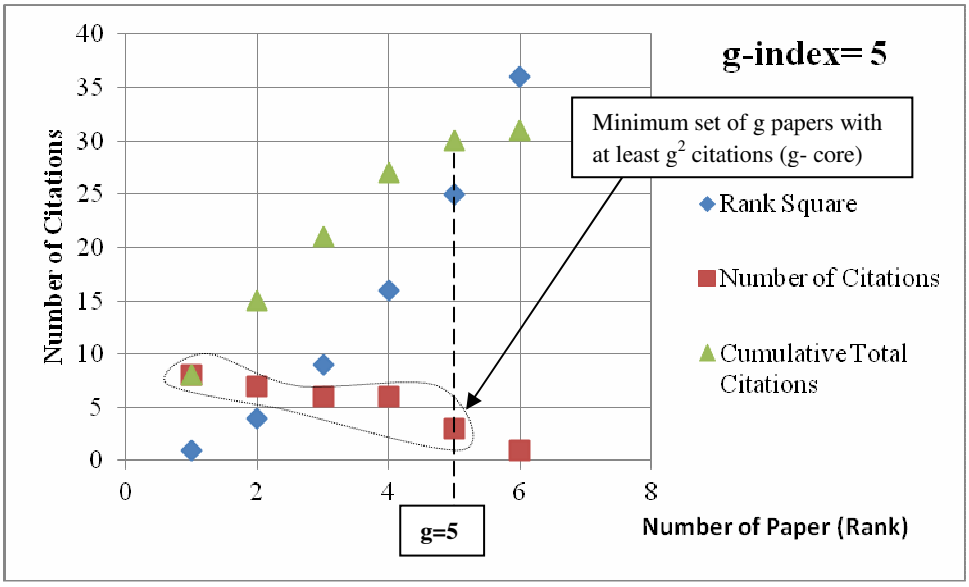

Figure 8: Graph of g-index for Sistla Suryanaryana Murthy

3.4.11 Scientific Productivity of Deepak Kumar

Deepak Kumar has published 10 papers (9th rank), out of which 70% of them has received 26 citations ranking him to 12th position and according to average citation per item (2.3), its 11th rank. h-index (9th rank) and g-index (11th rank) has same value (4). Further g/h which is 1 raise him to 7th rank.

