APPLICATION OF P INDEX TO EVALUATE THE RANKING OF PRODUCTIVE AUTHORS IN MALAYSIA

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ABSTRAK

Suatu pendekatan bibliometrik yang baru, yang dihuraikan dari perspektif analogi Termodinamik diuji untuk menilai prestasi penerbitan karya saintifik.. *P* indeks, yang dihitung sebagai $p = X^{1/3} = (iC)^{1/3} = (c / pC)^{1/3} = (c^2 / p)^{1/3}$, di mana C ialah bilangan petikan yang diterima dan *P* jumlah penerbitan, telah dikira untuk 499 penulis palingproduktif diMalaysia. Dua *rank* berdasarkan indeks *p*yang baru dan indeks *h*yang diterima secara meluas telah dikenal pasti dan dibandingkan. Kepentingan perbezaan diantara kedua-dua indeks telah dikaji. Kes tertunggak di mana *p* indeks menunjukkan prestasi yanglebih baik daripada *h* indeks telah diketengahkan.Penulis paling produktif, bidang atau subjek kajian dan universiti paling produktif di Malaysia telah dikenal pasti. Analisis statistik telah digunakan keatas *ranked datap* nisbah *h*, yang mencirikan perbezaan antara kedudukan berdasarkan h indeks dan *p*indeks.Keputusan kajian ini menunjukkan bahawa *p*-indeks memberi perwakilan yang lebih baik dari segi keseimbangan antara pengukuranproduktiviti dan impaknya.Kajian seperti ini adalah satu usaha dalam penyiasatan indeks *p* atau petunjuk prestasi yang telah dicadangkan oleh Prathap pada tahun 2010. Konsep analogi antara cawangan fizik iaitu, mekanikal dan elektrikal, kinetik, termodinamik dan bidang scientometric telah diambil, dan ia seolah-olah menjadi satu gabungan ilmu yang sangat menarik. Tanggapan bahawa pengukuran bibliometrik yang standard sebagai tenaga yang dibawa setiap kertas, membolehkan kita beroperasi dengan nombor-nombor ini dengan cara yang baru.Memandangkan cara pengukuran output saintifik merupakansatu isu semasa, ia dianggap amat penting bahawa indeks prestasi yang digunakan selain indeks*h* memiliki ciri-ciriyang eksklusif.

ABSTRACT

This particular research aims to investigate the *p*-index or performance indicator proposed by Prathap in 2010. The concept of analogy between such branches of physics as mechanical and electrical physics, kinetics, thermodynamics and scientometric field was assumed, and it seems to be an incredibly interesting consilience. Perceiving standard bibliometric measures as an energy which each paper carries, allow us to operate with these numbers in a new way. P index, which is calculated as $p=X^{1/3}=(iC)^{1/3}=(c/pC)^{1/3}=(c^2/p)^{1/3}$, where C is the total number of citations received and P is the total number of publications, were computed for 499 top productive authors affiliated with Malaysian institutuions, who were retrieved from Web of Science Database. Two ranks based on the newly proposed *p* index and widely accepted and well-known *h* index were identified and compared. The significance of the difference between the two indexes was examined. Outstanding cases where *p* index performs better than *h* index were highlighted.Top productive authors, subject areas and universities in Malaysiaare identified. Statistical analysis was applied to the ranked data of ratio *p* to *h*, which characterizes the difference between ranks based on *h* index and *p* index.It is shown that *p*index has better representation in terms of balance between measure of productivity and impact.Contributing to the current issue of how scientific output can be measured, it is assumed to be of great importance to introduce a performance index with exclusive properties to be used instead of the *h*-index.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Micro level measurement of research performance in evaluative bibliometrics, which is considered as a level of an individual scientist is problematic (Cole, 1989), but the extreme importance in providing such evaluation of the scientists cannot be denied, even though there are some difficulties that need to be overcome.

Therefore a question arises as to the basic reason why it is so problematic to evaluate the individual scientist's productivity and performance. The reason is that sufficient amount of publication output must be produced in manageable and reasonable time interval in order to obtain statistically reliable indicators, research productivity, publication numbers, and citation impact, which are not necessarily correlated variables (W. Glänzel, 2006b). Despite the difficulties, due to scarce resources, the quantification of scientific performance is really important for evaluation and comparison purposes to inform funding or tenure decisions (Ball, 2005; Hirsch, 2005).

In 2005, Hirsch (2005) proposed "the index $\boldsymbol{h}$, defined as the number of papers with citation number $\geq \boldsymbol{h}$, as a useful index to characterize the scientific output of a researcher.…A scientist has index $\boldsymbol{h}$ if $\boldsymbol{h}$ of his or her $\boldsymbol{N_p}$ papers have at least $\boldsymbol{h}$ citations each and the other ($\boldsymbol{N_p}$–$\boldsymbol{h}$) papers have $\leq \boldsymbol{h}$ citations each".It was developed by Hirsch to characterize, by means of a single number, both the productivity and the impact or influence of the scholar. Being practically simple and easy in obtaining and calculating, the h-index was eagerly accepted by scientists. This measure is used in decision making process for awarding grants and allocation of research funds, predicting potential candidates for Nobel Prize. "Thomson Reuters Institute for Scientific Information (ISI) uses citation metrics …as one indicator

among others to predict Nobel prizewinners" (Braun, Bergstrom, & Frey, 2010). "As well as determining membership of scientific societies, Hirsch suggests that the method could inform funding or tenure decisions" (Ball, 2005). So far, there has not been other substitute approved by the scientific community.

However, there aresome disadvantages of h-index which were summarized by Bornmann, et al., (2011) as follows - it is field-dependent, it may be influenced by self-citations, it does not consider multi-authorship, it is dependent on the scientific age of a scientist, it can never decrease, and it is only weakly sensitive to the highly cited papers.

Attempts to improve existing h-index or to discover a substitute are currently being undertaken. One of the recently proposed approaches is taken to be tested in this research.

1.2 Background of the study

Currently scientists are seeking for scalar single number measure or indicator to assess scientist's contribution. *Scalar* means the number which can be easily subjected to arithmetical operations such as addition, subtraction and multiplication, without distortion of results' meaning. In contrast to *vector* which has not only meaning but direction as well. So we cannot easily add meanings of two vectors. In bibliometric this can be illustrated by the case, when author A cited author B in a critical way, but author B still gets additional citation count, hence his citation indicator grows.

Yet, Costas & Bordons, (2007) found that h-index is highly correlated with the absolute number of publications and citations, which again proves its field dependence, also they pointed out that there is a need to include the other dimensions in the analysis of research performance of scientists and address the risks of relying only on the h-index. Bornmann, et al., (2011) have conducted the first meta-analysis of studies that computed correlations between the h-index and 37 different variants of the h-index that have been

proposed and discussed in the literature up to 2010. A high correlation between the h-index and its variants indicated that the h index variants hardly provided additional information than the h-index.

Despite this meta-analysis results, this study attempts to test the thermodynamic approach which is proposed by Prathap, (2010e). It is the latest theory and it is not covered by Bornmann's analysis. Although, no single researcher has supported Prathap's (Prathap, 2011b) theory, it seems this theory may be justified and it calls for more systematic review before it is rejected.

Prathap's theory states that each paper has Energy, let *e* be its denotation, which calculated as $e=c^2$, where *c* is number of citation, received by this particular paper.

Energy is the capacity of a physical system to performwork. Energy exists in several forms such asheat,kineticor mechanical energy, light,potential energy, electrical, or other forms.According to the law of conservation of energy, the total energy of a system remains constant, though energy may transform into another form. Two billiard balls colliding, for example, may come to rest, with the resulting energy becoming sound and perhaps a bit of heat at the point of collision (Jones, 2012).

Full Energy of author can be calculated as a sum $\sum_{i=1}^{n} c_i^2$, $X=iC$, where $i=C/P$, where *C* – total number of citations and *P* - total number of publications.$p=X^{1/3}$isthe performance indicator, where $X=iC$,$i=C/P$, where *C* – total number of citations and *P* - total number of publications.

He has been criticized by number of scientists such as Leydesdorff & Opthof, (2011) and Franceschini & Maisano, (2011) who assert that analogy with thermodynamic is just a consilience, and that there are many more special conditional factors in thermodynamic, and their equivalents cannot be found in bibliometric, such as temperature,

pressure, mass and others. Some other indicators were proposed instead such as Integrated Impact Indicator (I3) and Crown indicator.

Leydesdorff & Opthof, (2011) tells that unlike Prathap's scalar measures (Energy, Exergy, and Entropy or EEE), the Integrated Impact Indicator (I3) is based on non-parametric statistics using the percentiles of the distribution. This different approach takes into account not only ratio and scale of the sample, but the shape of distribution as well. Crown Indicator was introduced by the Centre for Science and Technology Studies (Opthof & Leydesdorff, 2010) at Leiden, and it was actually the first attempt of practicing normalization mechanism, and hence known as the CWTS approach. Prathap (2011b) gives a comprehensive overview of all indicators development in his paper, where he says that ''crown indicator'' is a variation of Schubert & Braun, (1986) RCR = MOCR/MECR. The other general name for this approach among researchers is "add-divide" method and its calculation sequence is following: all citations to the unit's publications should be counted and added together. Afterwards, all the world citation averages that correspond to the selected publications with respect to document type, publication year and research area should be added together. Finally, the sum of citations should be divided by the sum of world averages. This was challenged by Opthof & Leydesdorff, (2011), who proposed an alternative "divide-add" approach. In response to this, a new crown indicator was introduced by CWTS: the mean normalized citation score (MNCS) (Waltman, et al., 2011). Bornmann, et al., (2011) summed this up very neatly that both old and new crown indicators suffer from the weakness that all the operations are based on arithmetic averages of ratios or ratios of arithmetic averages (Bornmann, et al., 2011). As citation data is highly skewed, this will not lead to robust measures. Instead, Bornmann, et al., (2011) extend an earlier idea to calculate a single number measure for the citation impact that is not based on the arithmetic average but uses reference distributions based on the calculation of

percentiles. An expected value (EV) is then proposed but, this is an overall quality proxy and not a proxy for total performance. Leydesdorff & Opthof, (2011) make the same observation.

But Prathap, (2010e) insists on the successful application of Exergy approach in bibliometrics. He came up with this theory through a number of other suggested indicators such as mock h-index, p-index, composite indicator and Expected Value. It was found that "where the sample size is large (e.g., the scientific performance of 233 countries) and the values of citations and papers are also very large, the mock h-index and the original h-index are virtually indistinguishable" (Prathap, 2010e).

Another example is given by Prathap, (2010b) where he analyzed author productivity for six fellows elected in 2006 to the Royal Society. It was shown that p-index or Exergy was differ from h-index in favor of scientists who got much more citations than the number of paper he has published.

According to Bornmann & Marx, (2011) further studies are needed to examine the significance of the h index in different fields of application. According to Mingers, (2008) some priorities for future related studies are:

- Validity of the h index in large and diverse groups of researchers;
- Comparability of the h index across and within social sciences;
- Validation of the h index by more sophisticated bibliographic analyses.

1.3 Problem statement

Up to now h-index remains the only indicator of the extent of scientific performance. Furthermore, it is no longer being used as a measure of scientific achievement for single researchers only (Glänzel, 2006a). The index is alsobeing used to measure the scientific output of research groups (Van Raan, 2006) andcountries (Csajbók, et al., 2007).

This measure is used in decision making process for awarding grants and allocation of research funds, predicting potential candidates for Nobel Prize. “Thomson Reuters Institute for Scientific Information (ISI) uses citation metrics …as one indicator among others to predict Nobel prizewinners” (Braun, Bergstrom, & Frey, 2010).

So far, there is no other substitute approved by the scientific community, meaning that they have not actively started to use any other indicator. Currently, h index is automatically calculated by tools which are available at Web of Science, Scopus and Publish or Perish service.

It is stressed that the h-index is yet not perfect, in case when citation count of one paper significantly exceeds the total number of paper. Another potential distortion factor could be found in a high self-citation rate. Furthermore, h-index can never be more than the number of papers and once high mean of h-index is reached, researcher can leave all his or her worry because h-index will never decrease. Like other bibliometric measures, the h index depends on the length of an academic’s career, and it should be used for comparing researchers of similar age (Bornmann & Marx, 2011). On the other hand Exergy is showing current state of author activity and it allows to represent scientist’s activity in many ways – including chronologically.This study is needed to carry out to contribute the development of scientific measures.

1.4 Objectives of the Study

The main purpose of the present study is to apply the Thermodynamic approach to count Exergy which is a substitute of h-index to bibliometrically analyse author productivity in Malaysia, who has been publishing from 1980 till 2011.

The 31-year data is harvested from Web of Science database, which provided the necessary data to support a bibliometric study. Hence, the objectives of this study are to

(1) rank the top productive scientists in Malaysia by counting their h-index, average citations per paper and p index;

(2) compare the ranks by *p*index and *h*index and find out the if there is any difference in ranks;

(3) find out distribution of top authors publications within specific subjects' areas based on *p* index and *h* index;

(4) identify top productive subject areas by number of publications;

(5) identify top productive universities by number of publications;

(6) identify distribution of publications within the period of study from 1981 to 2011.

1.5 Research Questions

The research questions follow the objectives of the study:

(1) Who are top productive scientists in Malaysia based on their publication input in Web of Science (WOS)?

(2) What is the difference between top 50 author productivity rank based on *p* index and *h*index?

(3) Is *p* index really more accurate and more robust index rather than *h* index?

(4) Who are the top authors in specific subject areas based on *p* index and *h* index?

1.6 Significance of the Study

Scientific dispute is going on about significance of the approach based on formula derived from Thermodynamics, which was newly proposed by Prathap, (2011e). Majority of the authors consider his discovery as a consilience. Like Franceschini & Maisano,

(2011)analysed “the analogy between the evolution of thermodynamic and bibliometric systems, showing many ambiguities and inconsistencies, which are the inevitable result of some dubious assumptions at the foundations of the model. … [they] recognize to Prathap the merit of having proposed a fascinating (potential) connection between two worlds (i.e. thermodynamics and bibliometrics) that are apparently so different”. Leydesdorff & Opthof, (2011) state that the expression *Energy – Exergy = Entropy* is invalid the specification of a meta-physical analogon of the “temperature.”

However, in his following paper Prathap, (2011g) has given explanation and ensured “that unlike conventional thermodynamics,there is no need to define a temperature term, and so entropy here has the same units asenergy and exergy.”

Test of this thermodynamic approach will reveal the practical results of its application. Moreover, there has not been any research in the use of Energy index in examining author productivity pattern in Malaysia.

This research study aims to applyPrathap’s method of Energy concept – not only limited to data from Malaysia but to be generalized to the field of bibliometrics and scientific productivity measures.

1.7 Scope and limitation of the study

Sample of Malaysian authors are chosen by a set of search limitations. All available bibliographic details such as number of publications, citation count, *h*index for each author are harvested from the Web of Science database. As Glänzel, (2003) noticed that publication activity in longer observation periods is greater than in short periods since publication activity is cumulative process, data will be taken starting 1980 till 2011.

Full Energy of author can be calculated as a sum $\sum_{i=1}^{n} c_i^2$, $X=iC$, where $i=C/P$, where C – total number of citations and P - total number of publications.$p=X^{1/3}$is the performance indicator.

1.8 Summary

Research articles are the main mediator of the research communication. Such standard bibliometric indicators as a number of publications and number of citations remain the only measures to be operated in a process of scientific output evaluation. The number of citations received by each scientific product can be perceived as an extent of this product consumption. Thus, it is still a significant question: 'what is the best way to operate standard bibliometric measures in process of scientific performance assessment?'

This chapter introduced the background of this study, use and application of traditional *h* index and newly proposed *p* index. The research objectives were identified in order to answer research questions.

The following chapter reveals an in depth review of the literature to explain the meaning and also presents previous research on *p* index.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Research is an engine of progress at any time. Since *h index* was proposed by Hirsch in 2005, there has been a lot of discussion about how useful it is in evaluation of scientific output. The h-index has captured the imagination of scientometricians and bibliometricians to such an extent that one can now divide the history of the subject virtually into a pre-Hirsch and a post-Hirsch period (Prathap, 2010e). The most obvious measure available is the bibliographic record of a scientist or research institute - that is, the number and impact of their publications (Bornmann & Daniel, 2009). Different ways of operating these bibliometric measures are proposed in trying to find the best and fairest way to evaluate the scientist's performance and it still remains aquestion that different scientists are trying to solve by developing and proposing different h index compliments and substitutes.

Considering only recent papers, the so called first comparative and analytical review of h-index and its variants was published in 2008 (Bornmann, Mutz, & Daniel, 2008), another two comprehensive reviews of studies related to h-index and its variants were done before almost at the same time in 2009 by Panaretos & Malesios, (2009) and Alonso, et al., (2009), and one more and the latest comprehensive first meta-analysis of 37 indices was conducted by Bornmann, et al., (2011) in 2011.

In this chapter the review of studies that were undertaken to investigate h index and its properties is given, as well as its advantages, disadvantages are discussed. The variety of different application options are described. Other alternatives which were proposed to either compliment existing h index, or to substitute it are reviewed. Also the current and

update state of h-index research, which were not covered by the above mentioned studies, or by any other, is given.

Discovery of h-index brought many changes to the scientific world. Panaretos & Malesios, (2009) reports that the UK government has decided to change the way and concept of research assessment by involving bibliometric metrics rather than peer judgment, what can lead to methodological change in popular world rankings such as the Academic Ranking of World Universities published by the Shanghai Jiao Tang University (SJTU), the THES-QS World University Rankings published by the Times Higher Education supplement and Quacquarelli Symonds (THES). Furthermore, Adler, et al., (2008) expressed his disagreementthat the research is too important and complicated to be measured by only single "coarse tool".

2.2 What exactly is h-index?

H index or Hirsch index was proposed by physist Hirsch in 2005 as a measure of scientific performance among physicians. "A scientist has index h if h of his or her N papers have at least h citations each and the other (Np −h) papers have ≤h citations each" (Hirsch, 2005). It was eagerly accepted among not only physicians, but other scientists as well, to replace by single number indicator such standard bibliometric indicators as the number of publications, the average number of citations and the sum of all citations, citation per paper rate and number of highly cited papers.

Firstly, it was criticized by Lehmann et al, (2008) that "Hirsch assumes an equality between incommensurable quantities. An author's papers are listed in order of decreasing citations with paper i having C(i) citations. Hirsch's index is determined by the equality, h = C(h), which posits an equality between two quantities with no evident logical connection" (Lehmann et al, 2008).

But later on it was shown by few studies (Bornmann & Daniel, 2007; Bornmann, Wallon & Ledin, 2008) that there is a correlation between number of papers and number of citations. Also Bornmann & Daniel, (2009) in his paper gives an overview of the current state of *h*index research. Only 4 studies were done which were trying to find out if there is any correlation between *h* index and peer judgments. Bornmann & Daniel, (2005) and Bornmann, Wallon, & Ledin, (2008) found that *h*index doesn't have any strong correlation with peer judgments, but others Van Raan, (2006) and Lovegrove & Johnson, (2008) did found a correlation!

2.2.1 Advantages of h-index

Panaretos& Malesios, (2009) and Alonso et al., (2009) agree that among the advantages of *h* index are its simplicity in computation and verification using ISI Web of Science and its robustness. Vanclay, (2007) also has mentioned the robustness and it insensitivity to a set of lowly cited papers. It means that just an increase in the number of publications does not improve the *h* index.

Panaretos & Malesios,(2009) thinks that it is an advantage that it is not affected by single papers that have many citations and that h index encourages researchers to produce high quality work. It is interesting that other authors consider it as a disadvantage of *h*index, what will be discussed in the section 2.2.3.

Alonso,et al., (2009) reports that Costas & Bordons, (2007) called this indicator "objective" and it "performs better than other single-number criteria commonly used to evaluate the scientific output of a researcher (impact factor, total number of documents, total number of citations, citation per paper rate and number of highly cited papers)". Table 2.1 describes disadvantage of commonly used indicators which are overcome by *h* index.

Table 2.1. Disadvantages of standard bibliometric indicators which are overcome by *h* index. Adopted from Hirsch, (2005)

N	Indicator	Advantage	Disadvantage
1	Total number of papers (N_p)	measures productivity	does not measure importance or impact of papers
2	Total number of citations ($N_{c,tot}$)	measures total impact	- hard to find and may be inflated by a small number of "big hits," which may not be representative of the individual if he or she is a coauthor with many others on those papers. - $N_{c,tot}$gives undue weight to highly cited review articles versus original research contributions.
3	Citations per paper (i.e., ratio of$N_{c,tot}$toN_p)	allows comparison of scientists of different ages	hard to find, rewards low productivity, and penalizes high productivity.
4	Number of "significant papers," defined as the number of papers with >y citations	eliminates the disadvantages of above mentioned criteria and gives an idea of broad and sustained impact	$y$is arbitrary and will randomly favor or disfavor individuals, and$y$needs to be adjusted for different levels of seniority.
5	Number of citations to each of the q most-cited papers	overcomes many of the disadvantages of the criteria above	It is not a single number, making it more difficult to obtain and compare. Also,$q$is arbitrary and will randomly favor and disfavor individuals.

Errors in citation databases tendto occur in the lower citation portion of a researcher's scientific production which tends not to affect to the computation of the h-index. He also states that being the h-index an integer, it avoids the false impression of precision conveyed by the three decimal points in the ISI impact factor.

2.2.2 Disadvantages of *h*index

Almost the same advantages and disadvantages of h-index are consistently repeated from paper to paper. Panaretos & Malesios, (2009), Bornmann & Marx, (2011) and Alonso, et al., (2009) pointed that one of the main disadvantage is that *h* index is limited by number of publications. It means that if number of received citations is growing it will never affect on *h* index as long as number of publications remains the same. This disadvantage is closely related to another one such as scientist's age or career length's dependence.

Another disadvantage is that *h* index is extremely field dependent indicator. Bornmann & Marx, (2011) added that this disadvantage is shared by "most pure citation measures". By field dependence we mean that there is a tendency of *h* index to be much more higher in a such scientific fields where number of total publications is very big in general, rather than in other fields where not so many papers are produced.

Furthermore, *h* index can be manipulated by self-citations, what can provoke "changes in the publishing behavior of scientists" when scientist started to chase numbers. Alonso, et al., (2009) has mentioned few authors such as Schreiber, (2007) and Vinkler, (2007) who suggest to exclude self-citations in calculating process, but he think that after this such feature as its simplicity in calculation will suffer. But as databases are been developing consistently as well, this couldn't be a big problem. Currently such databases as Web of Science and Scopus provide self-citation count and h-index is calculated without self-citations.

Precision problem which is mainly caused by "homograph" cases, which implies existence of number of authors with the same names. Existing software tools which are built in such databases as Web of Science or Scopus are not able to guaranty 100 % precision. There is no such an encoded algorithm yet to provide ability to distinguish different scientists with exactly the same names.

Panaretos & Malesios, (2009) and Alonso, et al., (2009) pointed that highly cited papers are disregarded and sensitive. As Egghe, (2006) said that "once they [highly cited papers] are selected to belong to the top h papers, it is unimportant the number of citations they receive. So called a bias towards highly cited papers".

Also Panaretos & Malesios, (2009), and Alonso, et al., (2009) stated as that "research performance is a complex multifaceted endeavour that usually cannot be assessed adequately by means of a single indicator", and "it can lead to the detriment of doing more quality work, by focusing on numbers only."

Other disadvantages which are mentioned by Alonso, et. al. (2009) are "less predictive accuracy" and "precision" than the simpler measure of mean citations per paper; Also*h* index is calculated differently by different databases, which cause precision problem as well.

Bornmann & Marx, (2011) also mentioned such critical points of *h* index as existence of many other flexible indicators for research evaluation, difficulties in finding reference standards, limitation by applying it for comparing best scientists only. They state that "its power for distinguishing amongst average scientists is not acceptable."

Another disadvantage, which demands special attention, is that*h* index is not dynamic. Theoretically, it can grow even if no new paper is published, but never decrease. Also if number of publications is growing the *h*index is not necessary growing as long as citations are not receiving.

Combining publication and citation rates in one index is sometimes criticized. "The problem is that Hirsch assumes equality between incommensurable quantities. An author's papers are listed in order of decreasing citations with paper *i* having $C(i)$ citations. Hirsch's index is determined by the equality, $h=C(h)$, which posits equality between two quantities with no evident logical connection" (Lehmann, et al., 2008).

Finally, direction of the citation is not taken for consideration. It happens that citation can be done in a critical way, so the negative citations can still affect positively on the general rank of the researcher.

2.2.3 Some Comments on Disadvantage and Advantages Review

Some controversy among scientists can be seen regarding the advantages and disadvantages of *h*index. For example, Costas and Bordons (2007) consider *h* index as an objective indicator rather than peer review, because it is depends on numbers only, but not on subjective opinion of experts. But Panaretos & Malesios, (2009), Alonso, et al., (2009) and Martin, (1996) state that research is too complicated to be evaluated by the only single number "coarse tool". Another contradiction is rooted in what kind of publication behaviour*h* index can cause. Alonso, et al., (2009) reports that Purvis, 2006; van Raan, 2006; Zhivotovsky & Krutovsky, 2008) state that manipulation with self-citations can provoke scientist to start to chase numbers only disregarding high quality research, and Panaretos & Malesios, (2009) in contrast think that it conversely will encourage researchers to produce high quality work.

Despite all the drawbacks described above the use of *h* index has been greatly extended. Currently it is calculated automatically by most main scholar database, such as Web of Science, Scopus, Google scholar. There different condition of its usage like fee-based and free of charge, and different databases calculate different means of bibliometric indices. Full review of comparative studies upon existent databases is given by Alonso, et al., (2009). Drawbacks which are shared by all of them are mentioned.

2.2.4 Application of h-index

It becomes so popular that application of *h* index has extended to the scale of countries' research performance evaluation. It is now being also discussed to use h-index instead of Journal Impact factor. Alonso, et al., (2009) gave a comprehensive review of all the studies which were conducted from the different *h*index usage's aspects.

It is used to assess scientific performance not only individual scientists, but research groups, organizations, institutions, journals and even countries. It was generalized that *h*index can be applied to any level of aggregation. Also attempt was taken to adopt *h* index in assessment of scientific topic's interest.

2.3 What are other substitutes of h index which were proposed?

Discussing all the advantages and disadvantages, a number of scientists are continuously proposing new indicators, new formulas, and new ways of calculating metrics to measure or evaluate scientific performance. Bornmann, et al., (2008) pointed the most important variants but criteria he followed to justify which of them are the most significant are not mentioned. Probably decision is based on the previous review. List of taken variants are presented in the Table 2.2. He determined after the series of statistical calculation that each of the proposed variant can go under the one of the two identified categories – one is the type which describes most productive core and another one – the impact of the papers in the core. Statistical calculation includes factor analysis, where he found two factors ("quantity of productive core" and "impact of productive core"), which were taken as an independent variables and peer judgment was taken as a dependent variable for the following regression analysis.