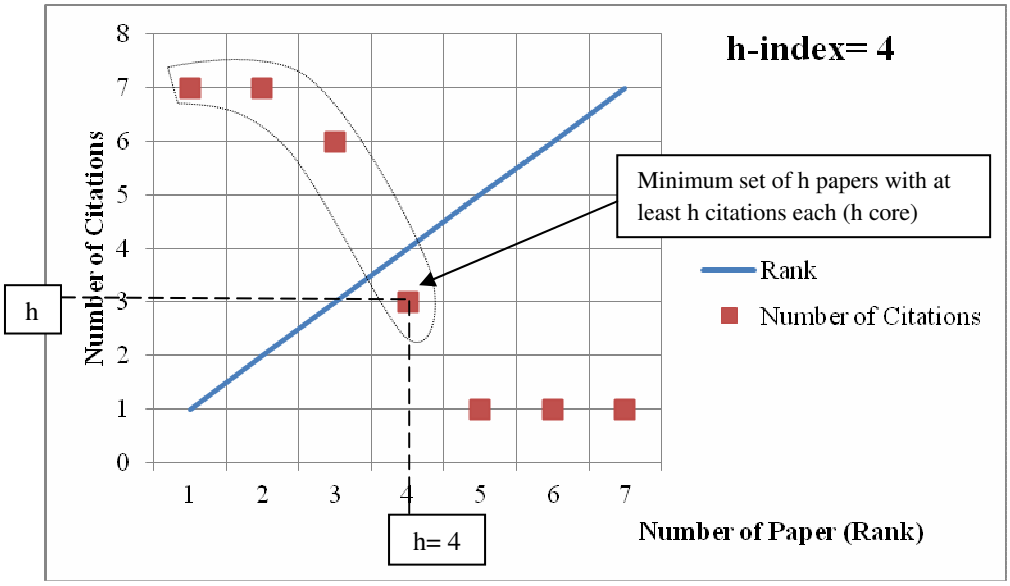

Figure 9: Graph of h-index for Deepak Kumar

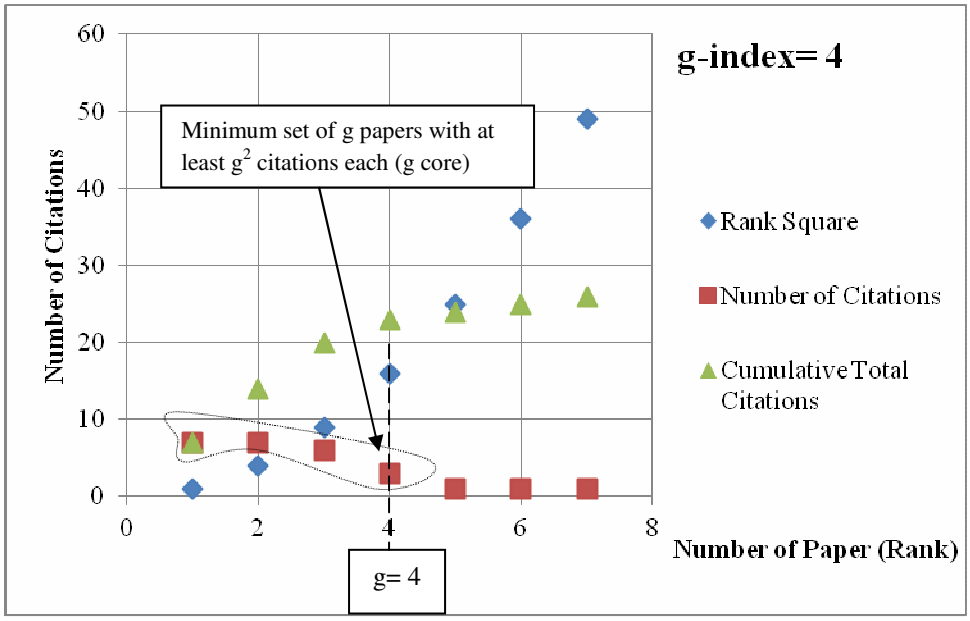

Figure 10: Graph of g-index for Deepak Kumar

3.4.12 Scientific Productivity of Akhilesh Pandey

The physicist Akhilesh Pandey has a total of 10 papers (9th rank), out of which 80% of them has received 24 citations in the period raising him to 11th and according to average citation per item (2.4) he is at 10th rank which is quite lowest among others. According to g/h (1.33), rank 3rd which is greater in comparison to others and from value of h-index (3) its 10th and g-index (4) raise it to 9th rank which is again lower among others.