Table 2.2. Definitions of the *h* index and its variants

Index	Definition	Creator	What was it meant to do?
h index	"A scientist has index *h* if *h* of his or her N_p papers have at least *h* citations each and the other ($N_p - h$) papers have fewer than $\leq h$ citations each"	(Hirsch, 2005)	To combine in a single number quantity and impact of the scientist's output
m quotient	*h/y* where *h*=*h*-index, *y* = number of years since publishing the first paper	(Hirsch, 2005)	To avoid a bias towards more senior scientists with longer careers and more publications.
g index	"The highest number *g* of papers that together received g^2 or more citations"	(Egghe, 2006)	The aim is to avoid effect that "once a paper belongs to the top *h* papers, its subsequent citations no longer 'count' " (Harzing, 2007) But Alonso (2009) reports its ability to be increased significantly if one paper received high number of citations as its drawback.
*h(2)*index	"A scientist's *h*(2) index is defined as the highest natural number such that his *h*(2) most-cited papers received each at least $[h(2)]^2$citations"	(Kosmulski, 2006)	Reduces the precision problem (Database issue)
a index	$\frac{1}{h}\sum_{j=1}^{h} cit_j$ where *h* = *h* index, cit = citation counts	(Jin, 2006)	The *a* index indicates the average number of citations of publications in the Hirsch core
m index	The median number of citations received by papers in the Hirsch core (this is the papers ranking smaller than or equal to *h*)	(Bornmann, Mutz & Daniel, 2008)	Variant of *a* index
r index	$\sqrt{\sum_{j=1}^{h} cit_j}$ where *h* = *h* index, cit = citation counts	(Jin, 2007)	Hirsch core
ar index	$\sqrt{\sum_{j=1}^{h} \frac{cit_j}{a_j}}$where *h* = *h* index, cit = citation counts, a = number of years since publishing	(Jin, 2007)	Aimed to avoid favoring scientists who have stopped publishing because the *h* index can never decrease over time;

Index	Definition	Creator	What was it meant to do?
h_w index	$\sqrt{\sum_{j=1}^{r_0} cit_j}$ where cit = citation counts, r_O = the largest row index j such that $r_w(j) \leq$ city	(Egghe & Rousseau, 2008)	Similar with *ar index*

Below are some other variants which were not covered by Bornmann, Mutz & Daniel, (2008) review but under Alonso, et al., (2009) review:

- hg index hg=$\sqrt{\mathrm{h} * \mathrm{g}}$(Alonso, et al., 2010);
- h_a-index (Van Eck & Waltman, 2008);
- the normalized h-index (Sidiropoulos, Katsaros, & Manolopoulos, 2007);
- Tapered h-index (Anderson, Hankin, & Killworth, 2008);
- Rational h_{rat}-index by (Ruane & Tol, 2008);
- Contemporary and trend h-index (Sidiropoulos, et al., 2007);
- Dynamic h-index by (Rousseau & Ye, 2008);
- H_m-index by (Schreiber, 2008);
- h_I-index (Batista, Campiteli, & Kinouchi, 2006);

Some other modifications which are mentioned by Panaretos & Malesios, (2009):

- w index (Wu, 2008);
- The i×ci index or Maxprod index by (Kosmulski, 2007);
- The t- and f-indices (Tol, 2009);
- h index for journals (Braun, Glänzel, & Schubert, 2006);
- The impact index h_m for journals/institutions (Molinari & Molinari, 2008);
- The successive h-index (Schubert, 2007);
- *h* index co authorship correction (Batista, et al., 2005);

- The h-b index for topics or compounds. To measure how much the scientific topic interesting is. (Banks, 2006);

Some other indices explored by (Bornmann, et al., 2011):

- *h* index to assess networks (Schubert, Korn, & Telcs, 2009);

Some other new indices are being consistently proposed like *j* index by Todeschini, (2011).

Panaretos & Malesios, (2009) states that despite many other new indices were proposed and many practical application of *h*index were conducted, mathematical and statistical properties and behavior of it were not investigated deeply and that there is lack of studies in literature exploring mathematical and statistical properties and behavior of *h*index.

2.4 Methods used to compare other h-index variants with original h-index

Egghe, (2006) compiled three different rank of the still active Price medalists for their complete careers up to 1972, based on *h*index, gindex, and on the ratio g to h (g/h), to be visually and subjectively observed. He made an attempt to show the difference, howeverthere was no statistical analysis applied.

Bornmann, et al., (2011) presented the first meta-analysis of studies that computed correlations between the h index and 37 different variants of the h index, that have been proposed and discussed in the literature. This meta-analysis included 135 correlation coefficients from 32 studies. The results of a three-level cross-classified mixed-effects meta-analysis show a high correlation between the h index and its variants. It means that the h index variants hardly provide added information to the h index. There is redundancy between most of the h index variants and the h index. The lowest correlation coefficients

with the h index are found for the h index variants MII and m index. Hence, these h index variants make a non-redundant contribution to the h index.

2.5 The thermodynamic paradigm and p-index

2.5.1 Thermodynamic paradigm

Firstly Prathap, (2010e) proposed another mock h index which supposed to compliment the h-index and give it better resolving power, especially in cases when researchers have the same h-index but different citations and publications distribution. There is no arithmetical or mathematical operation applied to calculate h –index, but as Prathap, (2010e) reported,scientists found that ratio of total number of Citation to total number of Publications (ratio C to P) can be a quality measure which expresses the impact.

As Prathap, (2010e) asserted the impressive result of Schubert & Glänzel's, (2007) study is that both theoretical considerations and empirical analysis points to a strong correlation between $\boldsymbol{h}$ and $\boldsymbol{x^{a/(a+1)}P^{1/(a+1)}}$ with $\boldsymbol{x}$ being the ratio of total citations to total publications ($x=C/P$). Apparently, a similar *composite indicator* based on ratio of total number of Citation to total number of Publications for journal impact was already suggested in 1978 by Lindsey, (1978) even before the Hirsch-index was introduced. It was called The Corrected Quality Ratio (CQ) is then defined as $\boldsymbol{CQ = (C/P)*(C*P)^{1/2} = (C^3/P)^{1/2}}$. In his subsequent research study, after investigating its properties, Glänzel, (2008) came up with the new *composite indicator* $h = cn^{1/3}x^{2/3}$, where $\boldsymbol{h}$ is the ***h-index***, $\boldsymbol{n}$ is the number of papers, $\boldsymbol{x}$ is the mean citation rate per paper and $\boldsymbol{c}$ is a positive constant. This formula was rewritten by Csajbók, et al., (2007) as $\boldsymbol{composite\ indicator = (C^2/P)^{1/3}}$, after he has found that $c=0.932$ which close to 1 and can be just skipped. Thus *Composite indicator* was obtained as follow $h= cn^{1/3}x^{2/3}=0.932P^{1/3}(C/P)^{2/3}=(PC^2/P^2)^{1/3}=(C^2/P)^{1/3}$.

Despite initially Glänzel, (2008) warned that *composite indicator* "is not intended to substitute h-index", Prathap, (2010e) suggested it to be treated as a substitute or mock h-index and p-index in future. In his paper Prathap, (2010e) looked at four different cases, where h index is the same but distribution of C and P is different, and he found out that mock h index gives better picture and more precise rank, considering length of the publication's "tail" and height of citation's "core".

In further research Prathap, (2011b) introduced the new term to be used in scientometric – Exergy, which calculations are actually the same as Glänzel, (2008) and Csajbók, et al., (2007) model, but the concept and perception of formulas are different, and very new and very interesting. Prathap, (2011b) defines an *energy* like term which shall be called *exergy, X = iC,* where *i* is a measure of quality, expressed as the ratio of total citations *C* to total papers published *P*. The thermodynamic paradigm leads further to concepts of *energy (E)*, and *entropy (S)*. Thus he came up with the *p index* which is calculated as a third root of *Exergy* ($p=X^{1/3}$). He states that *p index* is "more meaningful, if not more accurate, single number scalar indicator of a scientist's performance while entropy then becomes a measure of the unevenness (disorder) of the publication portfolio. Neither, P nor C (which are quantity measures), nor i (a quality measure), nor even the popular h-index, can serve this purpose." The new perspective of Schubert & Glänzel's model is in a parallel between Scientometric and other branches of Science such as Mechanical, Electrical, and Thermodynamical physics. The conceptual analogy of scientometrics and other branches of physics is presented in Table 2.3.

Table 2.3. Comparative understanding of the bibliometrics–thermodynamics consilience linking energy/exergy to quality and quantity through the quasity term. Prathap, (2011e)

Analogies	**Quality**	**Quantity**	**Quasity**	**Energy/exergy**
Moment definitions	Quality	‘‘Zeroth’’ moment	First moment	Second moment
Mathematical operations	Quality	Quantity	Quality x Quantity	Quality x Quality x Quantity
Mechanical	Velocity	Mass	Momentum	Energy
Electrical	Current	Resistance	Voltage	Power
Scientometric	Impact	Papers	Citations	Energy/exergy

In subsequent paper, after he put a parallel from kinetics, Prathap, (2011f) coined a new term Quasity to complete his proposal of Energy concept.

The following paper was logically expected, because normalization across different research fields is the issue, which is shared by any of existing h-index substitutes. In this paper Prathap, (2011e) gives explanation of normalization process. Normalization is a distinguish quite big issue which is not covered by this study, therefore, very briefly it can be explained as an attempt to universalize h-index to be applicable to any field of study, no matter how big is the number of publications in there, and to give the opportunity to compare scientists from different fields. So Prathap, (2011e) asserts that Exergy indicator is already normalized.

2.5.2 Studies on practical application of p-index

This section describesstudies, where practical application of newly proposed p-index or Exergy concept were applied. In Prathap, (2010e) the rank of the country scientific indicators of 233 countries in the SC Imago Journal & Country Rank developed from the

information contained in the Scopus database (Elsevier B.V.) was built , based on p-index. Here we can see that this theory can be applied on country level, meaning that it has aggregative property.

In another work Prathap, (2011b) has illustrated the opportunity of Thermodynamic approach to present nicely the scientific portfolio of the researcher from three different perspective, specifically “the time-series, event-series and phase diagram representations of his [researcher’s] bibliometric progress”.

One more interesting application consist of sport performance evaluation, where Prathap, (2011f) successfully applied thermodynamic approach based ranking for the results of Asian games in Guangzhou. It is shown that this approach might be a universal tool for any area where performance should be evaluated.

Also Prathap, (2010a) applied the performance index (p-index) to rank 100 most prolific economists. This sample was taken from a study conducted byTol, (2009). It was shown again that the p-index strikes the best balance between activity (total citations C) and excellence (mean citation rate C/P). As Prathap, (2010a) state it was remarkable that Robert F. Engle rises effortlessly to the top when p-index was used. The h-index is not able to do this because his output of 83 papers restricts his h-index to a low value although his mean citation rate is the highest in this list. Only the p-index captures this well.

Based on the Exergy concept Prathap, (2010c) proposed another way to graphically represent research performance of journal for the purpose of its evaluation. Three-dimensional landscape maps are suggested to be used, where dimensions are an impact (i), citations (C) and the product of impact and citations, which leads to an energy term (E). In his paper Prathap, (2010c) applied this iCE mapping approach to classify 100 Chemical Engineering Journals using Article Influence and Eigen factor, where it was shown that*E*factor is a very simple and reliable measure of prestige or prominence of a journal. In

the following study Prathap, (2010d) repeated the method but he applied it for country level. In the following year Nishy, et al., (2011) applied the same concept to analyse performance of the leading research institutes in India. In all three instances it was shown that iCE mapping is a nice and visually convenient way to represent prestige or impact of an item which can be either journal, institution or country.

One more advantage of p-index illustrated by Prathap, (2011d) in a case study, where he showed that the analogy with Energy measure allows *p-index* to be calculated in a two different ways - fractional and harmonic counting. Abstracting from the mathematical explanations, by simple words it means that *p-index* can evaluate particular researcher's scientific output considering total number of authors and their position a co-authorship raw for each paper he has contributed to.

Being based on the use of an energy like measure, it is not difficult to derive the fractional value of $p_f = ((C_f)^2/P_f)^{1/3} = (C_f.C_f/P_f)^{1/3}$. This need not be arranged in a ranking order according to descending number of citations, and can be left in chronological, or any other sequence. If for each paper placed at serial number i, the number of authors is a_i, then the author is given a fractional credit $r_i = 1/a_i$ and therefore to r_i papers and $r_i c_i$ citations. Thus, the fractional total for papers and citations taking into account multiple coauthorship is simply $C_f = \sum r_i c_i$ and $P_f = \sum r_i$. The fractional value of p_f then follows automatically. In harmonic counting, credit is given according to authorship rank and and number of co-authors. The j_{th} author where the number of authors is a_i, is given a weighted credit $r_i = (1/j)/(1 + (1/2)\cdots (1/a_i))$. Then the allocation of citations and publications to the scientist follows the same logic, i.e. $C_h = \sum r_i c_i$ and $P_h = \sum r_i$. The harmonic value of p_h then follows. The case study was done by Prathap, (2011d) where he has illustrated this advantage and usefulness.

Prathap, (2010b) also took a special look at such disadvantage of h index as limitation by number of publications. Two samples were taken for this study, one is theoretical set given by Vinkler, (2007) and the second is the sample which consisted of six real Fellows elected in 2006 to the Royal Society presented in Anderson, Hankin, & Killworth, (2008) study. The author computed p-index or mock h-index, h-index and tapered h-index for both of the samples and compared them from the perspective of mentioned above disadvantage. It was shown that mock h-index or p-index performs better than others.

2.6 Normalization

Another closely related question is the process of *normalization*. Such drawback of h-index as a research field dependence cause the need of normalization to allow measure to be applicable in any branches of science no matter how many publications are producing there, to develop really universal measure. Currently as Prathap, (2011a) reported there are two main camps which are discussing the process of normalization of citation count – CWTS (crown indicator) and Leydersdorff& Opthof's, (2011) way using percentile. In another paper Prathap, (2011c) showed how thermodynamic analogy can contribute to the percentile ranking normalization process, meaning not normalizes directly, but assists in it.

2.7 Summary

As Garfield, (2012) says that it is quite often that authors would say that it was not necessarily their most important papers, received high number of citations. Nowadays we can observe how the concept of citation indexing has evolved from a system of information retrieval to a tool for research evaluation. There is a risk that scientist's behaviour can

change towards chasing the numbers only, but not performing high quality research. Risk of "tail is wagging the dog" effect as Garfield, (2012) assumed may occur.

Panaretos & Malesios, (2009) reported that "authors argue strongly against the use (or misuse) of citation metrics (e.g., the impact factor or the h-index) alone as a tool for assessing quality of research, and encourage the use of more complex methods for judging scientists, journals or disciplines, that combine both citation metrics as well as other criteria such as memberships on editorial boards, awards, invitations or peer reviews". Also it is mentioned that there is still "the lack of mathematical and statistical analysis on the properties and behaviour of the h-index", (Panaretos & Malesios, 2009).

Bornmann & Daniel, (2009) warn that despite all the studies described above provide confirmation of the h index's validity, it will require more time and research before it can be used in practice to assess scientific work".

From the literature review, the issue can be seen and few assumptions regarding probable properties of p index which might surpass some disadvantage of h index are made. The issue is a lack of practical application of p index upon the bigger samples, following by further comparison with h index. Assumptions are that the p-index might overcome such disadvantages of h-index as limitation by number of publications, scientist's age or career length's dependence. Also the field-dependence disadvantage may be probably solved. Highly cited papers may not be suffered from this index as well.

This particular research attempts to investigate p-index or performance indicator which was proposed by Prathap in 2010. The reason why this indicator was picked to be explored is that it is not covered by any other practically applied studies or reviewed before. Another reason is that the concept of analogy between such branches of physics as Mechanical and Electrical and Scientometric field was assumed, and it seems to be an

incredibly interesting consilience. Perceiving standard bibliometric measures as an energy which each paper carries, allow us to operate with these numbers in a new way.

Being very hot issue how to measure scientific output, it is assumed to be of great importancethat performance index which was proposed by Prathap, (2010e) to be used instead of h index possesses exclusive properties. And the analogy which was assumed and parallels which were put between such research fields as mechanical and electrical physics, kinetics, thermodynamic, and bibliometrics has lead the researcher one more time to the idea that everything in this world obey to the laws of nature.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter describes the source, and the methods employed in the collection, handling and analyzing the information and measurement of the statistical data to analyze researcher's publication productivity in Malaysia and the test of the application of *p*-index in its evaluation.

3.2 Research method

Scientometrics can be defined as the measurement of scientific and technical research activity. Bibliometrics is a branch of scientometrics that focuses principally on the quantitative study of scientific publications for statistical purposes. Bibliometric methods serve three main functions, i.e. description, evaluation, and scientific and technological monitoring. As a descriptive tool, bibliometrics provides an account of publishing activities at the level of countries, provinces, cities or institutions, and is used for comparative analyses of productivity. The data can then be used to assess the performance of research units, as a complement to standard evaluation procedures. Bibliometric data are also used as a benchmark for the monitoring of science and technology, since longitudinal studies of scientific output help identify areas of research that are developing or regressing (Gauthier, et al., 1998)

Bibliometric indicators remained the only robust measures which can be used in describing and assessing the state of scientific productivity.

Bibliometric indicators can be subdivided into two major categories: descriptive indicators and relational indicators having an analytical function. Listings of papers and

citations, listings of patents and the citations they contain are examples of the most current descriptive indicators. They measure the volume and impact of research at various levels. When they are used over prolonged periods of time, they provide a means of identifying trends. Enumeration methods are based on calculations of the number of scientific publications that can be attributed to one actor in a given area. This may be an author, an institution, a sector of activity covering several institutions (universities, public laboratories, industries) or even a geographic area (city, province, country). A research area can be aggregated at the level of one scientific discipline or of one sub-discipline, one technology or even one specific technological niche.

Descriptive indicators can be applied to publications and patents depending on whether the analysis deals with scientific output or with technological output.

Co-author analysis is the most frequent relational indicator. It helps identify links and interactions between the actors of national and international systems of science and technology. Such interactions constitute the flow of knowledge. The methods known as co-word analysis and co-citation analysis are also relational indicators. They provide a picture of scientific activity based on the content of publications. Such indicators help monitor changes in science and technology and identify emerging research topics and the relevant contributors.

In this study descriptive indicators will be applied to understand picture of author productivity in Malaysia. The study relies on data contained in a database named Web of Science as a source of data, due to the fact that it covers the period of the years under the study and has features that provide relevant information needed for a informetric study of this nature.

The objectives of the study are to:

(1) rank the top productive scientists in Malaysia by counting their h-index, average citations per paper and p index;

(2) compare the ranks by *p* index and *h* index and find out the if there is any difference in ranks;

(3) find out distribution of top authors publications within specific subjects' areas based on *p* index and *h* index.

3.3 Datasets

All articles and reviews indexed with Malaysia as an affiliation country from year 1980 to 2011 serves as the sample for this study. The study examines a 31 year period in the publication of scientists who affiliated with any Malaysian institution, which is considered appropriate, to looking at long term publication activity and because h-index is accumulative indicator. The data were retrieved from Web Of Science. The numbers of records retrieved by 17/01/2012 for the purpose of this study were 58407 comprising 39612 articles and 1133 reviews and other types of documents.

Full records data from the citation report of top 499 productive authors with Malaysia as an affiliation country from year 1980 to 2011 were retrieved. h-index calculated by WOS was gotten for each author.

For the p-index calculation only, due to the big number of papers which were written under the research group collaboration with more than 30 co-authors, all research groups were excluded and limitation was settled by top productive universities. The list of top productive universities is presented in table 3.1.

Table 3.1 List of 25 top productiveuniversities

N	Institutions	Status	Achronym	Record Count
1	UNIVERSITY MALAYA	governmental	UM	10815
2	UNIVERSITY SAINS MALAYSIA	governmental	USM	8990
3	UNIVERSITY PUTRA MALAYSIA	governmental	UPM	6091
4	UNIVERSITY KEBANGSAAN MALAYSIA	governmental	UKM	4621
5	UNIVERSITY TEKNOL MALAYSIA	governmental	UTM	1764
6	MULTIMEDIA UNIVERSITY	private	MMU	1342
7	UNIVERSITY TEKNOL MARA	governmental	UiTM	920
8	INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA	governmental	IIUM	781
9	MONASH UNIVERSITY	private	MONASH	667
10	UNIVERSITY MALAYSIA SABAH	governmental	UMS	496
11	UNIVERSITY MALAYSIA SARAWAK	governmental	UNIMAS	478
12	UNIVERSITY TEKNOL PETRONAS	private	UTP	389
13	UNIVERSITY NOTTINGHAM	private	UNiM	366
14	INTERNATIONAL MED UNIVERSITY	private	IMU	319
15	UNIVERSITY TUNKU ABDUL RAHMAN	private	UTAR	315
16	UNIVERSITY TENAGA NAS	private	UNITEN	282
17	UNIVERSITY MALAYSIA PERLIS	governmental	UniMAP	242
18	UNIVERSITY MALAYSIA TERENGGANU	governmental	UMT	225
19	UNIVERSITY MALAYSIA PAHANG	governmental	UMP	143
20	UNIVERSITY TUN HUSSEIN ONN MALAYSIA	governmental	UTHM	115
21	CURTIN UNIVERSITY TECHNOL	private	Curtin	103
22	AIMST UNIVERSITY	private	AIMST	97
23	SWINBURNE UNIVERSITY TECHNOL	private	SWINBURNE	70
24	UNIVERSITY UTARA MALAYSIA	governmental	UUM	66
25	UNIVERSITY KUALA LUMPUR	private	UniKL	63

3.4 Data Collection

All data was collected from the Web of Science online database published from 1980 to 2011. It is assumed that the period of 31 years from 1980 to 2011 would project a clearer picture on the development of publications and is expected to quantitatively provide evidence on the nature of the research in Malaysia.

3.4.1 Web of Science

Web of Science (WOS) is one of the databases of the such source of scientific information as the Institute of Scientific Information (ISI) of Thomson Scientific, which has been serving as a data provider since the early 1960s, especially for citation analyses (Falagas, et al., 2008). WOS of ISI is originally from United States. It does not provide open access articles and belongs to commercial provider and require an access fee. It covers most scientific fields and covers the oldest publications, because its indexed and archived records going back to 1900.

The reasons why WOS was chosen as a source of information are:

Firstly and most importantly that it covers publications since oldest years, which is meaningful for author productivity calculation because the nature of a measure indicators are cumulative;Secondly, it covers most fields of research;Thirdly, it is an authority resource.

Main characteristics of WOS which distinguish this source from others are presented in table 3.2.

Table 3.2. Characteristics of Web of Science database. Adopted from Falagas, et. al. (2008)

Characteristic	**Web of Science**
Date of official inauguration	2004*
Content	
No. of journals	8700
Languages	English (plus 45 other languages)
Focus (field)	Science, technology, social sciences, arts and humanities
Period covered	1900–present
Databases covered	Science citation index expanded, social sciences citation index, arts and humanities citation index, index chemistry, current chemical reactions
No. of keywords allowed	15
Search	
Abstracts	+
Authors	+

Characteristic	Web of Science
Citations	+
Patents	+
Uses	Links to full-text, links to related articles
Updating	Weekly
Developer/owner (country)	Thomson Scientific and Health Care Corporation (US)
Citation analysis	As for Web of Science plus the total number of articles on a topic or by an individual author cited in other articles

Web of Science was created by Thomson Scientific to make citation indices (that E. Garfield assessed since the early 1960s) accessible via the Internet

The collection process involved the identifying all bibliographic records with Malaysia as an affiliation country or as a part of address. The records with data for this study limited by articles and reviews only as a type of documents published from 1980 to 2011. Becauseh-index is a cumulative process based indicator the whole life time window should be taken into account. It is assumed that the period of 31 years from 1980 to 2011 would project a clearer picture on the researcher's activities in Malaysia.

Also, limitation by set of particular universities was applied. Citation report feature was used to identify top 499 researchers.

The data extracted was converted into tabbed delimited format and imported into Microsoft Excel. The final result of the searches contributed a total of 58407 bibliographic records separated by different fields. Table 3.3 illustrates the data formats and fields used for the excel file.

Table 3.3: List of field names

N	Field Names
1	Authors
2	Results found
3	Times cited
4	Citing articles
5	Sum of c without self citations
6	Citing articles without self-citations
7	H index

N	Field Names
8	Average citations per item
9	Subject category

The aim of a pilot study is to try out the research approach to identify potential problems that may affect the quality and validity of the results. The need to do a pilot study before undertaking an empirical study cannot be overemphasized. Actually trying out the research as planned – including data processing, analysis, and drawing conclusions – will reveal that several changes are required if the study is to be effective and efficient (Blessing & Chakrabarti, 2009).

3.4.2 Pilot study

Pilot study was conductedin order to assess the proposed data analysis techniques, to uncover potential problems, to test adequacy of research instruments (van Teijlingen & Hundley, 2001).The set of other reasons why the pilot study was undertaken are described in a Table 3.4.

The first and the last author was taken out of 500 top authors in Malaysia, Fun and Maeda respectively. Total C citations received, total P publication, i index where $i=C/P$, Exergy, where $X=iC$, p-index, $p=X^{1/3}$ for each author where were calculated. As a result it was seen that rate of Maeda is higer than Fun's , despite he has published less publications.

Table 3.4. Reasons for conducting pilot studies. Adopted from van Teijlingen & Hundley, (2001)

N	Reasons for conducting pilot studies
1	Developing and testing adequacy of research instruments
2	Assessing the feasibility of a (full-scale) study/survey
3	Designing a research protocol
4	Assessing whether the research protocol is realistic and workable
5	Establishing whether the sampling frame and technique are effective
6	Assessing the likely success of proposed recruitment approaches
7	Identifying logistical problems which might occur using proposed methods
8	Estimating variability in outcomes to help determining sample size
9	Collecting preliminary data
10	Determining what resources are needed for a planned study
11	Assessing the proposed data analysis techniques to uncover potential problems
12	Developing a research question and research plan
13	Training a researcher in as many elements of the research process as possible
14	Convincing stakeholders that the research team is competent and knowledgeable
15	Convincing stakeholders that the main study is feasible and worth funding
16	Convincing other stakeholders that the main study is worth supporting

But p-index proposed by Prathap in 2010 and 2011 is not covered in that study, which means it probably doesn't have high coorelation with h-index like 37 others. The result is representing in a Table 3.5 and graphically shown in Figure 3.1.

Table 3.5 Pilot study results

	Fun	Maeda
C (Total number of Citations)	9903	4832
P (Total number of publications)	2170	492
I (Average number of citations per paper)	4.56	9.82
X (Exergy)	45193.28	47455.74
P index	35.62	36.20
H index	37	34

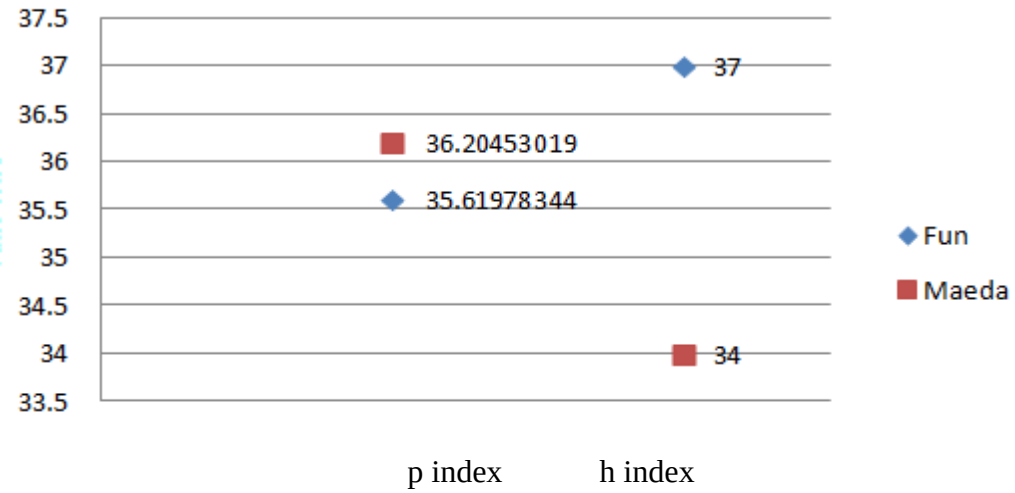

Figure 3.1 Pilot study results

Bornmann, et al. (2011) have conducted the first meta-analysis of studies that computed correlations between the h index and 37 different variants of the h-index that have been proposed and discussed in the literature by 2010. A high correlation between the h-index and its variants indicated that the h index variants hardly provide added information to the h-index. Despite the findings of Bornmann, et al. (2011) pilot study revealed that h-index and p-index give totally different numbers what convinced to continue research.

3.4.3 Handling Multi-Authored Works

After conducting the pilot study it was identified that there was 85 records, what is 17 % of the sample, which consists of set of records which has totally same standard bibliometric indicators such as the same number of publications and the same number of citations. It was determined that this fact was caused by participation in the same research group projects. Thus, the decision was made to exclude all research group collaborations from authors, because the study was interested in observing the behavior of p index in the

different combination of different numbers of total citations and total number of publications. As more various instances are in the sample as more interesting the result is.

3.4.4 Problem faced

During the process of data collection some confusion had occurred. Variation of institution's names needed to beidentified. This will include differences in spelling of names, differences in languages used, inversion of names and other variations that might affect the total number count for a particular institution.For example, University Putra Malaysia and University Pertanian Malaysia are actually the same universities. Thus, all variations stated above were noted, identified and unified.

3.5 Analysis of Data

Exergy and p index was calculated according to the formula which is described in the following section. Four separate Microsoft Excel sheets were created in order to generate different ranks based on number of publications, h index, p index, and ratio p to h respectively.

The theory proposed by Prathap, (2011g) states that each paper has Energy, let *e* be its denotation, which calculated as $e=c^2$, where c is number of citation, received by this particular paper. Full Energy of author can be calculated as a sum $\sum_{i=1}^{n} c_i^2$, X=iC, where i=C/P, where C – total number of citations and P - total number of publications. $p=X^{1/3}$ is the performance indicator, where X=iC, i=C/P, where C – total number of citations and P - total number of publications. Statistical and mathematical validity of the proposed formulas are based on the analogy with thermodynamic laws of physics, which can be read in details in Prathap (2011a), Prathap (2011b), Prathap (2011d), Prathap (2011e).

To present results pertaining to the productivity of authors, descriptive tables will be utilized, and data will be displayed in charts and graphs.

3.7 Summary

This chapter has explained and outlined the research method employed in this study. The source of data, the method and approach applied, are described as well. The subsequent chapters will focus on data analysis and present the overall findings resulting from the study.

CHAPTER 4

DATA ANALYSIS

4.1 Introduction

This chapter describes the findings in accordance to the research questions:

(1) Who are top productive scientists in Malaysia based on their publication input in Web of Science (WOS)?

(2) What is the difference between top 50 author productivity rank based on *p* index and *h* index?

(3) Is *p* index really more accurate and more robust index rather than *h* index?

(4) Who are the top authors in specific subject areas based on *p* index and *h* index?

Data was collected solely from *ISI Web of Science* database and covered publications for the period of 31 years from 1980 to 2011.

4.2 Total Publication Productivity in Malaysia

A total of 56,596 publications with Malaysia as a part of the affiliation address were retrieved from the Web of Sciencedatabase between the years 1980 and 2011. The works comprise of 39,612 (67, 82%) journal articles, 12,845 (21.99 %) proceeding papers, 2,336 (4%) meeting abstracts, 1133 (1.94 %) reviews and 2481 (4.25 %) other type of publications. Figure 4.1 shows the distribution of types of publications retrieved.

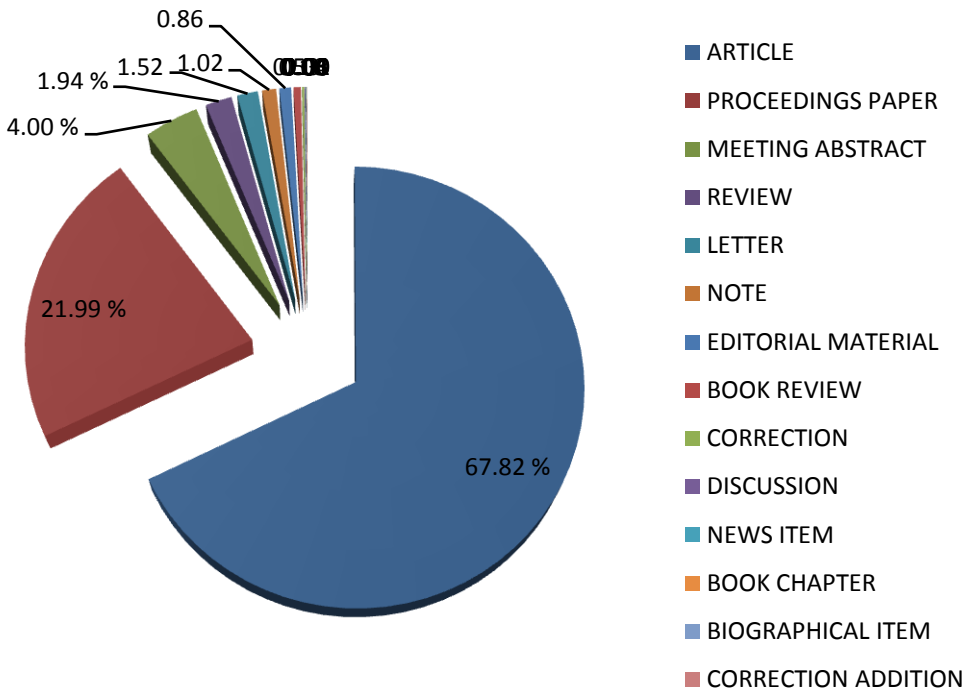

Figure 4.1 Distribution of types of documents

It is observed that journal article is the major way of scholarly communication. For this particular study such types of publications were determined as Articles and Review only which are considered as the main way of scholarly communication. After excluding all other types of document, a total of 40,745 items were used for further analysis.

Table 4.1 Distribution of types of documents

N	Type of document	Number
1	Article	39612
2	Proceedings paper	12845
3	Meeting abstract	2336
4	Review	1133
5	Letter	885
6	Note	594
7	Editorial material	500
8	Book review	308
9	Correction	95
10	Discussion	33
11	News item	25
12	Book chapter	15
13	Biographical item	7
14	Correction addition	7
15	Reprint	5
16	Bibliography	3
17	Item about an individual	2
18	Poetry	1
19	Theatre review	1

4.3 Top productive authors in Malaysia by number of publications

The leading position is occupied by Fun Hoong-Kun, who is Crystallography researcher from University Sains Malaysia, Penang, with the number of 2,179 records found, what comprise 5.34 %. Three following positions are taken by researchers from University of Malaya, who are Seik Weng Ng and Tiekink Edward R.T. from Crystallography field and Ahmad H. from Optic, with total number of publications found 1953, 377 and 321 records, what comprise 4.79, 0.93 and 0.79 percent respectively. Razak Ibrahim Abdul and Ismail H., both from USM, are following next from Crystallography and Polymer Science fields respectively, with the total number of publications 295 and 269, what are 0.72 and 0.66 percent accordingly.Table 4.2 was constructed to present the results of top productive authors. Some authors were found to be published in different subject areas. For easier representation only first dominant subject area was taken for each author.

Table 4.2 Top 499 productive authors by number of publications in Malaysia

N	Authors	Results found	Subject area
1	FUN HK	2179	CRYSTALLOGRAPHY
2	NG SW	1953	CRYSTALLOGRAPHY
3	CHANTRAPROMMA S	480	CRYSTALLOGRAPHY
4	TIEKINK ERT	377	CRYSTALLOGRAPHY
5	AHMAD H	321	OPTICS
6	RAZAK IA	295	CRYSTALLOGRAPHY
7	ISMAIL H	269	POLYMER SCIENCE
8	HARUN SW	245	OPTICS
9	YAMIN BM	224	CRYSTALLOGRAPHY
10	MAN YBC	202	FOOD SCIENCE TECHNOLOGY
11	HASSAN Z	195	MATERIALS SCIENCE
12	ALI HM	186	CRYSTALLOGRAPHY
13	CHINNAKALI K	186	CRYSTALLOGRAPHY
14	HEMAMALINI M	186	CRYSTALLOGRAPHY
15	TEOH SG	179	CRYSTALLOGRAPHY
16	HASHIM R	174	CHEMISTRY
17	GAO S	169	CRYSTALLOGRAPHY
18	LO KM	169	CRYSTALLOGRAPHY
19	ABDULLAH N	160	AGRICULTURE
20	BHATIA S	159	ENGINEERING
21	MAHDI MA	155	OPTICS
22	AHMAD AL	153	ENGINEERING
23	AROF AK	153	MATERIALS SCIENCE
24	BASRI M	153	BIOTECHNOLOGY APPLIED MICROBIOLOGY
25	MOHAMED AR	151	ENGINEERING
26	USMAN A	149	CRYSTALLOGRAPHY
27	RAJ SSS	148	CRYSTALLOGRAPHY
28	ISMAIL A	148	FOOD SCIENCE TECHNOLOGY
29	ISHAK ZAM	143	POLYMER SCIENCE
30	POP I	142	MECHANICS
31	ISMAIL AF	142	ENGINEERING
32	GOH KL	139	GASTROENTEROLOGY HEPATOLOGY
33	DAS S	136	PHARMACOLOGY PHARMACY
34	TAN CP	133	FOOD SCIENCE TECHNOLOGY
35	HASHIM I	132	MATHEMATICS
36	ISMAIL R	130	PHARMACOLOGY PHARMACY
37	YOU XZ	130	CRYSTALLOGRAPHY
38	YEAP CS	129	CRYSTALLOGRAPHY
39	AHMAD A	128	ENGINEERING
40	AWANG K	126	CHEMISTRY

N	Authors	Results found	Subject area
41	KAM TS	120	CHEMISTRY
42	SALLEH AB	120	BIOTECHNOLOGY APPLIED MICROBIOLOGY
43	DAUD WRW	116	ENGINEERING
44	HAMEED BH	116	ENGINEERING
45	KHAN MN	116	CHEMISTRY
46	OSMAN H	115	CRYSTALLOGRAPHY
47	PATIL PS	114	CRYSTALLOGRAPHY
48	NAZAR R	109	MECHANICS
49	ISMAIL Z	109	CHEMISTRY
50	NG KH	108	GENERAL INTERNAL MEDICINE
51	QUAH CK	108	CRYSTALLOGRAPHY
52	AHMAD M	107	CHEMISTRY
53	KIA R	106	CRYSTALLOGRAPHY
54	KALLURAYA B	103	CRYSTALLOGRAPHY
55	YUSOFF K	103	VIROLOGY
56	LEE KT	102	ENERGY FUELS
57	ZAINAL Z	102	MATERIALS SCIENCE
58	DHARMAPRAKASH SM	101	CRYSTALLOGRAPHY
59	RAHMAN RA	101	FOOD SCIENCE TECHNOLOGY
60	SAPUAN SM	100	MATERIALS SCIENCE
61	DAS VGK	99	CHEMISTRY
62	LAJIS NH	98	PHARMACOLOGY PHARMACY
63	TILLEY DR	98	PHYSICS CONDENSED MATTER
64	AHMAD Z	96	POLYMER SCIENCE
65	LEE CY	95	ENTOMOLOGY
66	MASJUKI HH	95	ENERGY FUELS
67	AMINI MM	94	CRYSTALLOGRAPHY
68	ISHAK A	94	MECHANICS
69	ISLOOR AM	94	CRYSTALLOGRAPHY
70	ABU HASSAN H	94	MATERIALS SCIENCE
71	ALI AM	93	PHARMACOLOGY PHARMACY
72	YUNUS WMZW	92	POLYMER SCIENCE
73	AHMAD S	91	CHEMISTRY
74	IBRAHIM K	91	MATERIALS SCIENCE
75	YUEN KH	91	PHARMACOLOGY PHARMACY
76	HUO LH	90	CRYSTALLOGRAPHY
77	XU JH	90	CRYSTALLOGRAPHY
78	OMAR AR	88	VETERINARY SCIENCES
79	SAAD B	88	CHEMISTRY
80	HASHIM MA	87	ENGINEERING
81	GOH JH	86	CRYSTALLOGRAPHY
82	TAN SG	86	ENVIRONMENTAL SCIENCES ECOLOGY

N	Authors	Results found	Subject area
83	MOHAMED A	85	ENGINEERING
84	OTHMAN M	85	ENGINEERING ELECTRICAL ELECTRONIC
85	HADI AHA	84	CHEMISTRY
86	ISMAIL M	84	FOOD SCIENCE TECHNOLOGY
87	ISMAIL N	83	ENGINEERING
88	KHALEDI H	83	CRYSTALLOGRAPHY
89	ABDULLAH S	82	ENGINEERING
90	MAK JW	82	PARASITOLOGY
91	RAHMAN NA	82	CHEMISTRY
92	AHMAD R	82	CHEMISTRY
93	MAK JW	82	PARASITOLOGY
94	RAHIM RA	81	INSTRUMENTS INSTRUMENTATION
95	ABD-SHUKOR R	80	PHYSICS
96	SAIDUR R	80	ENERGY FUELS
97	ABDULLAH MK	79	OPTICS
98	ARIFFIN A	79	CHEMISTRY
99	GHAZALI HM	79	FOOD SCIENCE TECHNOLOGY
100	KASSIM A	79	CHEMISTRY
101	KHALIL HPSA	79	MATERIALS SCIENCE
102	KHALID BAK	79	ENDOCRINOLOGY METABOLISM
103	LEE CK	78	ENVIRONMENTAL SCIENCES ECOLOGY
104	HO YW	77	AGRICULTURE
105	ZAKARIA ZA	77	PHARMACOLOGY PHARMACY
106	ABDULLAH Z	76	CRYSTALLOGRAPHY
107	CHUAH HT	76	ENGINEERING
108	GOSWAMI S	76	CRYSTALLOGRAPHY
109	HAMOUDA AMS	76	MATERIALS SCIENCE
110	TOU TY	76	PHYSICS
111	WARDELL JL	76	CRYSTALLOGRAPHY
112	JINAP S	75	FOOD SCIENCE TECHNOLOGY
113	LOOI LM	75	PATHOLOGY
114	LAI OM	74	FOOD SCIENCE TECHNOLOGY
115	PUTHUCHEARY SD	74	MICROBIOLOGY
116	SULAIMAN O	74	CRYSTALLOGRAPHY
117	GOH SH	73	CHEMISTRY
118	JEBAS SR	73	CRYSTALLOGRAPHY
119	SALEH MI	73	CRYSTALLOGRAPHY
120	SIVAKUMAR K	73	CHEMISTRY
121	TAN NH	73	CRYSTALLOGRAPHY
122	AL-MANSOORI MH	72	BIOCHEMISTRY MOLECULAR BIOLOGY
123	HASSAN A	72	OPTICS
124	LEE SL	72	POLYMER SCIENCE

N	Authors	Results found	Subject area
125	YEAP GY	72	MATHEMATICS
126	LEE SL	72	MATHEMATICS
127	AROUA MK	71	CRYSTALLOGRAPHY
128	HASSAN MA	70	ENGINEERING
129	ROZMAN HD	70	BIOTECHNOLOGY APPLIED MICROBIOLOGY
130	ASIRI AM	69	POLYMER SCIENCE
131	CHEONG KY	69	PHYSICS
132	IDRIS A	69	CRYSTALLOGRAPHY
133	ISHIAKU US	69	MATERIALS SCIENCE
134	KARALAI C	69	ENGINEERING
135	MOHAMED N	69	POLYMER SCIENCE
136	SULAIMAN S	69	PHYSICS
137	TAN WS	69	CRYSTALLOGRAPHY
138	BRADLEY DA	68	CRYSTALLOGRAPHY
139	WARDELL SMSV	68	ENGINEERING
140	LOW KS	67	BIOTECHNOLOGY APPLIED MICROBIOLOGY
141	POH BT	67	NUCLEAR SCIENCE TECHNOLOGY
142	SIAR CH	67	DENTISTRY ORAL SURGERY MEDICINE
143	AHMAD F	66	ENVIRONMENTAL SCIENCES ECOLOGY
144	HANAFI MM	66	SOIL SCIENCE
145	LOH WS	65	POLYMER SCIENCE
146	TAN CT	65	DENTISTRY ORAL SURGERY MEDICINE
147	TIAN YP	65	
148	ZAKARIA Z	65	
149	LAM SK	65	VIROLOGY
150	ABDULLAH AZ	64	PHYSICS
151	ALI A	64	CRYSTALLOGRAPHY
152	KARIM AA	64	NEUROSCIENCES NEUROLOGY
153	LING TC	64	ENGINEERING
154	RAHMAN MM	64	ENGINEERING
155	VELMURUGAN D	64	MATERIALS SCIENCE
156	YONG HS	64	
157	ZHANG Y	64	PHYSICS
158	KAMARULZAMAN A	64	INFECTIOUS DISEASES
159	ALI A	64	FOOD SCIENCE TECHNOLOGY
160	CHAN KL	63	VIROLOGY
161	MANDEEP JS	63	BIOTECHNOLOGY APPLIED MICROBIOLOGY
162	NOORANI MSM	63	MATERIALS SCIENCE
163	SEETHARAMU KN	63	CRYSTALLOGRAPHY
164	SULAIMAN MR	63	ZOOLOGY
165	ABU BAKAR A	63	PHYSICS

N	Authors	Results found	Subject area
166	TEY BT	63	BIOTECHNOLOGY APPLIED MICROBIOLOGY
167	SEETHARAMU KN	63	THERMODYNAMICS
168	HUSSEIN MZ	62	CHEMISTRY
169	VIJAYAKUMAR V	62	CHEMISTRY
170	AKIL HM	62	CHEMISTRY
171	ARIFF AB	62	BIOTECHNOLOGY APPLIED MICROBIOLOGY
172	LIM SC	62	PHYSICS MULTIDISCIPLINARY
173	ALIAS Y	62	CHEMISTRY MULTIDISCIPLINARY
174	NG CH	61	CHEMISTRY INORGANIC NUCLEAR
175	TAUFIQ-YAP YH	60	CHEMISTRY PHYSICAL
176	AZIZ HA	60	ENVIRONMENTAL SCIENCES
177	AHMAD ZA	60	MATERIALS SCIENCE MULTIDISCIPLINARY
178	ROSLI MM	60	CRYSTALLOGRAPHY
179	BIN SHAWKATALY O	59	CRYSTALLOGRAPHY
180	PHANG SM	59	MARINE FRESHWATER BIOLOGY
181	ABDULLAH MZ	59	THERMODYNAMICS
182	RAHMAN SA	59	MATERIALS SCIENCE MULTIDISCIPLINARY
183	TEO LP	59	PHYSICS MATHEMATICAL
184	SALLEH MM	58	MATERIALS SCIENCE MULTIDISCIPLINARY
185	SOPIAN K	58	ENERGY FUELS
186	THONG KL	58	MICROBIOLOGY
187	AMIN N	58	MECHANICS
188	HO CC	58	CHEMISTRY PHYSICAL
189	RAMESH S	58	MATERIALS SCIENCE MULTIDISCIPLINARY
190	LEE HL	58	TROPICAL MEDICINE
191	RADU S	57	MICROBIOLOGY
192	RAHMAN MBA	57	BIOTECHNOLOGY APPLIED MICROBIOLOGY
193	TEO SB	57	CHEMISTRY INORGANIC NUCLEAR
194	ISRAF DA	57	PHARMACOLOGY PHARMACY
195	OTHMAN R	57	MATERIALS SCIENCE MULTIDISCIPLINARY
196	IBRAHIM S	57	ENGINEERING CHEMICAL
197	MOHAMED Z	57	PHARMACOLOGY PHARMACY
198	MISRAN N	56	ENGINEERING ELECTRICAL ELECTRONIC
199	YAM FK	56	MATERIALS SCIENCE MULTIDISCIPLINARY
200	ALI MA	56	CRYSTALLOGRAPHY
201	ISLAM MT	56	ENGINEERING ELECTRICAL ELECTRONIC
202	MOHAMED S	56	FOOD SCIENCE TECHNOLOGY

N	Authors	Results found	Subject area
203	ABDULLAH A	56	MULTIDISCIPLINARY SCIENCES
204	RAHIM NA	56	ENGINEERING ELECTRICAL ELECTRONIC
205	IBRAHIM H	56	PLANT SCIENCES
206	YIP CH	56	ONCOLOGY
207	SINGH R	56	SPORT SCIENCES
208	CHUAH CH	55	BIOCHEMISTRY MOLECULAR BIOLOGY
209	NAVARATNAM V	55	PHARMACOLOGY PHARMACY
210	AHMAD N	55	ZOOLOGY
211	BOO NY	55	PEDIATRICS
212	ALAM MZ	55	BIOTECHNOLOGY APPLIED MICROBIOLOGY
213	ELTAYEB NE	54	CRYSTALLOGRAPHY
214	ESSASSI E	54	CRYSTALLOGRAPHY
215	FAKHRU'L-RAZI A	54	ENVIRONMENTAL SCIENCES
216	MOHAMMAD AW	54	ENGINEERING CHEMICAL
217	NG SL	54	CRYSTALLOGRAPHY
218	ISMAIL S	54	PHARMACOLOGY PHARMACY
219	ONG SH	54	STATISTICS PROBABILITY
220	LIM LHS	53	PARASITOLOGY
221	RAHMAN RNZRA	52	BIOTECHNOLOGY APPLIED MICROBIOLOGY
222	SARVESWARI S	52	CRYSTALLOGRAPHY
223	ZULKIFLI I	52	AGRICULTURE DAIRY ANIMAL SCIENCE
224	LIM CP	52	COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE
225	WONG KT	52	PATHOLOGY
226	CHOO YM	52	FOOD SCIENCE TECHNOLOGY
227	SIVANESARATNAM V	52	OBSTETRICS GYNECOLOGY
228	KAMARUDDIN AH	51	ENGINEERING CHEMICAL
229	MARIATTI M	51	POLYMER SCIENCE
230	RADIMAN S	51	MATERIALS SCIENCE MULTIDISCIPLINARY
231	ZAKARIA S	51	POLYMER SCIENCE
232	ABDULLAH M	51	MANAGEMENT
233	DAUD WMAW	50	ENGINEERING CHEMICAL
234	YUSOF MSM	50	CRYSTALLOGRAPHY
235	YAP CK	50	ENVIRONMENTAL SCIENCES
236	HUSSAIN A	50	ENGINEERING ELECTRICAL ELECTRONIC
237	IBRAHIM NA	50	POLYMER SCIENCE
238	AZIZ AA	50	MATERIALS SCIENCE
239	ALI J	50	OPTICS
240	WAHIDDIN MRB	50	OPTICS
241	MUSTAFA MR	49	PHARMACOLOGY PHARMACY

N	Authors	Results found	Subject area
242	OTHMAN F	49	MEDICINE GENERAL INTERNAL
243	OTHMAN MR	49	ENGINEERING CHEMICAL
244	YAHAYA AH	49	CHEMISTRY MULTIDISCIPLINARY
245	NASEF MM	49	POLYMER SCIENCE
246	AHMAD I	49	POLYMER SCIENCE
247	MOHAMED M	49	ENTOMOLOGY
248	HUSSAIN MA	48	ENGINEERING CHEMICAL
249	PEH KK	48	PHARMACOLOGY PHARMACY
250	TAN KW	48	CRYSTALLOGRAPHY
251	BABA I	48	CRYSTALLOGRAPHY
252	BAHARIN BS	48	FOOD SCIENCE TECHNOLOGY
253	RATNAM CT	48	POLYMER SCIENCE
254	ADNAN R	47	CRYSTALLOGRAPHY
255	GOH LY	47	CHEMISTRY
256	ISMAIL MR	47	AGRICULTURE
257	MORITA H	47	CHEMISTRY
258	MANSOR SM	47	PHARMACOLOGY PHARMACY
259	SASIDHARAN S	47	PHARMACOLOGY PHARMACY
260	IBRAHIM MH	47	ENGINEERING
261	ISMAIL BS	46	ENVIRONMENTAL SCIENCES
262	KADHUM AAH	46	MATERIALS SCIENCE MULTIDISCIPLINARY
263	KUTHUBUTHEEN AJ	46	MYCOLOGY
264	RUSUL G	46	FOOD SCIENCE TECHNOLOGY
265	SUDESH K	46	POLYMER SCIENCE
266	POH BL	46	CHEMISTRY
267	WEI C	46	CHEMISTRY
268	YUSOF S	46	FOOD SCIENCE TECHNOLOGY
269	MAJLIS BY	46	MATERIALS SCIENCE MULTIDISCIPLINARY
270	OTHMAN N	46	POLYMER SCIENCE
271	ALI RM	46	MATHEMATICS
272	ABDULLAH AH	46	ELECTROCHEMISTRY
273	CHEN XM	45	CHEMISTRY
274	JALALUDIN S	45	AGRICULTURE
275	RAHMANI M	45	CHEMISTRY
276	SAHARI BB	45	MATERIALS SCIENCE
277	BHAT R	45	FOOD SCIENCE TECHNOLOGY
278	SHAARI K	45	CHEMISTRY MEDICINAL
279	LIM KH	45	CHEMISTRY ORGANIC
280	HAIR-BEJO M	44	VETERINARY SCIENCES
281	KARGAR H	44	CRYSTALLOGRAPHY
282	ALAM GM	44	BUSINESS
283	HASHIM M	44	MATERIALS SCIENCE