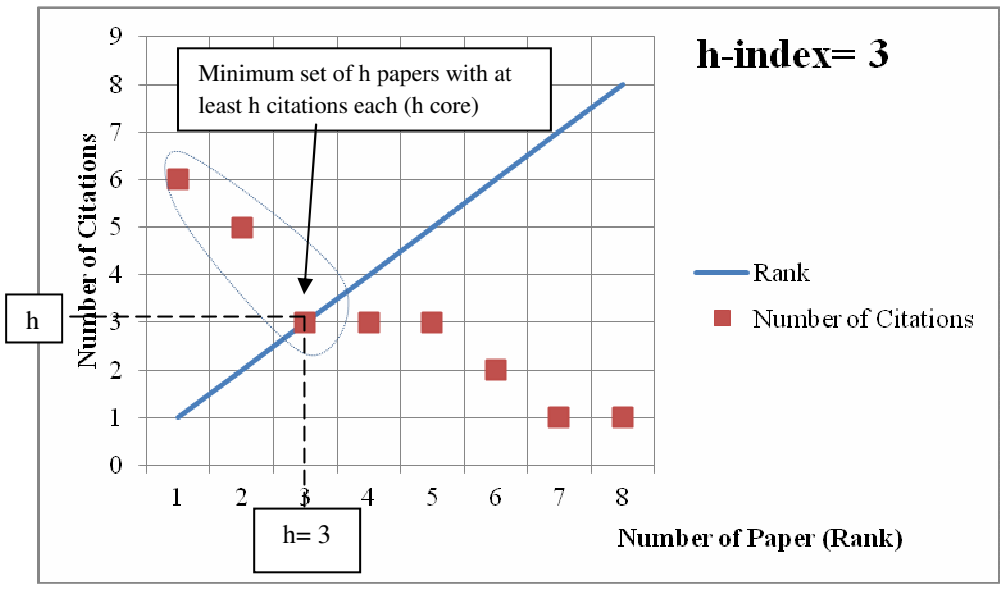

Figure 11: Graph of h-index for Akhilesh Pandey

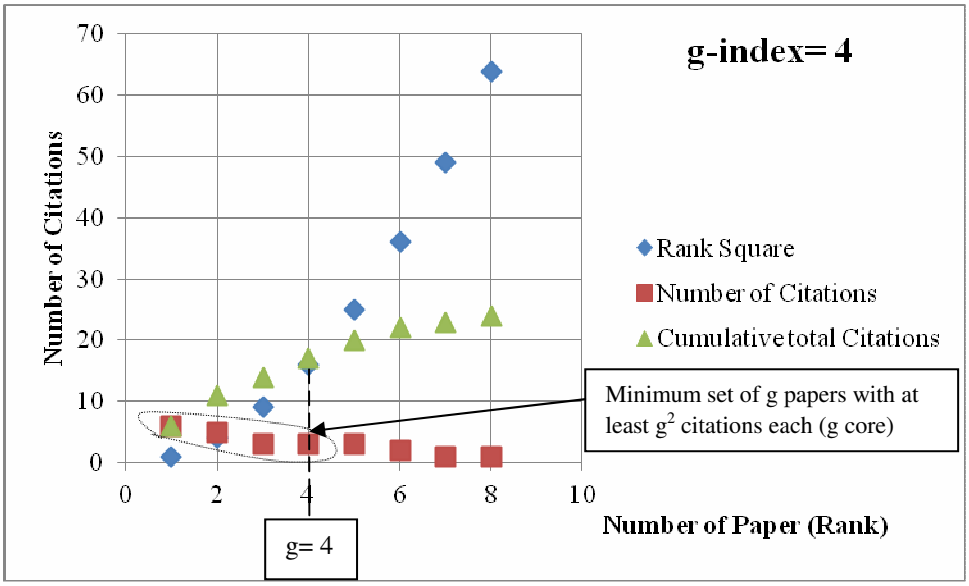

Figure 12: Graph of g-index for Akhilesh Pandey

3.4.13 Scientific Productivity of Shankar Prasad Das

The Physicist has published only 8 papers (11th rank) out of which 87.5% (9) has received only 15 citations (13th rank) and average citation per item is 1.875 which is 13th highest among others. It is interesting to note that here g=h=3 (which proves that value of $g \geq h$) in the same year 2007 and both raise to same rank of 12th position.

Table 10: Scientific Productivity of Shankar Prasad Das

Total Citations	Rank (r)	Cumulative Total Citations ∑TC	Rank Square (r^2)	Publication Year (PY)
5	1	5	1	2009
3	2	8	4	2007
3	3	11	9	2007
1	4	12	16	2009
1	5	13	25	2007
1	6	14	36	2007
1	7	15	49	2007
h-index=3		**g-index=3**		

3.4.14 Scientific Productivity of Ashok Kumar Rastogi

Ashok Kumar Rastogi has published a total of 14 articles (rank 7th) out of which 57.14 % (8) have received only 14 citations and is ranked 14th among others. According to average citation per item (1), he ranks 14th. h (11th rank) and g (13th rank) indices value for the Physicist is 2. According to g/h ratio, his rank is 7th which is lowest among others.

Table 11: Scientific Productivity of Ashok Kumar Rastogi

Total Citations	Rank (r)	Cumulative Total Citations ∑TC	Rank Square (r^2)	Publication Year (PY)
3	1	3	1	2010
2	2	5	4	2010

2	3	7	9	2010
2	4	9	16	2008
2	5	11	25	2008
1	6	12	36	2011
1	7	13	49	2008
1	8	14	64	2007
h-index=2		**g-index=2**		

5. Ranking of Physicists from various Scientific Indicators

From the graph and table, the ranking and scientific productivity of an individual physicists is presented. It is found that each physicists holds a different ranking according to different indicator.