N	Authors	Results found	Subject area
			MULTIDISCIPLINARY
284	NGAH WZW	44	NUTRITION DIETETICS
285	KARIM MIA	44	BIOTECHNOLOGY APPLIED MICROBIOLOGY
286	SHAARI S	44	OPTICS
287	LIM YY	44	FOOD SCIENCE TECHNOLOGY
288	ABUBAKAR S	43	INFECTIOUS DISEASES
289	CROUSE KA	43	CRYSTALLOGRAPHY
290	LOW WY	43	UROLOGY NEPHROLOGY
291	MAAH MJ	43	CRYSTALLOGRAPHY
292	TEH JBJ	43	CRYSTALLOGRAPHY
293	TENG TT	43	ENGINEERING CHEMICAL
294	YARMO MA	43	CHEMISTRY PHYSICAL
295	KILICMAN A	43	MATHEMATICS APPLIED
296	PEH SC	43	PATHOLOGY
297	ARSHAD A	43	CRYSTALLOGRAPHY
298	LIM KS	43	ENGINEERING ELECTRICAL ELECTRONIC
299	SAARI N	43	FOOD SCIENCE TECHNOLOGY
300	BURFIELD DR	42	POLYMER SCIENCE
301	DIMYATI K	42	ENGINEERING ELECTRICAL ELECTRONIC
302	MIRHOSSEINI H	42	FOOD SCIENCE TECHNOLOGY
303	TSO CP	42	THERMODYNAMICS
304	EE GCL	42	CHEMISTRY MEDICINAL
305	LEE WS	42	PEDIATRICS
306	MOHAMAD R	42	BIOTECHNOLOGY APPLIED MICROBIOLOGY
307	OSMAN J	42	PHYSICS CONDENSED MATTER
308	SATTAR MA	42	PHARMACOLOGY PHARMACY
309	SHARIFF M	42	FISHERIES
310	NG WK	42	FISHERIES
311	RAO MVC	42	COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE (
312	AWANG R	42	PHARMACOLOGY PHARMACY
313	IBRAHIM N	42	ENVIRONMENTAL SCIENCES
314	CHEE KK	41	POLYMER SCIENCE
315	CHOW WS	41	POLYMER SCIENCE
316	KUMAR RN	41	POLYMER SCIENCE
317	MAJID SR	41	MATERIALS SCIENCE MULTIDISCIPLINARY
318	NAWAWI A	41	MYCOLOGY
319	SADIKUN A	41	PHARMACOLOGY PHARMACY
320	NG KP	41	IMMUNOLOGY
321	NG SS	41	MATERIALS SCIENCE MULTIDISCIPLINARY

N	Authors	Results found	Subject area
322	WONG CS	41	PHYSICS FLUIDS PLASMAS
323	YUNUS WMM	41	MATERIALS SCIENCE MULTIDISCIPLINARY
324	MUSTAFA S	41	FOOD SCIENCE TECHNOLOGY
325	SUKARI MA	41	PHARMACOLOGY PHARMACY
326	SAMSUDIN AR	41	DENTISTRY ORAL SURGERY MEDICINE
327	AL-YOUBI AO	40	CRYSTALLOGRAPHY
328	BASIRUN WJ	40	CRYSTALLOGRAPHY
329	CHOUDHURY PK	40	OPTICS
330	HENG LY	40	CHEMISTRY ANALYTICAL
331	KASSIM MB	40	CRYSTALLOGRAPHY
332	SHIRAI Y	40	BIOTECHNOLOGY APPLIED MICROBIOLOGY
333	TAN GH	40	CHEMISTRY APPLIED
334	ZAIN SM	40	CRYSTALLOGRAPHY
335	BAKAR J	40	FOOD SCIENCE TECHNOLOGY
336	CHUAH TG	40	ENGINEERING CHEMICAL
337	LATIFF AA	40	MEDICINE GENERAL INTERNAL
338	MANAN ZA	40	ENGINEERING CHEMICAL
339	PANG T	40	MICROBIOLOGY
340	YUSOF NA	40	ELECTROCHEMISTRY
341	ASMAWI MZ	40	PHARMACOLOGY PHARMACY
342	TAN PC	40	OBSTETRICS GYNECOLOGY
343	TAN SH	40	BIOTECHNOLOGY APPLIED MICROBIOLOGY
344	YAHYA A	40	ENGINEERING ENVIRONMENTAL
345	HASAN M	40	ENGINEERING CHEMICAL
346	HAMID AA	40	FOOD SCIENCE TECHNOLOGY
347	CHAN KL	39	CHEMISTRY MEDICINAL
348	ADIKAN FRM	39	OPTICS
349	BOEY PL	39	CHEMISTRY APPLIED
350	CHUAH LS	39	MATERIALS SCIENCE MULTIDISCIPLINARY
351	ZHAO H	39	CRYSTALLOGRAPHY
352	DEVI S	39	IMMUNOLOGY
353	MOHAMAD AA	39	ELECTROCHEMISTRY
354	SEOW HF	39	IMMUNOLOGY
355	HASSALI MA	39	PHARMACOLOGY PHARMACY
356	MOHAMED R	39	BIOCHEMISTRY MOLECULAR BIOLOGY
357	SOSROSENO W	39	DENTISTRY ORAL SURGERY MEDICINE
358	FAIDALLAH HM	38	CRYSTALLOGRAPHY
359	KAMARUDIN SK	38	ENERGY FUELS
360	KHAN IA	38	CRYSTALLOGRAPHY
361	MUHAMAD MR	38	PHYSICS APPLIED

N	Authors	Results found	Subject area
362	NITHINCHANDRA	38	CRYSTALLOGRAPHY
363	OMAR AKM	38	FOOD SCIENCE TECHNOLOGY
364	RAGHUNATHAN R	38	CRYSTALLOGRAPHY
365	YAHYA AK	38	MATERIALS SCIENCE MULTIDISCIPLINARY
366	CHOONG TSY	38	ENGINEERING CHEMICAL
367	HA ST	38	CRYSTALLOGRAPHY
368	HARON MJ	38	CHEMISTRY MULTIDISCIPLINARY
369	OMAR K	38	MATERIALS SCIENCE MULTIDISCIPLINARY
370	YUSOFF FM	38	FISHERIES
371	ZULKIFLI MZ	38	OPTICS
372	YADAV M	38	ONCOLOGY
373	LEE KH	38	BIOTECHNOLOGY APPLIED MICROBIOLOGY
374	SHARIF S	38	CRYSTALLOGRAPHY
375	YUNUS R	38	ENGINEERING CHEMICAL
376	ABDULLAH NA	37	PHARMACOLOGY PHARMACY
377	ARIFFIN H	37	HEMATOLOGY
378	FU YL	37	CRYSTALLOGRAPHY
379	HUANG NM	37	MATERIALS SCIENCE MULTIDISCIPLINARY
380	RATNAM MM	37	AUTOMATION CONTROL SYSTEMS
381	ZHENG LS	37	CRYSTALLOGRAPHY
382	DARUS M	37	MATHEMATICS APPLIED
383	JAAFAR MS	37	ENGINEERING CIVIL
384	MAHDI E	37	MATERIALS SCIENCE COMPOSITES
385	MURUGESAN T	37	ENGINEERING CHEMICAL
386	MATSUURA T	37	ENGINEERING CHEMICAL
387	SIM KS	37	MICROSCOPY
388	LIANG JB	37	AGRICULTURE DAIRY ANIMAL SCIENCE
389	ABOUL-ENEIN HY	37	CHEMISTRY ANALYTICAL
390	YUSOFF MSA	37	FOOD SCIENCE TECHNOLOGY
391	HAMDAN H	37	CHEMISTRY PHYSICAL
392	JAMILAH B	36	FOOD SCIENCE TECHNOLOGY
393	LIONG MT	36	FOOD SCIENCE TECHNOLOGY
394	MUKHTAR MR	36	CHEMISTRY ORGANIC
395	RAHMAN MZA	36	POLYMER SCIENCE
396	RAZAK CNA	36	BIOTECHNOLOGY APPLIED MICROBIOLOGY
397	TAHIR MIM	36	CRYSTALLOGRAPHY
398	JEMAIN AA	36	METEOROLOGY ATMOSPHERIC SCIENCES
399	LOCKMAN Z	36	MATERIALS SCIENCE MULTIDISCIPLINARY
400	RATNAVELU K	36	PHYSICS ATOMIC MOLECULAR

N	Authors	Results found	Subject area
			CHEMICAL
401	SINNIAH D	36	PEDIATRICS
402	LIM TK	36	CHEMISTRY PHYSICAL
403	LIM KP	36	ECONOMICS
404	LIM MH	36	MATHEMATICS APPLIED
405	SUBRAMANIAM S	36	BIOTECHNOLOGY APPLIED MICROBIOLOGY
406	MOHAMAD H	36	ENGINEERING ELECTRICAL ELECTRONIC
407	CHUAH TC	35	ENGINEERING ELECTRICAL ELECTRONIC
408	GAN SN	35	POLYMER SCIENCE
409	MOHAMAD AB	35	CHEMISTRY PHYSICAL
410	NGAH WSW	35	ENGINEERING CHEMICAL
411	YAHYA MZA	35	MATERIALS SCIENCE MULTIDISCIPLINARY
412	ABDULLAH MH	35	MATERIALS SCIENCE MULTIDISCIPLINARY
413	ALI MAM	35	ENGINEERING ELECTRICAL ELECTRONIC
414	NOORDIN MM	35	VETERINARY SCIENCES
415	CHUA KH	35	BIOTECHNOLOGY APPLIED MICROBIOLOGY
416	OSMAN A	35	FOOD SCIENCE TECHNOLOGY
417	SCHILTHUIZEN M	35	ECOLOGY
418	AHMAD MN	35	CHEMISTRY ANALYTICAL
419	TAN SC	35	COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE
420	CHAN KY	34	MATERIALS SCIENCE MULTIDISCIPLINARY
421	FARINA Y	34	CRYSTALLOGRAPHY
422	HUANG RB	34	CRYSTALLOGRAPHY
423	JEFFERY J	34	PARASITOLOGY
424	KADIR MA	34	BIOTECHNOLOGY APPLIED MICROBIOLOGY
425	MAK TCW	34	CHEMISTRY INORGANIC NUCLEAR
426	SHUHAIMI M	34	BIOTECHNOLOGY APPLIED MICROBIOLOGY
427	STANSLAS J	34	PHARMACOLOGY PHARMACY
428	VIKINESWARY S	34	BIOTECHNOLOGY APPLIED MICROBIOLOGY
429	YAM MF	34	PHARMACOLOGY PHARMACY
430	DAUD AR	34	MATERIALS SCIENCE MULTIDISCIPLINARY
431	OMAR SZ	34	OBSTETRICS GYNECOLOGY
432	RAHMAT A	34	NUTRITION DIETETICS
433	ALIMON AR	34	AGRICULTURE DAIRY ANIMAL SCIENCE
434	RAHMAN AA	34	CRYSTALLOGRAPHY
435	ABDULLAH MP	34	CHEMISTRY ANALYTICAL

N	Authors	Results found	Subject area
436	HO CL	34	PLANT SCIENCES
437	ABDULLA MA	33	CRYSTALLOGRAPHY
438	AHMAD SH	33	POLYMER SCIENCE
439	CHONG CS	33	NUCLEAR SCIENCE TECHNOLOGY
440	JOHNS EJ	33	PHARMACOLOGY PHARMACY
441	LIM PE	33	ENVIRONMENTAL SCIENCES
442	LOH TC	33	AGRICULTURE DAIRY ANIMAL SCIENCE
443	LONG LS	33	CRYSTALLOGRAPHY
444	LU ZL	33	CRYSTALLOGRAPHY
445	OZTURK S	33	CRYSTALLOGRAPHY
446	SHAH MR	33	CRYSTALLOGRAPHY
447	SOMCHIT MN	33	PHARMACOLOGY PHARMACY
448	SUBRAMANIAM G	33	CHEMISTRY ORGANIC
449	TALIB ZA	33	MATERIALS SCIENCE MULTIDISCIPLINARY
450	WU JY	33	CHEMISTRY INORGANIC NUCLEAR
451	ZAIDUL ISM	33	FOOD SCIENCE TECHNOLOGY
452	ANUAR AR	33	AGRONOMY
453	ISA MH	33	ENVIRONMENTAL SCIENCES
454	NAING NN	33	MEDICINE GENERAL INTERNAL
455	RAHMAN IA	33	MATERIALS SCIENCE CERAMICS
456	YAHAYA M	33	MATERIALS SCIENCE MULTIDISCIPLINARY
457	ISMAIL J	33	POLYMER SCIENCE
458	PENG YH	33	MATHEMATICS
459	RAVICHANDRAN M	33	MICROBIOLOGY
460	SHAMSHUDDIN J	33	SOIL SCIENCE
461	ZAKARIA A	33	ELECTROCHEMISTRY
462	ARIFIN Z	32	CHEMISTRY PHYSICAL
463	CHANAWANNO K	32	CRYSTALLOGRAPHY
464	NAJAFI E	32	CRYSTALLOGRAPHY
465	RAHIM ASA	32	CRYSTALLOGRAPHY
466	SEKARAN SD	32	MICROBIOLOGY
467	SEOW CC	32	FOOD SCIENCE TECHNOLOGY
468	WONG RCS	32	CHEMISTRY INORGANIC NUCLEAR
469	ZAKARIA R	32	ENGINEERING CHEMICAL
470	ARIFF A	32	BIOTECHNOLOGY APPLIED MICROBIOLOGY
471	MOGHAVVEMI M	32	ENGINEERING ELECTRICAL ELECTRONIC
472	RAHMAN ARA	32	PHARMACOLOGY PHARMACY
473	AHMAD D	32	ENGINEERING ENVIRONMENTAL
474	CHEAH PL	32	PATHOLOGY
475	NGEOW YF	32	MICROBIOLOGY

N	Authors	Results found	Subject area
476	ANG HH	31	PHARMACOLOGY PHARMACY
477	ANJUM S	31	CRYSTALLOGRAPHY
478	BOONNAK N	31	CRYSTALLOGRAPHY
479	CHAI SP	31	MATERIALS SCIENCE MULTIDISCIPLINARY
480	CHENG HM	31	IMMUNOLOGY
481	HASHIM MR	31	MATERIALS SCIENCE MULTIDISCIPLINARY
482	KOMIYAMA K	31	CHEMISTRY MEDICINAL
483	MUNIANDY SV	31	PHYSICS FLUIDS PLASMAS
484	ROBINSON WT	31	CRYSTALLOGRAPHY
485	SELAMAT J	31	FOOD SCIENCE TECHNOLOGY
486	SEVENET T	31	PLANT SCIENCES
487	SHAMAAN NA	31	ENVIRONMENTAL SCIENCES
488	SHETTY P	31	CRYSTALLOGRAPHY
489	WONG LP	31	PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH
490	XIONG RG	31	CHEMISTRY INORGANIC NUCLEAR
491	YIP BC	31	CRYSTALLOGRAPHY
492	ZENG MH	31	CRYSTALLOGRAPHY
493	ZOUIHRI H	31	CRYSTALLOGRAPHY
494	ALI BM	31	ENGINEERING ELECTRICAL ELECTRONIC
495	FONG MY	31	PARASITOLOGY
496	ABU BAKAR F	30	FOOD SCIENCE TECHNOLOGY
497	ADAM F	30	CHEMISTRY PHYSICAL
498	ARMAN HD	30	CRYSTALLOGRAPHY
499	DE SOUZA MVN	30	CRYSTALLOGRAPHY

4.4 Top productive subject areas by number of publications

Table 4.3 represents distribution of publications within subject areas. As it is seen the most leading subjects areas are Engineering, Chemistry and Crystallography what constitute 14.42 %, 11.481 % and 10.7 % to the total number of publications respectively. This is followed by Materials Science and Physics with the fraction of 7.5 % and 6.26 % respectively.

Table 4.3 Top productive subject areas

N	Subject Areas	Record Count	%
1	ENGINEERING	5876	14.421
2	CHEMISTRY	4678	11.481
3	CRYSTALLOGRAPHY	4362	10.706
4	MATERIALS SCIENCE	3057	7.503
5	PHYSICS	2550	6.258
6	ENVIRONMENTAL SCIENCES ECOLOGY	1916	4.702
7	FOOD SCIENCE TECHNOLOGY	1763	4.327
8	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1628	3.996
9	PHARMACOLOGY PHARMACY	1504	3.691
10	COMPUTER SCIENCE	1356	3.328
11	AGRICULTURE	1351	3.316
12	POLYMER SCIENCE	1346	3.303
13	BIOCHEMISTRY MOLECULAR BIOLOGY	1325	3.252
14	SCIENCE TECHNOLOGY OTHER TOPICS	1300	3.191
15	MATHEMATICS	1146	2.813
16	PLANT SCIENCES	1031	2.53
17	ENERGY FUELS	980	2.405
18	OPTICS	922	2.263
19	BUSINESS ECONOMICS	848	2.081
20	GENERAL INTERNAL MEDICINE	833	2.044
21	PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH	732	1.797
22	TROPICAL MEDICINE	643	1.578
23	MICROBIOLOGY	635	1.558
24	NUTRITION DIETETICS	604	1.482
25	WATER RESOURCES	594	1.458
26	MECHANICS	574	1.409
27	MARINE FRESHWATER BIOLOGY	512	1.257
28	PARASITOLOGY	496	1.217
29	ZOOLOGY	457	1.122
30	ELECTROCHEMISTRY	438	1.075
31	IMMUNOLOGY	432	1.06
32	THERMODYNAMICS	430	1.055
33	VETERINARY SCIENCES	430	1.055
34	ONCOLOGY	429	1.053
35	ENTOMOLOGY	417	1.023
36	SURGERY	408	1.001
37	TELECOMMUNICATIONS	404	0.992
38	INSTRUMENTS INSTRUMENTATION	399	0.979
39	GEOLOGY	356	0.874
40	FISHERIES	355	0.871

N	Subject Areas	Record Count	%
41	PEDIATRICS	354	0.869
42	INFECTIOUS DISEASES	341	0.837
43	NEUROSCIENCES NEUROLOGY	339	0.832
44	FORESTRY	324	0.795
45	GENETICS HEREDITY	322	0.79
46	EDUCATION EDUCATIONAL RESEARCH	319	0.783
47	DENTISTRY ORAL SURGERY MEDICINE	304	0.746
48	TOXICOLOGY	299	0.734
49	NUCLEAR SCIENCE TECHNOLOGY	276	0.677
50	OBSTETRICS GYNECOLOGY	273	0.67
51	LIFE SCIENCES BIOMEDICINE OTHER TOPICS	267	0.655
52	METALLURGY METALLURGICAL ENGINEERING	256	0.628
53	AUTOMATION CONTROL SYSTEMS	247	0.606
54	RESEARCH EXPERIMENTAL MEDICINE	242	0.594
55	PATHOLOGY	241	0.591
56	CONSTRUCTION BUILDING TECHNOLOGY	231	0.567
57	PSYCHOLOGY	229	0.562
58	OPERATIONS RESEARCH MANAGEMENT SCIENCE	224	0.55
59	METEOROLOGY ATMOSPHERIC SCIENCES	206	0.506
60	GASTROENTEROLOGY HEPATOLOGY	199	0.488
61	VIROLOGY	196	0.481
62	CELL BIOLOGY	189	0.464
63	ENDOCRINOLOGY METABOLISM	183	0.449
64	RADIOLOGY NUCLEAR MEDICINE MEDICAL IMAGING	183	0.449
65	OPHTHALMOLOGY	173	0.425
66	INFORMATION SCIENCE LIBRARY SCIENCE	171	0.42
67	CARDIOVASCULAR SYSTEM CARDIOLOGY	154	0.378
68	PSYCHIATRY	154	0.378
69	HEALTH CARE SCIENCES SERVICES	151	0.371
70	OTORHINOLARYNGOLOGY	151	0.371
71	INTEGRATIVE COMPLEMENTARY MEDICINE	150	0.368
72	UROLOGY NEPHROLOGY	150	0.368
73	SPECTROSCOPY	148	0.363
74	EVOLUTIONARY BIOLOGY	147	0.361
75	BIOPHYSICS	142	0.349
76	HEMATOLOGY	130	0.319
77	OCEANOGRAPHY	129	0.317
78	PHYSIOLOGY	128	0.314
79	AREA STUDIES	127	0.312
80	MYCOLOGY	123	0.302
81	BIODIVERSITY CONSERVATION	119	0.292
82	MEDICAL LABORATORY TECHNOLOGY	113	0.277
83	PUBLIC ADMINISTRATION	112	0.275

N	Subject Areas	Record Count	%
84	SOCIAL SCIENCES OTHER TOPICS	110	0.27
85	ORTHOPEDICS	103	0.253
86	GEOCHEMISTRY GEOPHYSICS	93	0.228
87	TRANSPORTATION	85	0.209
88	ASIAN STUDIES	79	0.194
89	RESPIRATORY SYSTEM	78	0.191
90	ALLERGY	75	0.184
91	SPORT SCIENCES	75	0.184
92	IMAGING SCIENCE PHOTOGRAPHIC TECHNOLOGY	71	0.174
93	REMOTE SENSING	70	0.172
94	INTERNATIONAL RELATIONS	69	0.169
95	RHEUMATOLOGY	69	0.169
96	DERMATOLOGY	67	0.164
97	ASTRONOMY ASTROPHYSICS	63	0.155
98	MEDICAL INFORMATICS	61	0.15
99	ANTHROPOLOGY	60	0.147
100	MATHEMATICAL COMPUTATIONAL BIOLOGY	60	0.147
101	ACOUSTICS	59	0.145
102	LINGUISTICS	57	0.14
103	LITERATURE	56	0.137
104	PHYSICAL GEOGRAPHY	56	0.137
105	REPRODUCTIVE BIOLOGY	55	0.135
106	LEGAL MEDICINE	52	0.128
107	SOCIOLOGY	52	0.128
108	SUBSTANCE ABUSE	52	0.128
109	GOVERNMENT LAW	51	0.125
110	REHABILITATION	49	0.12
111	RELIGION	44	0.108
112	ANESTHESIOLOGY	43	0.106
113	TRANSPLANTATION	43	0.106
114	GEOGRAPHY	41	0.101
115	ANATOMY MORPHOLOGY	39	0.096
116	DEVELOPMENTAL BIOLOGY	38	0.093
117	MINING MINERAL PROCESSING	38	0.093
118	GERIATRICS GERONTOLOGY	37	0.091
119	URBAN STUDIES	37	0.091
120	BEHAVIORAL SCIENCES	34	0.083
121	COMMUNICATION	34	0.083
122	MICROSCOPY	34	0.083
123	EMERGENCY MEDICINE	33	0.081
124	NURSING	32	0.079
125	ROBOTICS	32	0.079
126	MINERALOGY	31	0.076

N	Subject Areas	Record Count	%
127	BIOMEDICAL SOCIAL SCIENCES	28	0.069
128	WOMEN S STUDIES	28	0.069
129	ARCHITECTURE	27	0.066
130	FAMILY STUDIES	22	0.054
131	SOCIAL WORK	21	0.052
132	PALEONTOLOGY	19	0.047
133	ARTS HUMANITIES OTHER TOPICS	18	0.044
134	DEMOGRAPHY	17	0.042
135	MUSIC	16	0.039
136	HISTORY PHILOSOPHY OF SCIENCE	14	0.034
137	MATHEMATICAL METHODS IN SOCIAL SCIENCES	13	0.032
138	HISTORY	10	0.025
139	PHILOSOPHY	10	0.025
140	ART	9	0.022
141	SOCIAL ISSUES	9	0.022
142	ARCHAEOLOGY	7	0.017
143	ETHNIC STUDIES	7	0.017
144	THEATER	4	0.01
145	CULTURAL STUDIES	3	0.007
146	MEDICAL ETHICS	3	0.007
147	CRIMINOLOGY PENOLOGY	2	0.005

4.5 Top productive institutions by number of publications

As it is seen from table 4.4 the top productive university is University of Malaya which strived with the 10 815 total number of publications under the period of study. Second position is occupied by University Science Malaysia, which is located in Penang Island, and number of records found is 8990 publications. University Putra Malaysia and University Kebangsan Malaysia with 6091 and 4621 publications placed on third and fourth positions respectively. Remaining universities appeared to have less than 2000 publications, what is less than 2% of total publication productivity of Malaysia.

Table 4.4. Top 50 productive Malaysian institutions by number of publications

N	Institutions	Status	Achronym	Record Count
1	UNIVERSITY MALAYA	governmental	UM	10815
2	UNIVERSITY SAINS MALAYSIA	governmental	USM	8990
3	UNIVERSITY PUTRA MALAYSIA	governmental	UPM	6091
4	UNIVERSITY KEBANGSAAN MALAYSIA	governmental	UKM	4621
5	UNIVERSITY TEKNOL MALAYSIA	governmental	UTM	1764
6	MULTIMEDIA UNIVERSITY	private	MMU	1342
7	UNIVERSITY TEKNOL MARA	governmental	UiTM	920
8	INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA	governmental	IIUM	781
9	MONASH UNIVERSITY	private	MONASH	667
10	INST MED RES	governmental		562
11	UNIVERSITY MALAYSIA SABAH	governmental	UMS	496
12	UNIVERSITY MALAYSIA SARAWAK	governmental	UNIMAS	478
13	FOREST RESEARCH INST MALAYSIA	governmental		406
14	UNIVERSITY TEKNOL PETRONAS	private	UTP	389
15	UNIVERSITY NOTTINGHAM	private	UNiM	366
16	INTERNATIONAL MED UNIVERSITY	private	IMU	319
17	UNIVERSITY TUNKU ABDUL RAHMAN	private	UTAR	315
18	MALAYSIAN PALM OIL BOARD	governmental		283
19	UNIVERSITY TENAGA NAS	private	UNITEN	282
20	HOSPITAL KUALA LUMPUR	governmental		278
21	UNIVERSITY MALAYSIA PERLIS	governmental	UniMAP	242
22	RUBBER RESEARCH INST MALAYSIA	governmental		226
23	UNIVERSITY MALAYSIA TERENGGANU	governmental	UMT	225
24	PALM OIL RESEARCH INST MALAYSIA	governmental		196
25	MALAYSIAN AGR RESEARCH DEV INST	governmental		192
26	UNIVERSITY MALAYSIA PAHANG	governmental	UMP	143
27	UNIVERSITY TUN HUSSEIN ONN MALAYSIA	governmental	UTHM	115
28	HOSPITAL UNIVERSITY KEBANGSAAN MALAYSIA	governmental		114
29	UNIVERSITY NOTTINGHAM MALAYSIA CAMPUS	private		104
30	CURTIN UNIVERSITY TECHNOL	private	Curtin	103
31	MALAYSIAN INST NUCL TECHNOL RES	governmental		103
32	MINIST HLTH	governmental		98
33	AIMST UNIVERSITY	private	AIMST	97
34	FOREST RESEARCH CTR (sabah)	governmental		90
35	SIRIM BERHAD	governmental		90
36	MALAYSIAN NUCL AGCY	governmental		89
37	SWINBURNE UNIVERSITY TECHNOL	private		70
38	UNIVERSITY UTARA MALAYSIA	governmental	UUM	66

N	Institutions	Status	Achronym	Record Count
39	VET RESEARCH INST	governmental		66
40	HOSPITAL UNIVERSITY SAINS MALAYSIA	governmental		63
41	UNIVERSITY KUALA LUMPUR	private	UniKL	63
42	SARAWAK GEN HOSP	governmental		57
43	NAT HIST MUSEUM	governmental		52
44	NATL INST TECHNOL	governmental		50
45	ASIAN INST MED SCI TECHNOL	governmental		46
46	HELP UNIVERSITY COLL	private	HELP	46
47	UNIVERSITY PENDIDIKAN SULTAN IDRIS	governmental	UPSI	42
48	MINIST HLTH MALAYSIA	governmental		37
49	MIMOS BERHAD	governmental		34
50	PENANG GEN HOSP	governmental		34

4.6 Distribution of publications within the period of study, from 1980 to 2011

The yearly average of research publications was 1,768,6250. Table 4.5 shows the total number and distribution ofMalaysian research publications over 32 years period beginning from the year 1980 until 2011. The chronological distribution of publications of these research publications is shown in Figure 4.2. It shows that there are several peaks can be seen – in 1982, 1988, 1991, 1995, and 1999 years. After 1999 it was a consistent growth of number of publications and rapid growth after 2006.

Table 4.5. Malaysian research publications from 1980 to 2011

Year	Number of Publications	%	Cumulative number of publications	Cumulative %
1980	291	0.51	291	0.51
1981	257	0.45	548	0.97
1982	334	0.59	882	1.56
1983	300	0.53	1182	2.09
1984	291	0.51	1473	2.60
1985	291	0.51	1764	3.12
1986	295	0.52	2059	3.64
1987	356	0.63	2415	4.27
1988	368	0.65	2783	4.92
1989	365	0.64	3148	5.56
1990	410	0.72	3558	6.29
1991	422	0.75	3980	7.03
1992	409	0.72	4389	7.75
1993	494	0.87	4883	8.63
1994	595	1.05	5478	9.68
1995	699	1.24	6177	10.91
1996	680	1.20	6857	12.12
1997	720	1.27	7577	13.39
1998	849	1.50	8426	14.89
1999	1013	1.79	9439	16.68
2000	956	1.69	10395	18.37
2001	1051	1.86	11446	20.22
2002	1092	1.93	12538	22.15
2003	1372	2.42	13910	24.58
2004	2053	3.63	15963	28.21
2005	2322	4.10	18285	32.31
2006	3015	5.33	21300	37.64
2007	3704	6.54	25004	44.18
2008	5846	10.33	30850	54.51
2009	7688	13.58	38538	68.09
2010	8407	14.85	46945	82.95
2011	9651	17.05	56596	100.00

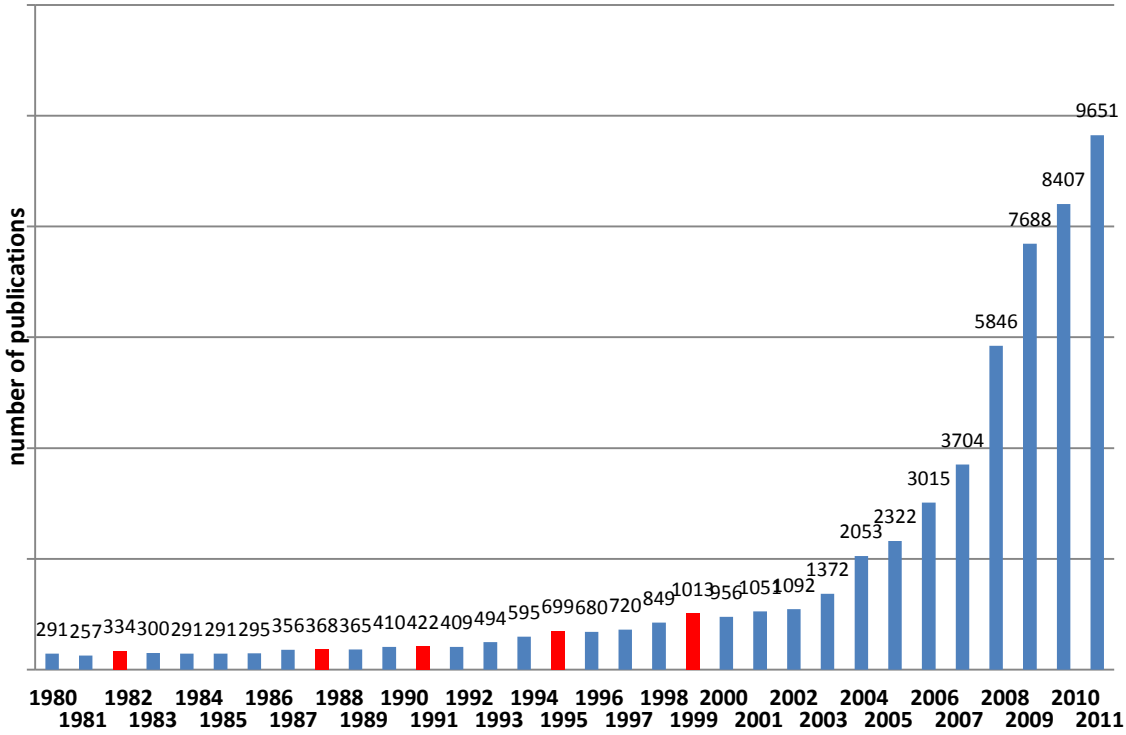

Figure 4.2 Time series representation of number of publications

One of the aim of Ninth Malaysian Plan was to strengthen Research &Development(R&D) Capacity, Science and Technology. "The public sector budget allocated for R&D activities is RM3.9 billion -twice the amount that was allocated under the Eighth Malaysia Plan" (Unit, E. P. 2006).Figure 4.2 shows that in general publication have been consistently and rapidly on the increase last eight years. This suggests that the research activity of Malaysian authors increasing.

4.7 Rank based on h-index

In this section rating based on h-index is presented. As it seen from the table leading position is occupied by Fun Hoong-Kung, from USM, who is researcher in the field of Crystallography. He is also leader in number of publications. Table 4.6 represent top 50 authors based on h index. It is observed that many scientists have the same h index with different standard indicators what can be evidence of precision problem of h index. Full rank can be found in Appendix B.

Table 4.6. Rank based on h-index and citations

N	Authors	Number of papers	Citations	Average Citations per paper	h index	Subject area
1	FUN HK	2179	10055	4.61	37	CRYSTALLOGRAPHY
2	HAMEED BH	116	2338	20.16	30	ENGINEERING
3	NG SW	1953	6935	3.55	28	CRYSTALLOGRAPHY
4	ISHAK ZAM	143	2385	16.68	28	POLYMER SCIENCE
5	LAM SK	65	2726	41.94	27	VIROLOGY
6	KAM TS	120	1747	14.56	25	CHEMISTRY
7	ISMAIL H	269	2462	9.15	24	POLYMER SCIENCE
8	YOU XZ	130	2302	17.71	24	CRYSTALLOGRAPHY
9	AHMAD AL	153	2029	13.26	24	ENGINEERING
10	LEE CK	78	1905	24.42	24	ENVIRONMENTAL SCIENCES ECOLOGY
11	BHATIA S	159	1812	11.4	24	ENGINEERING
12	GOH KL	139	1909	13.73	23	GASTROENTEROLOGY HEPATOLOGY
13	ISMAIL AF	142	1618	11.39	22	ENGINEERING
14	MOHAMED AR	151	1492	9.88	22	ENGINEERING
15	AROF AK	153	1301	8.5	22	MATERIALS SCIENCE
16	MAN YBC	202	1795	8.89	21	FOOD SCIENCE TECHNOLOGY
17	DAS VGK	99	1331	13.44	21	CHEMISTRY
18	CHANTRAPROMMA S	480	2281	4.75	20	CRYSTALLOGRAPHY
19	AHMAD H	321	1523	4.74	20	OPTICS
20	LOW KS	67	1455	21.72	20	BIOTECHNOLOGY APPLIED MICROBIOLOGY
21	ISHIAKU US	69	1295	18.77	20	MATERIALS SCIENCE
22	ALI AM	93	1115	11.99	20	PHARMACOLOGY PHARMACY
23	YUEN KH	91	1091	11.99	20	PHARMACOLOGY PHARMACY
24	WEI C	46	1050	22.83	20	CHEMISTRY

N	Authors	Number of papers	Citations	Average Citations per paper	h index	Subject area
25	GOH LY	47	812	17.28	20	CHEMISTRY
26	HARUN SW	245	1253	5.11	19	OPTICS
27	BASRI M	153	1185	7.75	19	BIOTECHNOLOGY APPLIED MICROBIOLOGY
28	SALLEH AB	120	1159	9.66	19	BIOTECHNOLOGY APPLIED MICROBIOLOGY
29	TAN CP	133	1087	8.17	19	FOOD SCIENCE TECHNOLOGY
30	ROZMAN HD	70	1005	14.36	19	BIOTECHNOLOGY APPLIED MICROBIOLOGY
31	LAJIS NH	98	960	9.8	19	PHARMACOLOGY PHARMACY
32	TAN NH	73	893	12.23	19	CRYSTALLOGRAPHY
33	WONG KT	52	1336	25.69	18	PATHOLOGY
34	KAMARULZAMAN A	64	1273	19.89	18	INFECTIOUS DISEASES
35	LOOI LM	75	1239	16.52	18	PATHOLOGY
36	TAN CT	65	1200	18.46	18	DENTISTRY ORAL SURGERY MEDICINE
37	HASHIM I	132	1149	8.7	18	MATHEMATICS
38	POP I	142	1035	7.29	18	MECHANICS
39	GOH SH	73	1032	14.14	18	CHEMISTRY
40	NASEF MM	49	1007	20.55	18	POLYMER SCIENCE
41	ABDULLAH N	160	1250	7.81	17	AGRICULTURE
42	ISMAIL A	148	1224	8.27	17	FOOD SCIENCE TECHNOLOGY
43	KHALID BAK	79	1170	14.85	17	ENDOCRINOLOGY METABOLISM
44	CHINNAKALI K	186	1135	6.1	17	CRYSTALLOGRAPHY
45	LEE KT	102	785	7.7	17	ENERGY FUELS
46	RAZAK IA	295	1579	5.35	16	CRYSTALLOGRAPHY
47	RAJ SSS	148	1182	7.99	16	CRYSTALLOGRAPHY
48	HO YW	77	986	12.81	16	AGRICULTURE
49	MASJUKI HH	95	913	9.61	16	ENERGY FUELS
50	YUSOFF K	103	866	8.41	16	VIROLOGY

4.8 Rank based on p-index

In this section rating based on p-index is presented. As it seen from Table 4.7, the leading position is not occupied by Fun Hoong-Kun, it is held by Lam S. K. from University of Malaya (UM), who is a researcher in the field of Virology. Whereas Fun

Hoong-Kun went down to the fourth place. Six authors, Ng SW, Kam TS, Ismail H, Bhatia S., Ahmad A.L., moved out of the top ten researchers' list. Full table can be found in Appendix C.

Table 4.7. Rank based on p-index

N	Authors	Number of papers	Citations	Average citations per paper	Exergy	p	Subject area
1	LAM SK	65	2726	41.94	114328.44	48.53	VIROLOGY
2	HAMEED BH	116	2338	20.16	47134.08	36.12	ENGINEERING
3	LEE CK	78	1905	24.42	46520.10	35.97	ENVIRONMENTAL SCIENCES ECOLOGY
4	FUN HK	2179	10055	4.61	46353.55	35.92	CRYSTALLOGRAPHY
5	CHEN XM	45	1439	31.98	46019.22	35.84	CHEMISTRY
6	TILLEY DR	98	2008	20.49	41143.92	34.52	PHYSICS CONDENSED MATTER
7	YOU XZ	130	2302	17.71	40768.42	34.42	CRYSTALLOGRAPHY
8	ISHAK ZAM	143	2385	16.68	39781.80	34.14	POLYMER SCIENCE
9	WONG KT	52	1336	25.69	34321.84	32.50	PATHOLOGY
10	LOW KS	67	1455	21.72	31602.60	31.62	BIOTECHNOLOGY APPLIED MICROBIOLOGY
11	XIONG RG	31	931	30.03	27957.93	30.35	CHEMISTRY INORGANIC NUCLEAR
12	NGAH WSW	35	983	28.09	27612.47	30.23	ENGINEERING CHEMICAL
13	YADAV M	38	1019	26.82	27329.58	30.12	ONCOLOGY
14	AHMAD AL	153	2029	13.26	26904.54	29.96	ENGINEERING
15	GOH KL	139	1909	13.73	26210.57	29.70	GASTROENTEROLOGY HEPATOLOGY
16	KAM TS	120	1747	14.56	25436.32	29.41	CHEMISTRY
17	KAMARUL ZAMAN A	64	1273	19.89	25319.97	29.36	INFECTIOUS DISEASES
18	NG SW	1953	6935	3.55	24619.25	29.09	CRYSTALLOGRAPHY
19	ISHIAKU US	69	1295	18.77	24307.15	28.97	MATERIALS SCIENCE
20	WEI C	46	1050	22.83	23971.50	28.83	CHEMISTRY
21	ISMAIL H	269	2462	9.15	22527.30	28.24	POLYMER SCIENCE
22	TAN CT	65	1200	18.46	22152.00	28.08	DENTISTRY ORAL SURGERY MEDICINE
23	NASEF MM	49	1007	20.55	20693.85	27.45	POLYMER SCIENCE
24	BHATIA S	159	1812	11.4	20656.80	27.44	ENGINEERING
25	LOOI LM	75	1239	16.52	20468.28	27.35	PATHOLOGY
26	ISMAIL AF	142	1618	11.39	18429.02	26.41	ENGINEERING
27	DAS VGK	99	1331	13.44	17888.64	26.15	CHEMISTRY

28	KHALID BAK	79	1170	14.85	17374.50	25.90	ENDOCRINOLOGY METABOLISM
29	MAN YBC	202	1795	8.89	15957.55	25.18	FOOD SCIENCE TECHNOLOGY
30	JALALUDIN S	45	821	18.24	14975.04	24.65	AGRICULTURE
31	MOHAMED AR	151	1492	9.88	14740.96	24.52	ENGINEERING
32	GOH SH	73	1032	14.14	14592.48	24.44	CHEMISTRY
33	ROZMAN HD	70	1005	14.36	14431.80	24.35	BIOTECHNOLOGY APPLIED MICROBIOLOGY
34	SEVENET T	31	660	21.29	14051.40	24.13	PLANT SCIENCES
35	GOH LY	47	812	17.28	14031.36	24.12	CHEMISTRY
36	ALI AM	93	1115	11.99	13368.85	23.73	PHARMACOLOGY PHARMACY
37	YUEN KH	91	1091	11.99	13081.09	23.56	PHARMACOLOGY PHARMACY
38	HO YW	77	986	12.81	12630.66	23.29	AGRICULTURE
39	PANG T	40	713	17.39	12399.07	23.15	MICROBIOLOGY
40	SALLEH AB	120	1159	9.66	11195.94	22.37	BIOTECHNOLOGY APPLIED MICROBIOLOGY
41	MAK TCW	34	614	18.06	11088.84	22.30	CHEMISTRY INORGANIC NUCLEAR
42	AROF AK	153	1301	8.5	11058.50	22.28	MATERIALS SCIENCE
43	TAN NH	73	893	12.23	10921.39	22.19	CRYSTALLOGRAPHY
44	CHANTRAP ROMMA S	480	2281	4.75	10834.75	22.13	CRYSTALLOGRAPHY
45	BURFIELD DR	42	670	15.95	10686.50	22.03	POLYMER SCIENCE
46	NGEOW YF	32	577	18.04	10409.08	21.83	MICROBIOLOGY
47	PEH KK	48	699	14.56	10177.44	21.67	PHARMACOLOGY PHARMACY
48	ISMAIL A	148	1224	8.27	10122.48	21.63	FOOD SCIENCE TECHNOLOGY
49	HASHIM I	132	1149	8.7	9996.30	21.54	MATHEMATICS
50	PUTHUCHE ARY SD	74	857	11.58	9924.06	21.49	MICROBIOLOGY

4.9 Analysis of ratio p to h index

As it was mentioned by Egghe (2006) the ratio of two competitive indexes might be interesting to explore. Analysis of ratio will give us a descriptive picture of the difference between *h* and *p* index. Descriptive statistics using Statistical Package for the Social Sciences (SPSS 18.0) was applied. From Figure 4.3 we can observe the distribution and variance of ratio means. The set of ratio is normally distributed, and the right tail of the curve is longer.

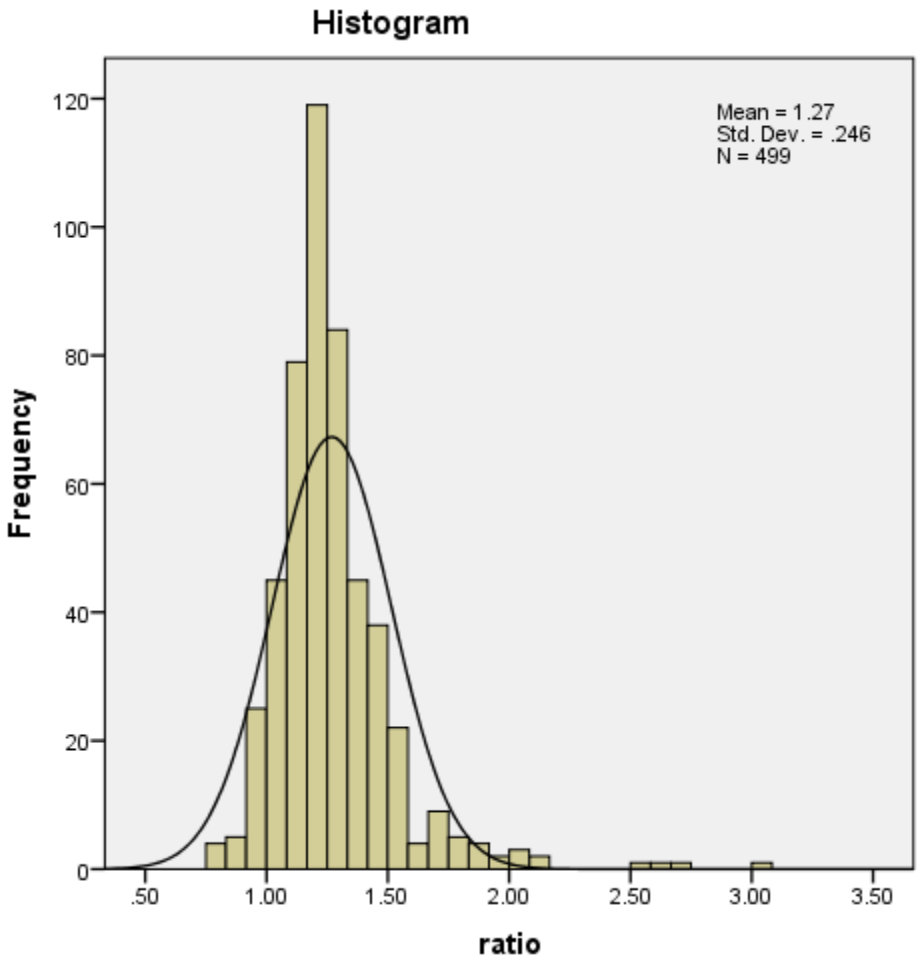

Figure 4.3. Distribution of mean of ratio *p* to *h (p/h)*

The histogram in Figure 4.3 indicates that the most values are more than 1, which means that *p* index gives more credits to the authors, what can benefit for those who are working in subject areas where there are not so many publications opportunities. Table 4.8 and Table 4.9 represents full statistical results.

Table 4.8. Descriptive statistics of ratio *p* to *h*

	Statistic	St. Error
N	499	-
Range	2.20	-
Minimum	.82	-
Maximum	3.03	-
Sum	632.96	-
Mean	1.2685	.01103
Std. Deviation	.24638	-
Variance	.061	-
Skewness	2.369	.109
Kurtosis	10.880	.218

Table 4.9. Frequencies of ratio

p/h	Frequency	Percent	Valid Percent	Cumulative Percent
.82	1	.2	.2	.2
.83	3	.6	.6	.8
.85	1	.2	.2	1.0
.86	1	.2	.2	1.2
.88	2	.4	.4	1.6
.89	1	.2	.2	1.8
.92	4	.8	.8	2.6
.93	3	.6	.6	3.2
.94	1	.2	.2	3.4
.95	4	.8	.8	4.2
.96	1	.2	.2	4.4
.97	5	1.0	1.0	5.4
.98	4	.8	.8	6.2
.99	3	.6	.6	6.8
1.00	4	.8	.8	7.6
1.01	7	1.4	1.4	9.0
1.02	5	1.0	1.0	10.0
1.03	4	.8	.8	10.8
1.04	5	1.0	1.0	11.8
1.05	7	1.4	1.4	13.2
1.06	4	.8	.8	14.0
1.07	8	1.6	1.6	15.6
1.08	1	.2	.2	15.8
1.09	8	1.6	1.6	17.4
1.10	11	2.2	2.2	19.6
1.11	10	2.0	2.0	21.6
1.12	9	1.8	1.8	23.4
1.13	10	2.0	2.0	25.5
1.14	10	2.0	2.0	27.5
1.15	13	2.6	2.6	30.1
1.16	8	1.6	1.6	31.7
1.17	14	2.8	2.8	34.5
1.18	16	3.2	3.2	37.7
1.19	12	2.4	2.4	40.1
1.20	22	4.4	4.4	44.5
1.21	24	4.8	4.8	49.3
1.22	12	2.4	2.4	51.7
1.23	8	1.6	1.6	53.3
1.24	11	2.2	2.2	55.5

p/h	Frequency	Percent	Valid Percent	Cumulative Percent
1.25	9	1.8	1.8	57.3
1.26	9	1.8	1.8	59.1
1.27	16	3.2	3.2	62.3
1.28	10	2.0	2.0	64.3
1.29	6	1.2	1.2	65.5
1.30	9	1.8	1.8	67.3
1.31	12	2.4	2.4	69.7
1.32	7	1.4	1.4	71.1
1.33	6	1.2	1.2	72.3
1.34	5	1.0	1.0	73.3
1.35	6	1.2	1.2	74.5
1.36	6	1.2	1.2	75.8
1.37	5	1.0	1.0	76.8
1.38	7	1.4	1.4	78.2
1.39	4	.8	.8	79.0
1.40	9	1.8	1.8	80.8
1.41	3	.6	.6	81.4
1.42	4	.8	.8	82.2
1.43	4	.8	.8	83.0
1.44	8	1.6	1.6	84.6
1.45	4	.8	.8	85.4
1.46	3	.6	.6	86.0
1.47	4	.8	.8	86.8
1.48	5	1.0	1.0	87.8
1.49	6	1.2	1.2	89.0
1.50	4	.8	.8	89.8
1.51	2	.4	.4	90.2
1.52	4	.8	.8	91.0
1.53	2	.4	.4	91.4
1.55	1	.2	.2	91.6
1.56	4	.8	.8	92.4
1.57	3	.6	.6	93.0
1.58	2	.4	.4	93.4
1.63	1	.2	.2	93.6
1.65	1	.2	.2	93.8
1.66	2	.4	.4	94.2
1.67	2	.4	.4	94.6
1.68	1	.2	.2	94.8
1.69	1	.2	.2	95.0
1.70	1	.2	.2	95.2
1.71	2	.4	.4	95.6
1.72	1	.2	.2	95.8
1.73	1	.2	.2	96.0
1.76	1	.2	.2	96.2
1.80	2	.4	.4	96.6
1.81	2	.4	.4	97.0
1.85	1	.2	.2	97.2
1.86	1	.2	.2	97.4
1.87	1	.2	.2	97.6
1.89	1	.2	.2	97.8
1.97	1	.2	.2	98.0
1.99	1	.2	.2	98.2
2.00	1	.2	.2	98.4
2.01	1	.2	.2	98.6
2.02	1	.2	.2	98.8
2.09	1	.2	.2	99.0
2.16	1	.2	.2	99.2

p/h	Frequency	Percent	Valid Percent	Cumulative Percent
2.56	1	.2	.2	99.4
2.66	1	.2	.2	99.6
2.73	1	.2	.2	99.8
3.02	1	.2	.2	100.0
Total	499	100.0	100.0	

The maximum value 3.02 indicates that there is an outstanding case where p index exceeds h index three times. Table 4.10 presents a further analysis of this case.