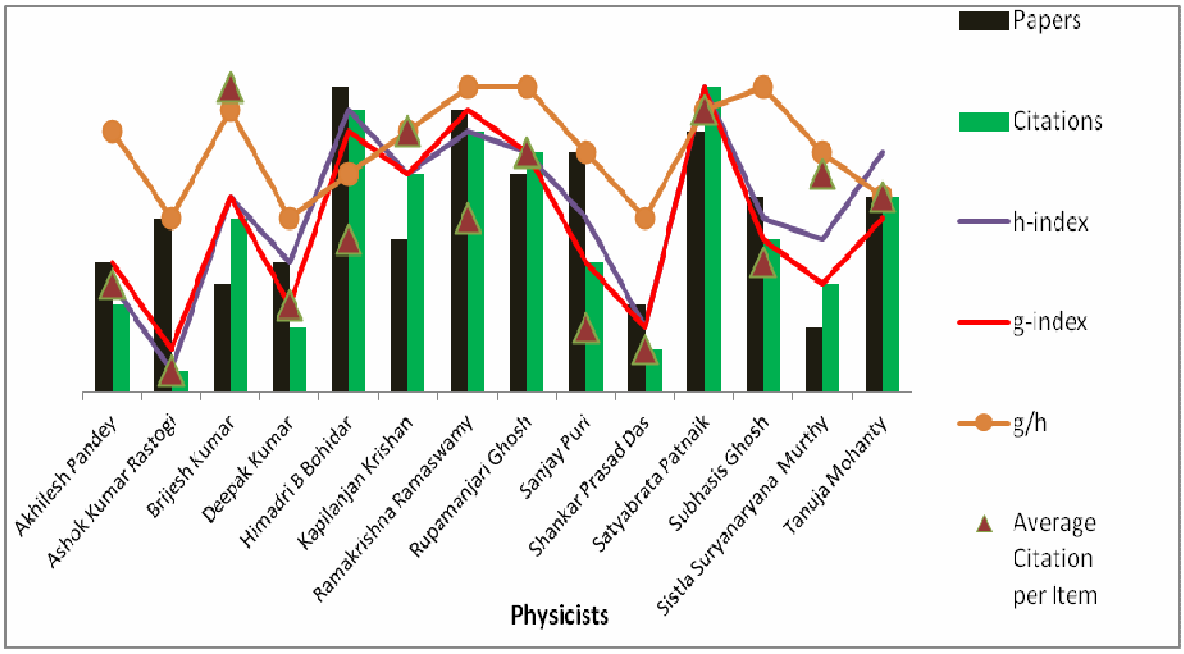

Figure 13: Graphical Presentation of Ranking of Physicists for Scientific Productivity

From the Table it is clear that Himadri B Bohidar has published highest number of papers and takes the first rank followed by Ramakrishna Ramaswamy (second rank) and then Satyabrata Patnaik is at third Rank. Further it is noted that Satyabrata Patnaik has most highly cited author who has received maximum citations and stands at first rank followed by Himadri B Bohidar who is at second rank and then Ramakrishna Ramaswamy at third rank. Average citation per item yields a different result and ranking among the physicists, according to it Brijesh Kumar is at first rank, and Kapilanjan Krishan is at third rank even though they both have not published highest number of papers and has not received maximum citations whereas Satyabrata Patnaik holds the second rank as per the indicator.

According to h-index indicator, Satyabrata Patnaik is at first rank followed by Himadri B Bohidar at second rank and then Ramakrishna Ramaswamy at third rank. Next, according to g-index again Satyabrata Patnaik secures the first rank followed by Ramakrishna Ramaswamy (second rank) and then Himadri B Bohidar (third). g/h indicators presents a different view of ranking among authors, according to it Ramakrishna Ramaswamy, Rupamanjari Ghosh and Subhasis Ghosh is at first rank followed by Brijesh Kumar and Satyabrata Patnaik (second rank) and then Akhilesh Pandey and Kapilanjan Krishan (third rank).

Table 12 : Ranking of Physicists

Physicists	Ranking					
	Papers	Citations	Average Citation per Item	h-index	g-index	g/h
Akhilesh Pandey	IX	XI	X	X	IX	III
Ashok Kumar Rastogi	VII	XIV	XIV	XI	XIII	VII
Brijesh Kumar	X	VII	I	VI	VI	II
Deepak Kumar	IX	XII	XI	IX	XI	VII
Himadri B Bohidar	I	II	VIII	II	III	V
Kapilanjan Krishan	VIII	V	III	V	V	III
Ramakrishna Ramaswamy	II	III	VII	III	II	I
Rupamanjari Ghosh	V	IV	IV	IV	IV	I
Sanjay Puri	IV	IX	XII	VII	IX	IV
Shankar Prasad Das	XI	XIII	XIII	XII	XII	VII
Satyabrata Patnaik	III	I	II	I	I	II
Subhasis Ghosh	VI	VIII	IX	VII	VIII	I
Sistla Suryanaryana Murthy	XII	X	V	VIII	X	IV
Tanuja Mohanty	VI	VI	VI	IV	VII	VI

From all the ranking status, it is generalized that 'Satyabrata Patnaik' occupies best three ranks in all categories which make him the 'high impact author' among other Physicists at JNU.

6. Conclusion

Quantification of scientific productivity of active physicists is done in the above study with the help of their total papers, total citations, average citation per item, by calculating h and g indices and g/h ratio and ranking them accordingly. Theoretical and practical application of h and g indices is performed. It is found from the above results that both the Scientometric and h-g indicators complement each other as both helps to know the best paper and high impact author. Further g-index as an improvement to h-index (Schreiber, 2008) is studied. It is seen that value of $g \geq h$ (almost 1.5 times greater) in the analysis where papers are arranged in descending order of their citations such that minimum set of g papers have at least g2 citations each (g core).

The high impact papers (represented by citations in bold in tables) are also found and ranked accordingly under each author. It is observed that Satyabrata Patnaik has maximum number of high impact papers and is most cited and one of the high impact physicist working in his field followed by Ramakrishna Ramaswamy with second highest papers and third highest citations

corresponding to first rank according to g/h and Himadri B Bohidar is the third most high impact author with second highest citations but have highest number of papers. It is seen that h and g index provides the appropriate rank and value to the citations received by paper of an individual. There is a variation in rankings according to different order h, g and g/h. Similar studies can be conducted for a evaluating the life time achievements of an individual in various scientific discplines.

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