Table 4.10. Rank based on ratio *p*indexto *h*index

N	Authors	Records found	Sum of C	Average citations per item	Subject area	ratio p/h
1	OMAR K	38	168	4.42	MATERIALS SCIENCE MULTIDISCIPLINARY	3.02
2	NGEOW YF	32	577	18.04	MICROBIOLOGY	2.73
3	TILLEY DR	98	2008	20.49	PHYSICS CONDENSED MATTER	2.66
4	CHEN XM	45	1439	31.98	CHEMISTRY	2.56
5	NGAH WSW	35	983	28.09	ENGINEERING CHEMICAL	2.16
6	ONG SH	54	503	9.31	STATISTICS PROBABILITY	2.09
7	XIONG RG	31	931	30.03	CHEMISTRY INORGANIC NUCLEAR	2.02
8	YADAV M	38	1019	26.82	ONCOLOGY	2.01
9	CHOW WS	41	490	11.95	POLYMER SCIENCE	2.00
10	HUSSAIN MA	48	361	7.52	ENGINEERING CHEMICAL	1.99
11	ABDULLAH AH	46	424	9.22	ELECTROCHEMISTRY	1.97
12	CHUAH TG	40	442	11.05	ENGINEERING CHEMICAL	1.89
13	SUBRAMANI AM S	36	80	2.22	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.87
14	ARIFFIN H	37	350	9.46	HEMATOLOGY	1.86
15	ALAM GM	44	528	12	BUSINESS	1.85
16	CHOONG TSY	38	278	7.32	ENGINEERING CHEMICAL	1.81
17	WONG KT	52	1336	25.69	PATHOLOGY	1.81
18	ABDULLAH MP	34	319	9.38	CHEMISTRY ANALYTICAL	1.80
19	LAM SK	65	2726	41.94	VIROLOGY	1.80
20	JALALUDIN S	45	821	18.24	AGRICULTURE	1.76
21	EE GCL	42	118	2.81	CHEMISTRY MEDICINAL	1.73
22	SEVENET T	31	660	21.29	PLANT SCIENCES	1.72
23	ZENG MH	31	100	3.23	CRYSTALLOGRAPHY	1.71
24	ABDULLA MA	33	144	4.36	CRYSTALLOGRAPHY	1.71
25	HARON MJ	38	309	8.13	CHEMISTRY MULTIDISCIPLINARY	1.70
26	FONG MY	31	278	8.97	PARASITOLOGY	1.69
27	MANAN ZA	40	501	12.52	ENGINEERING CHEMICAL	1.68
28	DAUD WMAW	50	556	11.12	ENGINEERING CHEMICAL	1.67

N	Authors	Records found	Sum of C	Average citations per item	Subject area	ratio p/h
29	MOHAMAD H	36	190	5.28	ENGINEERING ELECTRICAL ELECTRONIC	1.67
30	CHEE KK	41	434	10.59	POLYMER SCIENCE	1.66
31	SEOW CC	32	567	17.22	FOOD SCIENCE TECHNOLOGY	1.66
32	ABDULLAH MH	35	396	11.31	MATERIALS SCIENCE MULTIDISCIPLINARY	1.65
33	KAMARULZAMAN A	64	1273	19.89	INFECTIOUS DISEASES	1.63
34	LOW KS	67	1455	21.72	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.58
35	AHMAD SH	33	257	7.79	POLYMER SCIENCE	1.58
36	ALI MA	56	538	9.61	CRYSTALLOGRAPHY	1.57
37	AHMAD MN	35	215	6.14	CHEMISTRY ANALYTICAL	1.57
38	ABUBAKAR S	43	603	14.02	INFECTIOUS DISEASES	1.57
39	BOEY PL	39	330	8.46	CHEMISTRY APPLIED	1.56
40	CHUA KH	35	170	4.86	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.56
41	TAN CT	65	1200	18.46	DENTISTRY ORAL SURGERY MEDICINE	1.56
42	PANG T	40	713	17.39	MICROBIOLOGY	1.56
43	CROUSE KA	43	594	13.81	CRYSTALLOGRAPHY	1.55
44	SHARIFF M	42	511	12.17	FISHERIES	1.53
45	NASEF MM	49	1007	20.55	POLYMER SCIENCE	1.53
46	MANSOR SM	47	471	10.02	PHARMACOLOGY PHARMACY	1.52
47	KHALID BAK	79	1170	14.85	ENDOCRINOLOGY METABOLISM	1.52
48	LOOI LM	75	1239	16.52	PATHOLOGY	1.52
49	SELAMAT J	31	236	7.61	FOOD SCIENCE TECHNOLOGY	1.52
50	HA ST	38	212	5.58	CRYSTALLOGRAPHY	1.51

What does the investigation of p to h index ratio reveal? If the ratio higher than 1 it means that *p* index appeared to be higher than *h*. If ratio is equal to 1, it means that *h* and *p* indices are equal. Finally, if ratio is lower than 1 – *p* index is lower than *h* index. Exploring the ratio set, one would be able to see the distribution of differences. Figure 4.4 visually represents the fractions of the differences between *h* and *p* indices. As seen in Figure 4.4 and Table 4.12 most part of *p* index of the sample occurred to be higher than *h* index, 92.38%. But there are still fraction where *p* index is lower (6.81%) or equal (0.8%) to *h* index. It gave us a different rank.

Table 4.11. Distribution of differences between *p* and *h* index

Number of authors	%	Ratio
461	92.38	p/h>1
34	6.81	p/h=1
4	0.8	p/h<1

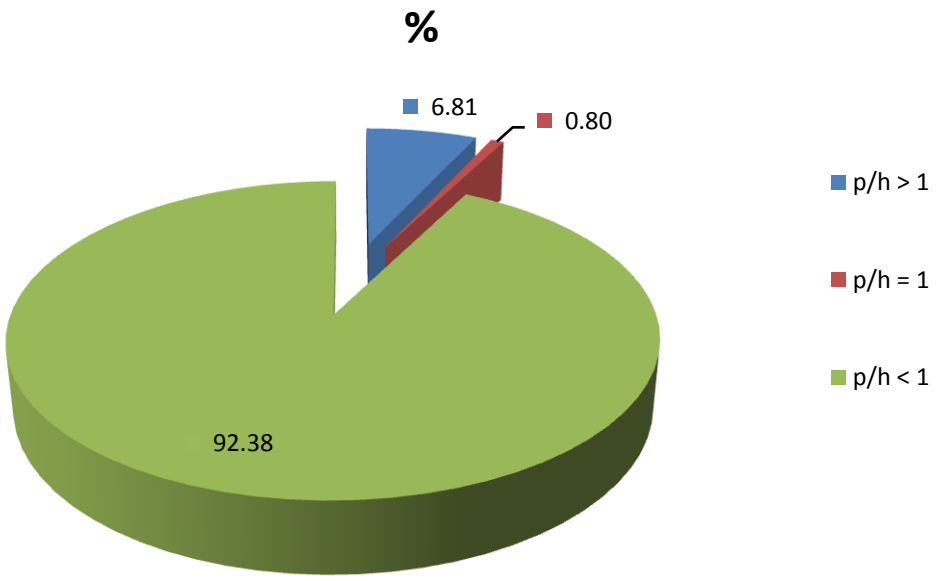

Figure 4.4. Distribution of differences between *p* and *h* index.

4.10 Comparison of ranks based on h-index and p-index

In this section a few cases will be demonstrated where *p* index gives more credits in contrast to *h* index. The attempts to identify the reasons of change will be undertaken.

As shown in the previous section 92.38 % of sample records received *p* index higher than *h* index. Only four records remained with the same p index as h index, which comprises 0.80 %. Another 6.81 % of records received p index lower than h index. From this we can conclude that *p* index is not just an another formula which gives the same rating as a *h* index concept but just in a different scale, it is actually giving variant results which

are totally different from the *h* index, remaining approximately at the same scale of measure, floating at the same range of means.

In the following section, the top authors in both ranks will are examined, as well as the top in ratio and the bottom in ratio. Thus total three cases.

Table 4.12. Top authors from both ranks *p* index and *h* index.

Authors	results found	Sum of C	Average citations per item	h index	Position in rating by h	p index	Position in rating by p	subject area
FUN HK	2179	10055	4.61	37	1	35.93	4	CRYSTALLOGRAPHY
LAM SK	65	2726	41.94	27	5	48.53	1	VIROLOGY

Figure 4.5 Visual presentation of two leaders from two different ranks

According to h-index based rating the first position is occupied by Fun, and using p –index concept Fun moves down to the 4th position. Lam who was occupying 5th position

in h index rank went up on top. As it is seen from table 4.13 such standard bibliometric indicator as average number of citation per paper of Lam is ten times higher than Fun's one. From this it can be assume that there is a high correlation between average citation per paper and p index. But in thecase of Hameed B.H. and Chen X.M. this assumption is not supported because the order based on average is totally different from the order based on p index.

Results of statistical analysis, which are presented in Table 4.13, has revealed that correlation between average citation per paper, total number of publications and p, h index is significant at the 0.01 level (2-tailed). As it seen from the Table 4.13 Pearson correlation between average number of citations per paper and *p* index is higher than between average number of citations per paper and *h* index. Also *h* index has stronger correlation with number of total publications than *p* index has.

Table 4.13. Pearson Correlation coefficient and Spearman's rho between standard bibliometric indicators and p and h index

		h_index	p_index
Average number of citation per paper	Pearson correlation	.687**	.892**
	Spearman's rho	.832**	.935**
Total number of publications	Pearson correlation	.436**	.280**
	Spearman's rho	.490**	.357**

**. Correlation is significant at the 0.01 level (2-tailed).

Even though as it shown in table 4.14 correlation between *p* and *h* is high, and it may be argued that p index doesn't give any extra information on author's scientific performance, on a practical application it is clear that the rank is different.

Table 4.14. Pearson Correlation coefficient and Spearman's rho between *p* and *h* index

		P index
h_index	Pearson Correlation	.921**
	Spearman rho Correlation Coefficient	.948**

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.15 represents two instances from the first and the last position from the rank based on ratio *p* to *h*.

Table 4.15. Three cases – the top, the last from ratio rank and the one who remained at the same position in both p and h basis ranks

Authors	results found	Sum of C	Average citations per item	h index	Position in rating by h	p index	Position in rating by p	subject area
Omar K	38	168	4.42	3	484	9.06	343	Materials science Multidisciplinary
Hameed BH	116	2338	20.16	30	2	36.12	2	engineering
Najafi E	32	22	0.69	3	493	2.47	497	Crystallography

Omar K. is occupying first position in ratio *p* to *h* basis rank with the number of 3.02. It means that his *p* exceeds his *h* 3.02 times. Najafi E. Who was taken from the last record carrying mean of ratio 0.82, which means that his *p* is less than his *h*.

The above statistical results has indicated that *p* index has a significant correlation with such standard bibliometric indicator as average number of citation per paper and total number of publications. Also it has been revealed that correlation between *p* index and average citations per paper is stronger than correlation between *h* index and total number of

publications. It means that *p* index measure impact more rather than productivity which is more bounded with *h* index.

Comparative table (Table 4.16) was compiled where first ten authors from different ranks were ordered, and showed visible change.

Table 4.16. Comparative table of different ranks

Position in ranking	Total number of papers	h index	p index	Average citations per paper
1	FUN HK	FUN HK	LAM SK	LAM SK
2	NG SW	HAMEED BH	HAMEED BH	CHEN XM
3	CHANTRAPROMMA S	NG SW	LEE CK	XIONG RG
4	TIEKINK ERT	ISHAK ZAM	FUN HK	NGAH WSW
5	AHMAD H	LAM SK	CHEN XM	YADAV M
6	RAZAK IA	KAM TS	TILLEY DR	WONG KT
7	ISMAIL H	ISMAIL H	YOU XZ	LEE CK
8	HARUN SW	YOU XZ	ISHAK ZAM	WEI C
9	YAMIN BM	AHMAD AL	WONG KT	LOW KS
10	MAN YBC	LEE CK	LOW KS	SEVENET T
11	HASSAN Z	BHATIA S	XIONG RG	NASEF MM
12	ALI HM	GOH KL	NGAH WSW	TILLEY DR
13	CHINNAKALI K	ISMAIL AF	YADAV M	HAMEED BH
14	HEMAMALINI M	MOHAMED AR	AHMAD AL	KAMARULZAMAN A
15	TEOH SG	AROF AK	GOH KL	ISHIAKU US
16	HASHIM R	MAN YBC	KAM TS	TAN CT
17	GAO S	DAS VGK	KAMARULZAMAN A	JALALUDIN S
18	LO KM	CHANTRAPROMMA S	NG SW	MAK TCW
19	ABDULLAH N	AHMAD H	ISHIAKU US	NGEOW YF
20	BHATIA S	LOW KS	WEI C	YOU XZ
21	MAHDI MA	ISHIAKU US	ISMAIL H	PANG T
22	AHMAD AL	ALI AM	TAN CT	GOH LY
23	AROF AK	YUEN KH	NASEF MM	SEOW CC
24	BASRI M	WEI C	BHATIA S	ISHAK ZAM
25	MOHAMED AR	GOH LY	LOOI LM	LOOI LM
26	USMAN A	HARUN SW	ISMAIL AF	BURFIELD DR
27	RAJ SSS	BASRI M	DAS VGK	KHALID BAK
28	ISMAIL A	SALLEH AB	KHALID BAK	KAM TS

Position in ranking	Total number of papers	h index	p index	Average citations per paper
29	ISHAK ZAM	TAN CP	MAN YBC	PEH KK
30	POP I	ROZMAN HD	JALALUDIN S	ROZMAN HD
31	ISMAIL AF	LAJIS NH	MOHAMED AR	KOMIYAMA K
32	GOH KL	TAN NH	GOH SH	GOH SH
33	DAS S	WONG KT	ROZMAN HD	ABUBAKAR S
34	TAN CP	KAMARULZAMAN A	SEVENET T	OMAR AKM
35	HASHIM I	LOOI LM	GOH LY	CROUSE KA
36	ISMAIL R	TAN CT	ALI AM	GOH KL
37	YOU XZ	HASHIM I	YUEN KH	DAS VGK
38	YEAP CS	POP I	HO YW	AHMAD AL
39	AHMAD A	GOH SH	PANG T	HAMID AA
40	AWANG K	NASEF MM	SALLEH AB	RUSUL G
41	KAM TS	ABDULLAH N	MAK TCW	HO YW
42	SALLEH AB	ISMAIL A	AROF AK	NG WK
43	DAUD WRW	KHALID BAK	TAN NH	MANAN ZA
44	HAMEED BH	CHINNAKALI K	CHANTRAPROMM A S	RAZAK CNA
45	KHAN MN	LEE KT	BURFIELD DR	TAN NH
46	OSMAN H	RAZAK IA	NGEOW YF	PEH SC
47	PATIL PS	RAJ SSS	PEH KK	SHARIFF M
48	NAZAR R	HO YW	ISMAIL A	CHOO YM
49	ISMAIL Z	MASJUKI HH	HASHIM I	MOHAMED S
50	NG KH	YUSOFF K	PUTHUCHEARY SD	ALAM GM

Full comparative table which compiled all indices can be found in Appendix A.

4.11 Summary

This chapter has presented the findings such as a total publication productivity in Malaysia, top productive authors in Malaysia by number of publications, top productive subject areas, top productive universities, distribution of publications within the period of study, from 1980 to 2011. Also it has shown the authors scientific activity and impact ranks built on h-index basis, and p-index basis. The difference in the ranks based on h-index and p-index were revealed.

The reasons why the changes in ranks had taken place, were attempted to be described. Thus, statistical analysis revealed that there is higher and stronger correlation between *p* index and average citations per paper rather than between *h* index and total number of publications. Even though there is a strong correlation between *p* and *h* index, two ranks appeared to be totally different.

This means that there is redundancy between most of the h index variants and the h index.

Even though according to Navon, (2009) "high correlations indicate that despite the differences in how the metrics are calculated, there is too much redundancy in the information they yield". And as Bornmann, et al., (2011) said that even if the "actual" correlations might be higher than that claimed in the original papers introducing the new *h* type indices due to systematic sampling selection effects, a mean correlation coefficient of between .8 and .9 is still high and might not justify the development of more and more *h* index variants.

Despite the above opinion, *p* index being another *h* index variant was not covered by any review or comparative analysis before.

This section has shown the results of practical employment of *p* index and its ability of wider application.

CHAPTER 5

CONCLUSION

5.1 Introduction

The main objective of the present study was to apply bibliometric analysis, such as the newly proposed Prathap's, (2011a,b,c,d) Thermodynamic approach to calculate *Exergy*, which substitute h-index to indicate author productivity and author performance in Malaysia, who have been publishing since 1980 till 2011 years.

The 31-year data were harvested from databases such as Web of Science, which provided the necessary data to support a bibliometric study. Hence, the objectives of this study are to determine the top productive authors in Malaysian by counting their *h*-index and *Exergy* or *p* index; to compare the rank by *Exergy* index or *p*-index and *h*-index; to find out if there is any difference in rank by *Exergy* index or *p*-index and *h*-index; to find out distribution of top authors publications within the subjects areas. This chapter will discuss the results and answer the research questions. Finally, it will conclude with recommendations for future studies.

5.2 Findings and Discussions

It was observed that journal article is the major way of scholarly communication among Malaysian researchers.

Only ten first authors were presented in the tables in data analysis section because of a huge gap between first two positions and the remained authors. It seems that two authors took the lead significantly. Remaining numbers of publications of 497 authors gradually decreases from third position till the end. It tells us that the most productive authors are in *Crystallography* subject area.

147 subject areas were identified where Malaysian scientist publish. Leading position is occupied by *Engineering*, following by *Chemistry* and *Crystallography*. An interesting fact is that Crystallography area consists of 4362 records, which means that almost half of all papers are written by one particular researcher, - Fun, who is the most productive author in this subject area. Top productive university is University of Malaya.

It was found out that in general publication have been consistently on the increase during the period under the study. This suggests that the research activity of Malaysian authors increasing yearly. Several peaks of research activity were identified – in 1982, 1988, 1991, 1995, and 1999 years. After 1999 it was a consistent growth of number of publications.

The fact was highlighted that four last authors out of top ten who are presented in a *h* index based performance rank has the same *h*-index - 24. But actually, one of them, You X.Z. in particular, who is on the last position has received more citations than three other authors who are in front of him. This proves that *h* index is not so precise in terms of impact.

Performance rank based on average citations per paper also revealed that the top productive author is Lam. It was assumed that *p* index has stronger correlation with average number of citations per paper than *h* index has with total number of publications, what was statistically proved afterwards.

It was identified that 92.38 % of sample records received *p* index higher than *h* index. Only four records remained with the same *p* index as *h* index, which comprises 0.80 %. Also 6.81 %of records received *p* index lower than *h* index. p index is not just an another formula which gives the same rating as a *h* index concept but just in a different scale, it is actually giving various results which are totally different from the *h* index, remaining approximately at the same scale of measure, floating at the same range of means.

According to h-index based rating the first position is occupied by Fun, and using p –index concept Fun is going down on 4th position. Lam who was occupying 5th position in h index rank went up on top. As it was identified such standard bibliometric indicator as average number of citation per paper of Lam is ten times higher than Fun's one. From this it can be assumed that there is a high correlation between average citation per paper and p index. But such cases as Hameed B.H. and Chen X.M. don't support this assumption because the order based on average is totally different from the order based on *p* index.

Performance rank based on *p*-index revealed totally different results. Fun is not leader anymore. Why is it assumedthat this rank performs better than *h*-index rank? If attention is paid to such standard bibliometric indicator as average citations per paper,Fun has 4,61 citations per paper meanwhile Lam has 41,94 citations per paper. Thus the subject area with the most high performance researcher is appeared to be a *Virology*.

Hirsch (2005) mentioned that one of the disadvantages of Citations per paper indicator is that it "rewards low productivity, and penalizes high productivity". It may be argued that *Lam* has less performance than *Fun*, but the field of study should be considered as well. It should not be forgotten that *Lam* from *Virology* science, where opportunity to be published might be less than in *Crystallography*. *Fun* with huge number of publications in *Crystallography* area is certainly high productive and *Lam* from *Virology* with big number of highly cited papers is scientifically influential and brings impact. Thus in terms of scientific performance according to a new method Lam is leader.

Statistical analysis has revealed that correlation is significant at the 0.01 level (2-tailed). Even though correlation is high and somebody might say that p index doesn't give any extra information on author's scientific performance, on a practical application we can see that rank is different. Also h index has stronger correlation with number of total publications than p index has.

The reasons why the changes in ranks had place, were attempted to be described. Thus, statistical analysis revealed that there is a higher and stronger correlation between p index and average citations per paper rather than between h index and total number of publications. Even though there is a strong correlation between p and h index, two ranks appeard to be totally different. Tables 5.1 and 5.2 shows that p index has a better balance between standard bibliometric indicators than h index. Statistical results which are summarised in Tables 5.1 and 5.2 support findings of Prathap, (2010a) where he re-examined the performance of this new p-index using the example of the hundred most prolific economists (Tol 2009). What was remarkable in that study that Robert F. Engle had rose effortlessly to the top. The h-index was not able to do this because his output of 83 papers restricts his h-index to a low value although his mean citation rate is the highest in this list. Only the p-index captured this well. Similarly, Robert Barro benefited from this new classification, rising to third place.

Tables 5.1 and 5.2 reveal the correlation matrix connecting the various indices. It appears that same as in Prathap, (2010a) study p-index gives the best balance between quality (C/P) and quantity (C). And as Prathap, (2010a) saying "it is not surprising because by definition, the performance index is based on the substitute or mock index, $p = h_m = (C (C/P))^{(1/3)}$ and has the significance of a ''geometric mean'' that is consistent with the dimensions of h, and therefore should give the best balance between C and C/P for any non-linear process governed by random multiplicative processes".

Table 5.1. Correlation matrix for the various indices (P - total number of publications, C - total number of citations)

	P	*C*	*C/P*	*p*	*h*
P	1	.967	.067	.357	.490
C	-	1	.828	.967	.959
C/P	-	-	1	.935	.832
p	-	-	-	1	.948
H	-	-	-	-	1

Table 5.2. Correlation matrix emphasizing that *p* gives the best balance between quantity (*C*) and *quality* (C/P)

	p index	*h index*
C	.967	.959
C/P	.935	.832

Table 5.3 has summarised that *p* index resolves some drawbacks of *h* index. In this section it will be discussed in more detail. P index is not limited by number of publications, what is explained by strong correlation with number of average citation per publication. By other words it means that *p* index can exceed number of publications but *h* index never can. Other formulations of closely related disadvantages are solved automatically, such as dependence on scientist's age or career length's.

Table 5.3. Problems of *h* index and the ways *p* index resolves it

	Disadvantage of *h* index	**How does *p* index solves this problem**
1	Limited by number of publications	Not limited, because according to the formula as average going higher index can increase
2	Scientist's age or career length's dependence	To obtain high p index not necessary to have a plenty of publications because average is in charge
3	Extremely field dependent	Less Field dependent, again because of high correlation with average citations per paper
4	Can be manipulated by self-citations	More difficult to manipulate, because new publication has affect as well
5	To simple to assess complex scientific output	Complicated enough
6	Applying it for comparing best scientists only	Not only for best scientists
7	Not dynamic	Can decrease

Another disadvantage which was tried to be overcome is extremely field dependence. It can be observed that such new subject areas as *Physics Condensed Matter, Pathology, Biotechnology Applied Microbiology, Chemistry Inorganic Nuclear, Engineering Chemical, Oncology, Infectious Diseases* appeared in a top twenty records in a new *p* index based rank. It tells us that p index brought up new scientific fields where not so many publications as in such top fields from h index based rank as *Crystallography.* It means that now scientists from different fields can be compared approximately at the same scale level. Closely related disadvantage which was formulated as applicability for comparing best scientists only, naturally resolved as well. As it was shown in chapter 4 scientist from small number publications fields raise up on top.

Also p index is more dynamic than the h index. H index can never decrease and p index can, when number of publications goes higher and number of citation remains the same. With p index researchers have to maintain or try to increase ratio of total citations to total publications. Hence it could be derived, that such disadvantage of h index as

opportunity to manipulate with self-citations, is resolved as well. With p index it is much more difficult to affect on the index just by new citation, because a new publication has affect on it itself as well.

Another disadvantage of h index, which is more like an opinion of distinguish researchers that *h* index is to simple single measure for evaluating a research output, was also attempted to be overcome by p index. P index is not as simple as it could be perceived. The reason is in deep philosophy which lies behind it. Analogy between bibliometric and other science is simple and complicated enough to evaluate research output.

Moreover there are some features of *p* index which give more advantages to *p* over *h* index. Among them are opportunity of p index to present nicely the scientific portfolio of the researcher from three different perspective, specifically "the time-series, event-series and phase diagram representations of his [researcher's] bibliometric progress". Another is its universality and ability to be used in any aggregated level, meaning that it is actually applicable at any field and any scale level where performance is needed to be assessed. Lastly, its ability to be calculated in fractional and harmonic way, allows to take into account position of author in a authorship raw in a multi-authored works to give more precise assessment.

The main purpose of the present study, to apply bibliometric analysis, specifically the newly proposed Thermodynamic approach to count Exergy which is a substitute of h-index to indicate author productivity in Malaysia, who have been publishing since 1980 till 2011, was successfully achieved.

The settled objectives were auspiciously accomplished. Top productive authors in Malaysia by counting their h-index and Exergy or p index were identified.; Two ranks by Exergy index or p-index and h-index were compared by applying statistical analysis to rank based on ratio of these two indices, which method was taken from Egghe, (2006) and

improved; The difference in ranks by Exergy index or p-index and h-index was found out; Distribution of top authors publications within the subjects areas was identified; Top productive universities were identified.

The research questions, which followed the objectives of the study, were answered. There is really the difference between the author productivity rank based on p-index and h-index took place. According to the results of this study p index appeared to be more accurate and robust index rather than h. Names of the top productive authors in Malaysia were revealed.

5.3 Implications and further studies

For further studies recommended research directions were tried to be identified.

Among them is statistical analysis of *p* index behaviour in different cases. Thus, it is recommended to apply *p* index for evaluation scientific output of more various samples at different levels of aggregation such as not only individual scientific performance but the level of research groups, institutions and countries.

More detailed mathematical explanation of the rewritten in a new way, through the Thermodynamics perspective, formula is needed to be delivered.

Investigation of how robust is normalization state of *p* index may be explored.

5.4. Conclusion

This chapter has presented the conclusion remarks based on findings such as a total publication productivity in Malaysia, top productive authors in Malaysia by number of publications, top productive subject areas, top productive universities, distribution of publications within the period of study, from 1980 to 2011. Also it has shown the authors scientific activity and impact ranks built on *h*-index basis, and *p*-index basis. The difference in the ranks biult on *h*-index basis and *p*-index basis was revealed.

It was practically shown that p-index has better picture in terms of balance between measure of productivity and impact.

This particular research was an attempt in investigation of *p*-index or performance indicator which was proposed by Prathap in 2010. The concept of analogy between such branches of physics as Mechanical and Electrical physics and Scientometric field was assumed, and it seems to be an incredibly interesting consilience. Perceiving standard bibliometric measures as an energy which each paper carries, allow us to operate with these numbers in a new way.

Being current issue how to measure scientific output, it is assumed to be of great importance that performance index which was proposed by Prathap, (2011g) to be used instead of *h*-index possesses exclusive properties. And the analogy which was assumed and parallels which were put between such research fields as Mechanical and Electrical physics, Kinetics, Thermodynamics, and Bibliometrics has lead me one more time to the idea that everything in this world can be explained by universal laws of nature.

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Appendix A. Comparative table of *h* and *p* index based on ratio *p* to *h*

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
1	OMAR K	38	168	162	4.42	3	742.74	9.06	MATERIALS SCIENCE MULTIDISCIPLINARY	3.02
2	NGEOW YF	32	577	575	18.04	8	10404.03	21.83	MICROBIOLOGY	2.73
3	TILLEY DR	98	2008	1295	20.49	13	41143.51	34.52	PHYSICS CONDENSED MATTER	2.66
4	CHEN XM	45	1439	1265	31.98	14	46016.02	35.83	CHEMISTRY	2.56
5	NGAH WSW	35	983	768	28.09	14	27608.26	30.22	ENGINEERING CHEMICAL	2.16
6	ONG SH	54	503	395	9.31	8	4685.35	16.73	STATISTICS PROBABILITY	2.09
7	XIONG RG	31	931	780	30.03	15	27960.03	30.35	CHEMISTRY INORGANIC NUCLEAR	2.02
8	YADAV M	38	1019	984	26.82	15	27325.29	30.12	ONCOLOGY	2.01
9	CHOW WS	41	490	353	11.95	9	5856.10	18.02	POLYMER SCIENCE	2.00
10	HUSSAIN MA	48	361	314	7.52	7	2715.02	13.95	ENGINEERING CHEMICAL	1.99
11	ABDULLAH AH	46	424	402	9.22	8	3908.17	15.75	ELECTROCHEMISTRY	1.97
12	CHUAH TG	40	442	409	11.05	9	4884.10	16.97	ENGINEERING CHEMICAL	1.89
13	SUBRAMANIAM S	36	80	68	2.22	3	177.78	5.62	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.87
14	ARIFFIN H	37	350	334	9.46	8	3310.81	14.90	HEMATOLOGY	1.86
15	ALAM GM	44	528	173	12	10	6336.00	18.50	BUSINESS	1.85
16	CHOONG TSY	38	278	253	7.32	7	2033.79	12.67	ENGINEERING CHEMICAL	1.81
17	WONG KT	52	1336	932	25.69	18	34324.92	32.50	PATHOLOGY	1.81
18	ABDULLAH MP	34	319	299	9.38	8	2992.97	14.41	CHEMISTRY ANALYTICAL	1.80

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
19	LAM SK	65	2726	1709	41.94	27	114324.25	48.53	VIROLOGY	1.80
20	JALALUDIN S	45	821	582	18.24	14	14978.69	24.65	AGRICULTURE	1.76
21	EE GCL	42	118	99	2.81	4	331.52	6.92	CHEMISTRY MEDICINAL	1.73
22	SEVENET T	31	660	567	21.29	14	14051.61	24.13	PLANT SCIENCES	1.72
23	ZENG MH	31	100	95	3.23	4	322.58	6.86	CRYSTALLOGRAPHY	1.71
24	ABDULLA MA	33	144	141	4.36	5	628.36	8.57	CRYSTALLOGRAPHY	1.71
25	HARON MJ	38	309	291	8.13	8	2512.66	13.59	CHEMISTRY MULTIDISCIPLINARY	1.70
26	FONG MY	31	278	266	8.97	8	2493.03	13.56	PARASITOLOGY	1.69
27	MANAN ZA	40	501	259	12.52	11	6275.03	18.44	ENGINEERING CHEMICAL	1.68
28	DAUD WMAW	50	556	454	11.12	11	6182.72	18.35	ENGINEERING CHEMICAL	1.67
29	MOHAMAD H	36	190	174	5.28	6	1002.78	10.01	ENGINEERING ELECTRICAL ELECTRONIC	1.67
30	CHEE KK	41	434	387	10.59	10	4594.05	16.62	POLYMER SCIENCE	1.66
31	SEOW CC	32	567	497	17.22	13	10046.53	21.58	FOOD SCIENCE TECHNOLOGY	1.66
32	ABDULLAH MH	35	396	342	11.31	10	4480.46	16.49	MATERIALS SCIENCE MULTIDISCIPLINARY	1.65
33	KAMARULZAMAN A	64	1273	1000	19.89	18	25320.77	29.36	INFECTIOUS DISEASES	1.63
34	LOW KS	67	1455	1148	21.72	20	31597.39	31.61	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.58
35	AHMAD SH	33	257	236	7.79	8	2001.48	12.60	POLYMER SCIENCE	1.58
36	ALI MA	56	538	426	9.61	11	5168.64	17.29	CRYSTALLOGRAPHY	1.57
37	AHMAD MN	35	215	189	6.14	7	1320.71	10.97	CHEMISTRY ANALYTICAL	1.57
38	ABUBAKAR S	43	603	475	14.02	13	8456.02	20.37	INFECTIOUS DISEASES	1.57

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
39	BOEY PL	39	330	220	8.46	9	2792.31	14.08	CHEMISTRY APPLIED	1.56
40	CHUA KH	35	170	138	4.86	6	825.71	9.38	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.56
41	TAN CT	65	1200	833	18.46	18	22153.85	28.09	DENTISTRY ORAL SURGERY MEDICINE	1.56
42	PANG T	40	713	611	17.39	15	12709.23	23.34	MICROBIOLOGY	1.56
43	CROUSE KA	43	594	390	13.81	13	8205.49	20.17	CRYSTALLOGRAPHY	1.55
44	SHARIFF M	42	511	481	12.17	12	6217.17	18.39	FISHERIES	1.53
45	NASEF MM	49	1007	591	20.55	18	20694.88	27.45	POLYMER SCIENCE	1.53
46	MANSOR SM	47	471	393	10.02	11	4720.02	16.77	PHARMACOLOGY PHARMACY	1.52
47	KHALID BAK	79	1170	1058	14.85	17	17327.85	25.88	ENDOCRINOLOGY METABOLISM	1.52
48	LOOI LM	75	1239	1139	16.52	18	20468.28	27.35	PATHOLOGY	1.52
49	SELAMAT J	31	236	224	7.61	8	1796.65	12.16	FOOD SCIENCE TECHNOLOGY	1.52
50	HA ST	38	212	121	5.58	7	1182.74	10.58	CRYSTALLOGRAPHY	1.51
51	RAHMAN SA	59	264	251	4.47	7	1181.29	10.57	MATERIALS SCIENCE MULTIDISCIPLINARY	1.51
52	LEE CK	78	1905	1468	24.42	24	46525.96	35.97	ENVIRONMENTAL SCIENCES ECOLOGY	1.50
53	ALI BM	31	114	109	3.68	5	419.23	7.48	ENGINEERING ELECTRICAL ELECTRONIC	1.50
54	OMAR AKM	38	529	390	13.92	13	7364.24	19.46	FOOD SCIENCE TECHNOLOGY	1.50
55	YUSOF S	46	453	392	9.85	11	4461.07	16.46	FOOD SCIENCE TECHNOLOGY	1.50
56	SEETHARAMU KN	63	529	473	8.4	11	4441.92	16.44	THERMODYNAMICS	1.49
57	KAMARUDIN SK	38	410	333	10.79	11	4423.68	16.42	ENERGY FUELS	1.49
58	RAHMAN AA	34	240	234	7.06	8	1694.12	11.92	CRYSTALLOGRAPHY	1.49
59	ZAKARIA Z	65	271	252	4.17	7	1129.86	10.42		1.49

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
60	LEE WS	42	317	293	7.55	9	2392.60	13.37	PEDIATRICS	1.49
61	MUNIANDY SV	31	228	192	7.35	8	1676.90	11.88	PHYSICS FLUIDS PLASMAS	1.49
62	SEETHARAMU KN	63	522	468	8.29	11	4325.14	16.29	CRYSTALLOGRAPHY	1.48
63	MURUGESAN T	37	203	134	5.49	7	1113.76	10.37	ENGINEERING CHEMICAL	1.48
64	CHAI SP	31	227	173	7.32	8	1662.23	11.85	MATERIALS SCIENCE MULTIDISCIPLINARY	1.48
65	KUMAR RN	41	479	399	11.68	12	5596.12	17.75	POLYMER SCIENCE	1.48
66	TENG TT	43	430	367	10	11	4300.00	16.26	ENGINEERING CHEMICAL	1.48
67	LOH TC	33	115	85	3.48	5	400.76	7.37	AGRICULTURE DAIRY ANIMAL SCIENCE	1.47
68	SHIRAI Y	40	358	224	8.95	10	3204.10	14.74	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.47
69	LU ZL	33	325	245	9.85	10	3200.76	14.74	CRYSTALLOGRAPHY	1.47
70	BURFIELD DR	42	670	560	15.95	15	10688.10	22.03	POLYMER SCIENCE	1.47
71	ISA MH	33	321	240	9.73	10	3122.45	14.62	ENVIRONMENTAL SCIENCES	1.46
72	RADIMAN S	51	459	397	9	11	4131.00	16.05	MATERIALS SCIENCE MULTIDISCIPLINARY	1.46
73	HO YW	77	986	664	12.81	16	12625.92	23.29	AGRICULTURE	1.46
74	HAMID AA	40	519	425	12.98	13	6734.03	18.88	FOOD SCIENCE TECHNOLOGY	1.45
75	RAGHUNATHAN R	38	86	64	2.26	4	194.63	5.80	CRYSTALLOGRAPHY	1.45
76	ISHIAKU US	69	1295	944	18.77	20	24304.71	28.97	MATERIALS SCIENCE	1.45
77	TEH JBJ	43	211	122	4.91	7	1035.37	10.12	CRYSTALLOGRAPHY	1.45
78	YUSOF MSM	50	137	102	2.74	5	375.38	7.21	CRYSTALLOGRAPHY	1.44
79	MOHAMED S	56	679	630	12.12	14	8232.88	20.19	FOOD SCIENCE TECHNOLOGY	1.44
80	WEI C	46	1050	838	22.83	20	23967.39	28.83	CHEMISTRY	1.44

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
81	WU JY	33	268	245	8.12	9	2176.48	12.96	CHEMISTRY INORGANIC NUCLEAR	1.44
82	HASAN M	40	345	279	8.62	10	2975.63	14.38	ENGINEERING CHEMICAL	1.44
83	MUSTAFA MR	49	326	281	6.65	9	2168.90	12.94	PHARMACOLOGY PHARMACY	1.44
84	MOHAMED M	49	326	308	6.65	9	2168.90	12.94	ENTOMOLOGY	1.44
85	CHANAWANNO K	32	78	43	2.44	4	190.13	5.75	CRYSTALLOGRAPHY	1.44
86	YOU XZ	130	2302	1908	17.71	24	40763.11	34.42	CRYSTALLOGRAPHY	1.43
87	WONG RCS	32	307	140	9.59	10	2945.28	14.33	CHEMISTRY INORGANIC NUCLEAR	1.43
88	STANSLAS J	34	226	195	6.65	8	1502.24	11.45	PHARMACOLOGY PHARMACY	1.43
89	SCHILTHUIZEN M	35	419	307	11.97	12	5016.03	17.12	ECOLOGY	1.43
90	AHMAD D	32	141	118	4.41	6	621.28	8.53	ENGINEERING ENVIRONMENTAL	1.42
91	TAN SH	40	198	197	4.95	7	980.10	9.93	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.42
92	AROUA MK	71	745	600	10.49	14	7817.25	19.85	CRYSTALLOGRAPHY	1.42
93	THONG KL	58	534	440	9.21	12	4916.48	17.00	MICROBIOLOGY	1.42
94	YIP BC	31	296	275	9.55	10	2826.32	14.14	CRYSTALLOGRAPHY	1.41
95	DEVI S	39	382	359	9.79	11	3741.64	15.52	IMMUNOLOGY	1.41
96	AHMAD I	49	131	126	2.67	5	350.22	7.05	POLYMER SCIENCE	1.41
97	KHAN IA	38	29	21	0.76	2	22.13	2.81	CRYSTALLOGRAPHY	1.40
98	LIM YY	44	517	434	11.57	13	6074.75	18.25	FOOD SCIENCE TECHNOLOGY	1.40
99	YAHYA MZA	35	222	173	6.34	8	1408.11	11.21	MATERIALS SCIENCE MULTIDISCIPLINARY	1.40
100	LONG LS	33	140	126	4.24	6	593.94	8.41	CRYSTALLOGRAPHY	1.40
101	LOCKMAN Z	36	184	144	5.11	7	940.44	9.80	MATERIALS SCIENCE MULTIDISCIPLINARY	1.40
10	LIM KH	45	405	273	9	11	3645.00	15.39	CHEMISTRY ORGANIC	1.40

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
2										
103	MOHAMMAD AW	54	635	500	11.76	14	7467.13	19.55	ENGINEERING CHEMICAL	1.40
104	TAUFIQ-YAP YH	60	289	202	4.82	8	1392.02	11.17	CHEMISTRY PHYSICAL	1.40
105	LIM LHS	53	324	156	6.11	9	1980.68	12.56	PARASITOLOGY	1.40
106	MAK TCW	34	614	472	18.06	16	11088.12	22.30	CHEMISTRY INORGANIC NUCLEAR	1.39
107	NAVARATNAM V	55	638	511	11.6	14	7400.80	19.49	PHARMACOLOGY PHARMACY	1.39
108	HASSALI MA	39	29	28	0.74	2	21.56	2.78	PHARMACOLOGY PHARMACY	1.39
109	AMIN N	58	453	354	7.81	11	3538.09	15.24	MECHANICS	1.39
110	RAO MVC	42	285	280	6.79	9	1933.93	12.46	COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE (	1.38
111	LEE KH	38	227	203	5.97	8	1356.03	11.07	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.38
112	SINGH R	56	328	297	5.86	9	1921.14	12.43	SPORT SCIENCES	1.38
113	CHAN KL	39	273	210	7	9	1911.00	12.41	CHEMISTRY MEDICINAL	1.38
114	YIP CH	56	503	409	8.98	12	4518.02	16.53	ONCOLOGY	1.38
115	SOMCHIT MN	33	210	169	6.36	8	1336.36	11.01	PHARMACOLOGY PHARMACY	1.38
116	OTHMAN MR	49	357	282	7.29	10	2601.00	13.75	ENGINEERING CHEMICAL	1.38
117	RATNAVELU K	36	261	216	7.25	9	1892.25	12.37	PHYSICS ATOMIC MOLECULAR CHEMICAL	1.37
118	LIM MH	36	179	131	4.97	7	890.03	9.62	MATHEMATICS APPLIED	1.37

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
119	RAHMAN IA	33	209	177	6.33	8	1323.67	10.98	MATERIALS SCIENCE CERAMICS	1.37
120	ZAKARIA A	33	103	102	3.12	5	321.48	6.85	ELECTROCHEMISTRY	1.37
121	ZHAO H	39	185	159	4.74	7	877.56	9.57	CRYSTALLOGRAPHY	1.37
122	POH BL	46	292	185	6.35	9	1853.57	12.28	CHEMISTRY	1.36
123	TALIB ZA	33	102	96	3.09	5	315.27	6.81	MATERIALS SCIENCE MULTIDISCIPLINARY	1.36
124	OZTURK S	33	134	97	4.06	6	544.12	8.16	CRYSTALLOGRAPHY	1.36
125	ZAKARIA R	32	203	169	6.34	8	1287.78	10.88	ENGINEERING CHEMICAL	1.36
126	GOH SH	73	1032	828	14.14	18	14589.37	24.43	CHEMISTRY	1.36
127	PHANG SM	59	568	460	9.63	13	5468.20	17.62	MARINE FRESHWATER BIOLOGY	1.36
128	ZAINAL Z	102	925	838	9.07	15	8388.48	20.32	MATERIALS SCIENCE	1.35
129	CHUAH CH	55	548	394	9.96	13	5460.07	17.61	BIOCHEMISTRY MOLECULAR BIOLOGY	1.35
130	PEH KK	48	699	647	14.56	16	10179.19	21.67	PHARMACOLOGY PHARMACY	1.35
131	RAZAK CNA	36	442	375	12.28	13	5426.78	17.57	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.35
132	TEY BT	63	393	254	6.24	10	2451.57	13.48	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.35
133	SHAARI S	44	116	103	2.64	5	305.82	6.74	OPTICS	1.35
134	NG WK	42	529	351	12.6	14	6662.88	18.82	FISHERIES	1.34

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
135	PUTHUCHEARY SD	74	857	760	11.58	16	9924.99	21.49	MICROBIOLOGY	1.34
136	LIM SC	62	506	318	8.16	12	4129.61	16.04	PHYSICS MULTIDISCIPLINARY	1.34
137	BHAT R	45	192	171	4.27	7	819.20	9.36	FOOD SCIENCE TECHNOLOGY	1.34
138	SAIDUR R	80	647	338	8.09	13	5232.61	17.36	ENERGY FUELS	1.34
139	SHAH MR	33	25	20	0.76	2	18.94	2.67	CRYSTALLOGRAPHY	1.33
140	MOHAMAD R	42	146	140	3.48	6	507.52	7.98	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.33
141	NG KP	41	358	303	8.73	11	3125.95	14.62	IMMUNOLOGY	1.33
142	LIM TK	36	208	110	5.78	8	1201.78	10.63	CHEMISTRY PHYSICAL	1.33
143	PEH SC	43	525	493	12.21	14	6409.88	18.58	PATHOLOGY	1.33
144	KOMIYAMA K	31	445	249	14.35	14	6387.90	18.55	CHEMISTRY MEDICINAL	1.33
145	RAJ SSS	148	1182	1044	7.99	16	9440.03	21.13	CRYSTALLOGRAPHY	1.32
146	ZHENG LS	37	171	153	4.62	7	790.30	9.25	CRYSTALLOGRAPHY	1.32
147	ARIFF A	32	126	102	3.94	6	496.13	7.92	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.32
148	YUSOFF MSA	37	291	242	7.86	10	2288.68	13.18	FOOD SCIENCE TECHNOLOGY	1.32
149	ARIFIN Z	32	270	134	8.44	10	2278.13	13.16	CHEMISTRY PHYSICAL	1.32
150	RAHMAN ARA	32	270	245	8.44	10	2278.13	13.16	PHARMACOLOGY PHARMACY	1.32

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
151	GAN SN	35	202	185	5.77	8	1165.83	10.52	POLYMER SCIENCE	1.32
152	RUSUL G	46	594	556	12.91	15	7670.35	19.72	FOOD SCIENCE TECHNOLOGY	1.31
153	CHOO YM	52	631	445	12.13	15	7656.94	19.71	FOOD SCIENCE TECHNOLOGY	1.31
154	JOHNS EJ	33	127	54	3.85	6	488.76	7.88	PHARMACOLOGY PHARMACY	1.31
155	CHAN KY	34	98	84	2.88	5	282.47	6.56	MATERIALS SCIENCE MULTIDISCIPLINARY	1.31
156	TAN SC	35	201	192	5.748	8	1154.31	10.49	COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	1.31
157	ZHANG Y	64	438	347	6.84	11	2997.56	14.42	PHYSICS	1.31
158	DARUS M	37	73	57	1.97	4	144.03	5.24	MATHEMATICS APPLIED	1.31
159	SIAR CH	67	643	497	9.6	14	6170.88	18.34		1.31
160	RAHIM ASA	32	44	25	1.38	3	60.50	3.93	CRYSTALLOGRAPHY	1.31
161	BOONNAK N	31	188	108	6.06	8	1140.13	10.45	CRYSTALLOGRAPHY	1.31
162	KUTHUBUTHEEN AJ	46	320	231	6.96	10	2226.09	13.06	MYCOLOGY	1.31
163	NG SL	54	203	160	3.76	7	763.13	9.14	CRYSTALLOGRAPHY	1.31
164	RAMESH S	58	659	512	11.36	15	7487.60	19.56	MATERIALS SCIENCE MULTIDISCIPLINARY	1.30
165	SALEH MI	73	528	441	7.23	12	3818.96	15.63	CRYSTALLOGRAPHY	1.30
166	ALI A	64	269	245	4.2	8	1130.64	10.42	FOOD SCIENCE TECHNOLOGY	1.30
167	ABU BAKAR A	63	266	221	4.22	8	1123.11	10.39	PHYSICS	1.30

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
168	HENG LY	40	296	257	7.4	10	2190.40	12.99	CHEMISTRY ANALYTICAL	1.30
169	NOORDIN MM	35	70	66	2	4	140.00	5.19	VETERINARY SCIENCES	1.30
170	SOSROSENO W	39	171	108	4.38	7	749.77	9.08	DENTISTRY ORAL SURGERY MEDICINE	1.30
171	HUANG NM	37	284	243	7.68	10	2179.89	12.97	MATERIALS SCIENCE MULTIDISCIPLINARY	1.30
172	SUBRAMANIAM G	33	309	165	9.36	11	2893.36	14.25	CHEMISTRY ORGANIC	1.30
173	SUDESH K	46	364	247	7.91	11	2880.35	14.23	POLYMER SCIENCE	1.29
174	GOH KL	139	1909	1585	13.73	23	26217.85	29.71	GASTROENTEROLOGY HEPATOLOGY	1.29
175	MASJUKI HH	95	913	635	9.61	16	8774.41	20.63	ENERGY FUELS	1.29
176	GAO S	169	601	468	3.56	10	2137.28	12.88	CRYSTALLOGRAPHY	1.29
177	IDRIS A	69	383	350	5.55	10	2125.93	12.86	CRYSTALLOGRAPHY	1.29
178	JEFFERY J	34	68	66	2	4	136.00	5.14	PARASITOLOGY	1.29
179	SUKARI MA	41	137	114	3.34	6	457.78	7.71	PHARMACOLOGY PHARMACY	1.28
180	ISMAIL J	33	304	281	9.21	11	2800.48	14.10	POLYMER SCIENCE	1.28
181	ROZMAN HD	70	1005	700	14.36	19	14428.93	24.35	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.28
182	ABDULLAH A	56	201	196	3.59	7	721.45	8.97	MULTIDISCIPLINARY SCIENCES	1.28
183	SAAD B	88	636	539	7.23	13	4596.55	16.63	CHEMISTRY	1.28
18	YAP CK	50	323	239	6.46	10	2086.58	12.78	ENVIRONMENTAL SCIENCES	1.28

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
184										
185	ADAM F	30	179	102	5.97	8	1068.03	10.22	CHEMISTRY PHYSICAL	1.28
186	ALI A	64	261	238	4.08	8	1064.39	10.21	CRYSTALLOGRAPHY	1.28
187	ISMAIL S	54	286	247	5.3	9	1514.74	11.48	PHARMACOLOGY PHARMACY	1.28
188	HUO LH	90	369	281	4.1	9	1512.90	11.48	CRYSTALLOGRAPHY	1.28
189	BRADLEY DA	68	493	381	7.25	12	3574.25	15.29	CRYSTALLOGRAPHY	1.27
190	YONG HS	64	539	456	8.42	13	4539.39	16.56		1.27
191	ABU BAKAR F	30	88	83	2.93	5	258.13	6.37	FOOD SCIENCE TECHNOLOGY	1.27
192	ABDULLAH M	51	190	186	3.73	7	707.84	8.91	MANAGEMENT	1.27
193	RAZAK IA	295	1579	1245	5.35	16	8451.66	20.37	CRYSTALLOGRAPHY	1.27
194	ISMAIL A	148	1224	1022	8.27	17	10122.81	21.63	FOOD SCIENCE TECHNOLOGY	1.27
195	MOHAMED R	39	242	224	6.21	9	1501.64	11.45	BIOCHEMISTRY MOLECULAR BIOLOGY	1.27
196	ISMAIL R	130	597	507	4.59	11	2741.61	14.00	PHARMACOLOGY PHARMACY	1.27
197	CHENG HM	31	332	270	10.71	12	3555.61	15.26	IMMUNOLOGY	1.27
198	IBRAHIM N	42	172	169	4.1	7	704.38	8.90	ENVIRONMENTAL SCIENCES	1.27
199	TEO SB	57	507	313	8.89	13	4509.63	16.52	CHEMISTRY INORGANIC NUCLEAR	1.27
200	NAWAWI A	41	290	209	7.07	10	2051.22	12.71	MYCOLOGY	1.27

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
201	CHUAH HT	76	231	193	3.04	7	702.12	8.89	ENGINEERING	1.27
202	CHEONG KY	69	375	226	5.43	10	2038.04	12.68	PHYSICS	1.27
203	TAN PC	40	204	160	5.1	8	1040.40	10.13	OBSTETRICS GYNECOLOGY	1.27
204	SULAIMAN MR	63	305	216	4.84	9	1476.59	11.39	ZOOLOGY	1.27
205	LIANG JB	37	127	109	3.43	6	435.92	7.58	AGRICULTURE DAIRY ANIMAL SCIENCE	1.26
206	SHAARI K	45	215	194	4.78	8	1027.22	10.09	CHEMISTRY MEDICINAL	1.26
207	YAM FK	56	196	175	3.5	7	686.00	8.82	MATERIALS SCIENCE MULTIDISCIPLINARY	1.26
208	ASMAWI MZ	40	202	191	5.05	8	1020.10	10.07	PHARMACOLOGY PHARMACY	1.26
209	ABDULLAH N	160	1250	930	7.81	17	9765.63	21.37	AGRICULTURE	1.26
210	HO CL	34	186	161	5.47	8	1017.53	10.06	PLANT SCIENCES	1.26
211	JINAP S	75	386	329	5.15	10	1986.61	12.57	FOOD SCIENCE TECHNOLOGY	1.26
212	MOHAMAD AB	35	304	262	8.69	11	2640.46	13.82	CHEMISTRY PHYSICAL	1.26
213	SIVANESARATNAM V	52	321	302	6.17	10	1981.56	12.56	OBSTETRICS GYNECOLOGY	1.26
214	ZAKARIA S	51	226	166	4.43	8	1001.49	10.00	POLYMER SCIENCE	1.25
215	SINNIAH D	36	265	227	7.36	10	1950.69	12.49	PEDIATRICS	1.25
216	AHMAD AL	153	2029	1460	13.26	24	26907.46	29.97	ENGINEERING	1.25
217	AHMAD S	91	301	262	3.31	8	995.62	9.99	CHEMISTRY	1.25

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
218	MAK JW	82	661	602	8.06	14	5328.30	17.47	PARASITOLOGY	1.25
219	LIM PE	33	292	257	8.85	11	2583.76	13.72	ENVIRONMENTAL SCIENCES	1.25
220	JAMILAH B	36	189	170	5.25	8	992.25	9.97	FOOD SCIENCE TECHNOLOGY	1.25
221	MAK JW	82	660	601	8.05	14	5312.20	17.45	PARASITOLOGY	1.25
222	DAS VGK	99	1331	781	13.44	21	17894.56	26.16	CHEMISTRY	1.25
223	FARINA Y	34	119	79	3.5	6	416.50	7.47	CRYSTALLOGRAPHY	1.24
224	ABD-SHUKOR R	80	230	154	2.88	7	661.25	8.71	PHYSICS	1.24
225	AZIZ AA	50	144	129	2.88	6	414.72	7.46	MATERIALS SCIENCE	1.24
226	OTHMAN R	57	236	210	4.14	8	977.12	9.92	MATERIALS SCIENCE MULTIDISCIPLINARY	1.24
227	DAUD AR	34	254	215	7.47	10	1897.53	12.38	MATERIALS SCIENCE MULTIDISCIPLINARY	1.24
228	SHARIF S	38	192	172	5.05	8	970.11	9.90	CRYSTALLOGRAPHY	1.24
229	TIAN YP	65	520	418	8	13	4160.00	16.08		1.24
230	OSMAN J	42	282	187	6.71	10	1893.43	12.37	PHYSICS CONDENSED MATTER	1.24
231	JEMAIN AA	36	66	40	1.83	4	121.00	4.95	METEOROLOGY ATMOSPHERIC SCIENCES	1.24
232	AMINI MM	94	149	105	1.59	5	236.18	6.18	CRYSTALLOGRAPHY	1.24
233	RAHMAN MBA	57	280	224	4.91	9	1375.44	11.12	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.24
23	LAI OM	74	552	397	7.46	13	4117.62	16.03	FOOD SCIENCE TECHNOLOGY	1.23

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
234										
235	HAIR-BEJO M	44	205	154	4.66	8	955.11	9.85	VETERINARY SCIENCES	1.23
236	VIKINESWARY S	34	215	197	6.32	9	1359.56	11.08	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.23
237	BAHARIN BS	48	299	239	6.23	10	1862.52	12.30	FOOD SCIENCE TECHNOLOGY	1.23
238	KARIM MIA	44	376	304	8.55	12	3213.09	14.76	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.23
239	HUANG RB	34	147	130	4.32	7	635.56	8.60	CRYSTALLOGRAPHY	1.23
240	ISMAIL BS	46	249	204	5.41	9	1347.85	11.05	ENVIRONMENTAL SCIENCES	1.23
241	OSMAN A	35	217	205	6.2	9	1345.40	11.04	FOOD SCIENCE TECHNOLOGY	1.23
242	ARIFFIN A	79	381	313	4.82	10	1837.48	12.25	CHEMISTRY	1.22
243	ISMAIL Z	109	588	542	5.39	12	3171.96	14.69	CHEMISTRY	1.22
244	ZAIDUL ISM	33	246	181	7.45	10	1833.82	12.24	FOOD SCIENCE TECHNOLOGY	1.22
245	OTHMAN N	46	170	166	3.7	7	628.26	8.56	POLYMER SCIENCE	1.22
246	ADIKAN FRM	39	124	108	3.18	6	394.26	7.33	OPTICS	1.22
247	HUSSAIN A	50	140	124	2.8	6	392.00	7.32	ENGINEERING ELECTRICAL ELECTRONIC	1.22
248	ISHAK ZAM	143	2385	1613	16.68	28	39777.80	34.14	POLYMER SCIENCE	1.22
249	MAHDI E	37	221	131	5.97	9	1320.03	10.97	MATERIALS SCIENCE COMPOSITES	1.22
250	CHONG CS	33	244	201	7.39	10	1804.12	12.17	NUCLEAR SCIENCE TECHNOLOGY	1.22

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
251	SEOW HF	39	306	298	7.85	11	2400.92	13.39	IMMUNOLOGY	1.22
252	HASHIM MA	87	655	560	7.53	14	4931.32	17.02	ENGINEERING	1.22
253	ROSLI MM	60	83	77	1.38	4	114.82	4.86	CRYSTALLOGRAPHY	1.22
254	KAMARUDDIN AH	51	448	369	8.78	13	3935.37	15.79	ENGINEERING CHEMICAL	1.21
255	SULAIMAN S	69	300	275	4.35	9	1304.35	10.93	PHYSICS	1.21
256	MATSUURA T	37	184	158	4.97	8	915.03	9.71	ENGINEERING CHEMICAL	1.21
257	HAMDAN H	37	184	172	4.97	8	915.03	9.71	CHEMISTRY PHYSICAL	1.21
258	MARIATTI M	51	216	198	4.24	8	914.82	9.71	POLYMER SCIENCE	1.21
259	TAN SG	86	720	574	8.37	15	6027.91	18.20	ENVIRONMENTAL SCIENCES ECOLOGY	1.21
260	ANJUM S	31	168	132	5.42	8	910.45	9.69	CRYSTALLOGRAPHY	1.21
261	OMAR SZ	34	144	110	4.24	7	609.88	8.48	OBSTETRICS GYNECOLOGY	1.21
262	ARIFF AB	62	332	285	5.35	10	1777.81	12.11	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.21
263	YUSOFF K	103	866	696	8.41	16	7281.13	19.38	VIROLOGY	1.21
264	ABDULLAH NA	37	119	48	3.22	6	382.73	7.26	PHARMACOLOGY PHARMACY	1.21
265	ABDULLAH MK	79	374	285	4.73	10	1770.58	12.10	OPTICS	1.21
266	YAMIN BM	224	933	664	4.17	13	3886.11	15.72	CRYSTALLOGRAPHY	1.21

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
267	TAN WS	69	459	264	6.65	12	3053.35	14.51	CRYSTALLOGRAPHY	1.21
268	NAZAR R	109	806	463	7.39	15	5959.96	18.13	MECHANICS	1.21
269	IBRAHIM H	56	225	199	4.02	8	904.02	9.67	PLANT SCIENCES	1.21
270	HUSSEIN MZ	62	548	451	8.84	14	4843.61	16.92		1.21
271	RAHMAN RA	101	422	396	4.18	10	1763.21	12.08	FOOD SCIENCE TECHNOLOGY	1.21
272	ANUAR AR	33	61	59	1.85	4	112.76	4.83	AGRONOMY	1.21
273	TOU TY	76	422	365	5.55	11	2343.21	13.28	PHYSICS	1.21
274	WONG CS	41	192	156	4.68	8	899.12	9.65	PHYSICS FLUIDS PLASMAS	1.21
275	NOORANI MSM	63	611	354	9.7	15	5925.73	18.10	MATERIALS SCIENCE	1.21
276	GOH LY	47	812	405	17.28	20	14028.60	24.12	CHEMISTRY	1.21
277	BOO NY	55	358	346	6.51	11	2330.25	13.26	PEDIATRICS	1.21
278	USMAN A	149	938	746	6.3	15	5904.99	18.07	CRYSTALLOGRAPHY	1.20
279	YEAP GY	72	466	269	6.47	12	3016.06	14.45	MATHEMATICS	1.20
280	HAMEED BH	116	2338	1379	20.16	30	47122.79	36.12	ENGINEERING	1.20
281	RAHMAN MZA	36	214	186	5.94	9	1272.11	10.84	POLYMER SCIENCE	1.20
282	DHARMAPRAKASH SM	101	484	204	4.79	11	2319.37	13.24	CRYSTALLOGRAPHY	1.20
283	TAN GH	40	264	249	6.6	10	1742.40	12.03	CHEMISTRY APPLIED	1.20

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
284	AZIZ HA	60	425	303	7.08	12	3010.42	14.44	ENVIRONMENTAL SCIENCES	1.20
285	ZULKIFLI I	52	347	230	6.67	11	2315.56	13.23	AGRICULTURE DAIRY ANIMAL SCIENCE	1.20
286	IBRAHIM NA	50	211	148	4.22	8	890.42	9.62	POLYMER SCIENCE	1.20
287	AL-MANSOORI MH	72	465	233	6.46	12	3003.13	14.43	BIOCHEMISTRY MOLECULAR BIOLOGY	1.20
288	ISMAIL AF	142	1618	1154	11.39	22	18436.08	26.42	ENGINEERING	1.20
289	GHAZALI HM	79	748	542	9.47	16	7082.33	19.20	FOOD SCIENCE TECHNOLOGY	1.20
290	ISRAF DA	57	520	416	9.12	14	4743.86	16.80	PHARMACOLOGY PHARMACY	1.20
291	TEOH SG	179	921	621	5.15	14	4738.78	16.80	CRYSTALLOGRAPHY	1.20
292	MAN YBC	202	1795	1202	8.89	21	15950.62	25.17	FOOD SCIENCE TECHNOLOGY	1.20
293	KARIM AA	64	436	395	6.81	12	2970.25	14.37	NEUROSCIENCES NEUROLOGY	1.20
294	HASHIM I	132	1149	591	8.7	18	10001.52	21.55	MATHEMATICS	1.20
295	FAKHRU'L-RAZI A	54	451	336	8.35	13	3766.69	15.56	ENVIRONMENTAL SCIENCES	1.20
296	ALAM MZ	55	307	200	5.58	10	1713.62	11.97	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.20
297	DAUD WRW	116	819	726	7.06	15	5782.42	17.95	ENGINEERING	1.20
298	IBRAHIM K	91	231	183	2.54	7	586.38	8.37	MATERIALS SCIENCE	1.20
299	LOW WY	43	194	169	4.51	8	875.26	9.57	UROLOGY NEPHROLOGY	1.20
30	YUSOF NA	40	153	136	3.83	7	585.23	8.36	ELECTROCHEMISTRY	1.19

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
0										
301	AHMAD N	55	261	250	4.75	9	1238.56	10.74	ZOOLOGY	1.19
302	MOGHAVVEMI M	32	108	86	3.38	6	364.50	7.14	ENGINEERING ELECTRICAL ELECTRONIC	1.19
303	SADIKUN A	41	188	149	4.59	8	862.05	9.52	PHARMACOLOGY PHARMACY	1.19
304	YAHAYA M	33	138	117	4.18	7	577.09	8.33	MATERIALS SCIENCE MULTIDISCIPLINARY	1.19
305	HASSAN MA	70	451	297	6.44	12	2905.73	14.27	ENGINEERING	1.19
306	RAHIM NA	56	262	211	4.68	9	1225.79	10.70	ENGINEERING ELECTRICAL ELECTRONIC	1.19
307	SHAMSHUDDIN J	33	201	156	6.09	9	1224.27	10.70	SOIL SCIENCE	1.19
308	TAN KW	48	166	143	3.46	7	574.08	8.31	CRYSTALLOGRAPHY	1.19
309	SAPUAN SM	100	409	353	4.09	10	1672.81	11.87	MATERIALS SCIENCE	1.19
310	ALI AM	93	1115	865	11.99	20	13368.01	23.73	PHARMACOLOGY PHARMACY	1.19
311	ALI J	50	73	54	1.46	4	106.58	4.74	OPTICS	1.19
312	TSO CP	42	189	163	4.5	8	850.50	9.47	THERMODYNAMICS	1.18
313	RAHMAN NA	82	315	299	3.84	9	1210.06	10.66	CHEMISTRY	1.18
314	ANG HH	31	162	107	5.23	8	846.58	9.46	PHARMACOLOGY PHARMACY	1.18
315	RATNAM CT	48	370	192	7.71	12	2852.08	14.18	POLYMER SCIENCE	1.18
316	LIONG MT	36	208	144	5.78	9	1201.78	10.63	FOOD SCIENCE TECHNOLOGY	1.18

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
317	AHMAD R	82	263	210	3.21	8	843.52	9.45	CHEMISTRY	1.18
318	NG CH	61	317	229	5.2	10	1647.36	11.81	CHEMISTRY INORGANIC NUCLEAR	1.18
319	SOPIAN K	58	405	348	6.98	12	2828.02	14.14	ENERGY FUELS	1.18
320	POH BT	67	670	311	10	16	6700.00	18.85	NUCLEAR SCIENCE TECHNOLOGY	1.18
321	YUEN KH	91	1091	963	11.99	20	13080.01	23.56	PHARMACOLOGY PHARMACY	1.18
322	ABOUL-ENEIN HY	37	144	117	3.89	7	560.43	8.24	CHEMISTRY ANALYTICAL	1.18
323	RAHMAN RNZRA	52	383	299	7.37	12	2820.94	14.13	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.18
324	SALLEH AB	120	1159	887	9.66	19	11194.01	22.37	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.18
325	ISMAIL H	269	2462	1481	9.15	24	22533.25	28.24	POLYMER SCIENCE	1.18
326	ZULKIFLI MZ	38	178	117	4.68	8	833.79	9.41	OPTICS	1.18
327	KAM TS	120	1747	539	14.56	25	25433.41	29.41	CHEMISTRY	1.18
328	LEE HL	58	219	202	3.78	8	826.91	9.39	TROPICAL MEDICINE	1.17
329	SHAMAAN NA	31	131	97	4.23	7	553.58	8.21	ENVIRONMENTAL SCIENCES	1.17
330	RAVICHANDRAN M	33	107	95	3.24	6	346.94	7.03	MICROBIOLOGY	1.17
331	TAHIR MIM	36	85	66	2.36	5	200.69	5.85	CRYSTALLOGRAPHY	1.17
332	SATTAR MA	42	152	93	3.62	7	550.10	8.19	PHARMACOLOGY PHARMACY	1.17
333	RADU S	57	448	428	7.86	13	3521.12	15.21	MICROBIOLOGY	1.17

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
334	SIM KS	37	86	70	2.32	5	199.89	5.85	MICROSCOPY	1.17
335	TAN NH	73	893	580	12.23	19	10923.96	22.19	CRYSTALLOGRAPHY	1.17
336	SHUHAIMI M	34	108	98	3.18	6	343.06	7.00	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.17
337	HO CC	58	557	460	9.6	15	5349.12	17.49	CHEMISTRY PHYSICAL	1.17
338	LEE SL	72	444	299	6.17	12	2738.00	13.99	MATHEMATICS	1.17
339	MORITA H	47	233	156	4.96	9	1155.09	10.49	CHEMISTRY	1.17
340	HAMOUDA AMS	76	347	261	4.57	10	1584.33	11.66	MATERIALS SCIENCE	1.17
341	RAHMAT A	34	198	179	5.82	9	1153.06	10.49	NUTRITION DIETETICS	1.17
342	ELTAYEB NE	54	171	93	3.17	7	541.50	8.15	CRYSTALLOGRAPHY	1.16
343	RAHMANI M	45	156	126	3.47	7	540.80	8.15	CHEMISTRY	1.16
344	KHALIL HPSA	79	646	490	8.18	15	5282.48	17.42	MATERIALS SCIENCE	1.16
345	FU YL	37	85	64	2.3	5	195.27	5.80	CRYSTALLOGRAPHY	1.16
346	YUNUS R	38	86	78	2.26	5	194.63	5.80	ENGINEERING CHEMICAL	1.16
347	PATIL PS	114	624	320	5.47	13	3415.58	15.06	CRYSTALLOGRAPHY	1.16
348	SHETTY P	31	36	32	1.16	3	41.81	3.47	CRYSTALLOGRAPHY	1.16
349	ABDULLAH AZ	64	363	330	5.67	11	2058.89	12.72	PHYSICS	1.16
35	MAAH MJ	43	91	84	2.12	5	192.58	5.77	CRYSTALLOGRAPHY	1.15

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
0										
351	ZAKARIA ZA	77	294	217	3.82	9	1122.55	10.39	PHARMACOLOGY PHARMACY	1.15
352	NGAH WZW	44	222	184	5.05	9	1120.09	10.39	NUTRITION DIETETICS	1.15
353	KHAN MN	116	854	278	7.36	16	6287.21	18.46	CHEMISTRY	1.15
354	ADNAN R	47	192	164	4.09	8	784.34	9.22	CRYSTALLOGRAPHY	1.15
355	YARMO MA	43	337	294	7.84	12	2641.14	13.82	CHEMISTRY PHYSICAL	1.15
356	CHEAH PL	32	221	207	6.91	10	1526.28	11.51	PATHOLOGY	1.15
357	MUHAMAD MR	38	141	120	3.71	7	523.18	8.06	PHYSICS APPLIED	1.15
358	AHMAD M	107	816	658	7.63	16	6222.95	18.39	CHEMISTRY	1.15
359	YUNUS WMZW	92	685	575	7.45	15	5100.27	17.21	POLYMER SCIENCE	1.15
360	SULAIMAN O	74	239	201	3.23	8	771.91	9.17	CRYSTALLOGRAPHY	1.15
361	BABA I	48	125	82	2.6	6	325.52	6.88	CRYSTALLOGRAPHY	1.15
362	YUSOFF FM	38	204	186	5.37	9	1095.16	10.31	FISHERIES	1.15
363	WAHIDDIN MRB	50	316	257	6.32	11	1997.12	12.59	OPTICS	1.14
364	MUKHTAR MR	36	82	56	2.28	5	186.78	5.72	CHEMISTRY ORGANIC	1.14
365	BHATIA S	159	1812	1353	11.4	24	20649.96	27.44	ENGINEERING	1.14
366	ALIMON AR	34	37	34	1.09	3	40.26	3.43	AGRICULTURE DAIRY ANIMAL SCIENCE	1.14

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
367	OSMAN H	115	353	324	3.07	9	1083.56	10.27	CRYSTALLOGRAPHY	1.14
368	YAHAYA AH	49	311	265	6.35	11	1973.90	12.54	CHEMISTRY MULTIDISCIPLINARY	1.14
369	MAJLIS BY	46	66	60	1.43	4	94.70	4.56	MATERIALS SCIENCE MULTIDISCIPLINARY	1.14
370	LEE SL	72	428	293	5.94	12	2544.22	13.65	POLYMER SCIENCE	1.14
371	VELMURUGAN D	64	262	229	4.09	9	1072.56	10.24	MATERIALS SCIENCE	1.14
372	SAHARI BB	45	184	115	4.09	8	752.36	9.10	MATERIALS SCIENCE	1.14
373	AHMAD ZA	60	173	143	2.88	7	498.82	7.93	MATERIALS SCIENCE MULTIDISCIPLINARY	1.13
374	JAAFAR MS	37	82	47	2.22	5	181.73	5.66	ENGINEERING CIVIL	1.13
375	GOH JH	86	125	92	1.45	5	181.69	5.66	CRYSTALLOGRAPHY	1.13
376	SEKARAN SD	32	100	87	3.12	6	312.50	6.79	MICROBIOLOGY	1.13
377	CHOUDHURY PK	40	205	124	5.12	9	1050.63	10.17	OPTICS	1.13
378	OMAR AR	88	468	378	5.32	12	2488.91	13.55	VETERINARY SCIENCES	1.13
379	SARVESWARI S	52	127	72	2.44	6	310.17	6.77	CRYSTALLOGRAPHY	1.13
380	MOHAMED A	85	204	180	2.4	7	489.60	7.88	ENGINEERING	1.13
381	ARMAN HD	30	34	28	1.13	3	38.53	3.38	CRYSTALLOGRAPHY	1.13
382	ZAIN SM	40	111	110	2.78	6	308.03	6.75	CRYSTALLOGRAPHY	1.13
38	SIVAKUMAR K	73	534	425	7.32	14	3906.25	15.75	CHEMISTRY	1.12

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
383										
384	IBRAHIM S	57	132	121	2.32	6	305.68	6.74	ENGINEERING CHEMICAL	1.12
385	ISHAK A	94	604	299	6.43	14	3881.02	15.72	MECHANICS	1.12
386	KADIR MA	34	36	34	1.06	3	38.12	3.37	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.12
387	BASIRUN WJ	40	84	73	2.1	5	176.40	5.61	CRYSTALLOGRAPHY	1.12
388	CHINNAKALI K	186	1135	878	6.1	17	6925.94	19.06	CRYSTALLOGRAPHY	1.12
389	OTHMAN F	49	122	117	2.49	6	303.76	6.72	MEDICINE GENERAL INTERNAL	1.12
390	KARALAI C	69	358	213	5.19	11	1857.45	12.29	ENGINEERING	1.12
391	IBRAHIM MH	47	183	141	3.89	8	712.53	8.93	ENGINEERING	1.12
392	MOHAMED AR	151	1492	1094	9.88	22	14742.15	24.52	ENGINEERING	1.11
393	DIMYATI K	42	172	152	4.1	8	704.38	8.90	ENGINEERING ELECTRICAL ELECTRONIC	1.11
394	LAJIS NH	98	960	832	9.8	19	9404.08	21.11	PHARMACOLOGY PHARMACY	1.11
395	MOHAMAD AA	39	303	229	7.77	12	2354.08	13.30	ELECTROCHEMISTRY	1.11
396	BAKAR J	40	269	246	6.72	11	1809.03	12.18	FOOD SCIENCE TECHNOLOGY	1.11
397	KIA R	106	222	149	2.09	7	464.94	7.75	CRYSTALLOGRAPHY	1.11
398	CHANTRAPROMMA S	480	2281	1499	4.75	20	10839.50	22.13	CRYSTALLOGRAPHY	1.11
399	LIM KP	36	158	128	4.39	8	693.44	8.85	ECONOMICS	1.11

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
399										
400	MAJID SR	41	138	91	3.37	7	464.49	7.74	MATERIALS SCIENCE MULTIDISCIPLINARY	1.11
401	RATNAM MM	37	104	78	2.81	6	292.32	6.64	AUTOMATION CONTROL SYSTEMS	1.11
402	KALLURAYA B	103	218	169	2.12	7	461.40	7.73	CRYSTALLOGRAPHY	1.10
403	WARDELL JL	76	113	58	1.49	5	168.01	5.52	CRYSTALLOGRAPHY	1.10
404	AHMAD Z	96	210	203	2.19	7	459.38	7.72	POLYMER SCIENCE	1.10
405	BASRI M	153	1185	889	7.75	19	9177.94	20.94	BIOTECHNOLOGY APPLIED MICROBIOLOGY	1.10
406	AKIL HM	62	206	176	3.32	8	684.45	8.81		1.10
407	BIN SHAWKATALY O	59	71	55	1.2	4	85.44	4.40	CRYSTALLOGRAPHY	1.10
408	YAM MF	34	75	63	2.21	5	165.44	5.49	PHARMACOLOGY PHARMACY	1.10
409	AWANG K	126	471	331	3.74	11	1760.64	12.08	CHEMISTRY	1.10
410	WARDELL SMSV	68	106	51	1.56	5	165.24	5.49	ENGINEERING	1.10
411	LING TC	64	208	123	3.25	8	676.00	8.78	ENGINEERING	1.10
412	ISMAIL N	83	282	258	3.4	9	958.12	9.86	ENGINEERING	1.10
413	JEBAS SR	73	143	123	1.96	6	280.12	6.54		1.09
414	TAN CP	133	1087	798	8.17	19	8883.98	20.71	FOOD SCIENCE TECHNOLOGY	1.09
415	POP I	142	1035	559	7.29	18	7543.84	19.61	MECHANICS	1.09

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
416	YAHYA AK	38	103	62	2.71	6	279.18	6.54	MATERIALS SCIENCE MULTIDISCIPLINARY	1.09
417	ALIAS Y	62	283	185	4.56	10	1291.76	10.89	CHEMISTRY MULTIDISCIPLINARY	1.09
418	ALI RM	46	174	127	3.78	8	658.17	8.70	MATHEMATICS	1.09
419	VIJAYAKUMAR V	62	131	74	2.11	6	276.79	6.52		1.09
420	AHMAD A	128	600	514	4.69	13	2812.50	14.12	ENGINEERING	1.09
421	RAHIM RA	81	274	226	3.38	9	926.86	9.75	INSTRUMENTS INSTRUMENTATION	1.08
422	ISMAIL MR	47	112	100	2.38	6	266.89	6.44	AGRICULTURE	1.07
423	CHAN KL	63	366	292	5.81	12	2126.29	12.86	VIROLOGY	1.07
424	LEE KT	102	785	558	7.7	17	6041.42	18.21	ENERGY FUELS	1.07
425	LO KM	169	326	278	1.93	8	628.85	8.57	CRYSTALLOGRAPHY	1.07
426	LATIFF AA	40	103	89	2.58	6	265.23	6.42	MEDICINE GENERAL INTERNAL	1.07
427	HASHIM M	44	136	125	3.09	7	420.36	7.49	MATERIALS SCIENCE MULTIDISCIPLINARY	1.07
428	AWANG R	42	132	110	3.14	7	414.86	7.46	PHARMACOLOGY PHARMACY	1.07
429	MAHDI MA	155	795	477	5.13	15	4077.58	15.98	OPTICS	1.07
430	KARGAR H	44	107	81	2.43	6	260.20	6.38	CRYSTALLOGRAPHY	1.06
431	DE SOUZA MVN	30	67	29	2.23	5	149.63	5.31	CRYSTALLOGRAPHY	1.06
43	ISMAIL M	84	317	294	3.77	10	1196.30	10.62	FOOD SCIENCE TECHNOLOGY	1.06

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
432										
433	KASSIM MB	40	101	52	2.53	6	255.03	6.34	CRYSTALLOGRAPHY	1.06
434	HANAFI MM	66	199	176	3.02	8	600.02	8.43	SOIL SCIENCE	1.05
435	YUNUS WMM	41	128	119	3.12	7	399.61	7.37	MATERIALS SCIENCE MULTIDISCIPLINARY	1.05
436	YEAP CS	129	137	126	1.06	5	145.50	5.26	CRYSTALLOGRAPHY	1.05
437	ABDULLAH Z	76	138	112	1.82	6	250.58	6.30	CRYSTALLOGRAPHY	1.05
438	MUSTAFA S	41	77	73	1.88	5	144.61	5.25	FOOD SCIENCE TECHNOLOGY	1.05
439	ROBINSON WT	31	88	84	2.84	6	249.81	6.30	CRYSTALLOGRAPHY	1.05
440	KADHUM AAH	46	266	210	5.78	11	1538.17	11.54	MATERIALS SCIENCE MULTIDISCIPLINARY	1.05
441	GOSWAMI S	76	294	198	3.87	10	1137.32	10.44	CRYSTALLOGRAPHY	1.04
442	AHMAD F	66	196	189	2.97	8	582.06	8.35	ENVIRONMENTAL SCIENCES ECOLOGY	1.04
443	SASIDHARAN S	47	107	82	2.28	6	243.60	6.25	PHARMACOLOGY PHARMACY	1.04
444	NG SW	1953	6935	5055	3.55	28	24625.82	29.09	CRYSTALLOGRAPHY	1.04
445	TEO LP	59	256	142	4.34	10	1110.78	10.36	PHYSICS MATHEMATICAL	1.04
446	MISRAN N	56	88	71	1.57	5	138.29	5.17	ENGINEERING ELECTRICAL ELECTRONIC	1.03
447	HEMAMALINI M	186	160	100	0.86	5	137.63	5.16	CRYSTALLOGRAPHY	1.03
448	KILICMAN A	43	127	78	2.95	7	375.09	7.21	MATHEMATICS APPLIED	1.03

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
449	HADI AHA	84	396	296	4.71	12	1866.86	12.31	CHEMISTRY	1.03
450	SALLEH MM	58	213	190	3.67	9	782.22	9.21	MATERIALS SCIENCE MULTIDISCIPLINARY	1.02
451	LIM CP	52	272	232	5.23	11	1422.77	11.25	COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	1.02
452	ABDULLAH MZ	59	289	235	4.9	11	1415.61	11.23	THERMODYNAMICS	1.02
453	ISLAM MT	56	86	67	1.54	5	132.07	5.09	ENGINEERING ELECTRICAL ELECTRONIC	1.02
454	LEE CY	95	416	343	4.38	12	1821.64	12.21	ENTOMOLOGY	1.02
455	SAMSUDIN AR	41	121	114	2.95	7	357.10	7.09	DENTISTRY ORAL SURGERY MEDICINE	1.01
456	NG KH	108	555	468	5.14	14	2852.08	14.18	GENERAL INTERNAL MEDICINE	1.01
457	AROF AK	153	1301	785	8.5	22	11062.75	22.28	MATERIALS SCIENCE	1.01
458	KASSIM A	79	330	308	4.18	11	1378.48	11.13	CHEMISTRY	1.01
459	SAARI N	43	151	142	3.51	8	530.26	8.09	FOOD SCIENCE TECHNOLOGY	1.01
460	HASSAN A	72	272	233	3.78	10	1027.56	10.09	OPTICS	1.01
461	MIRHOSSEINI H	42	177	132	4.21	9	745.93	9.07	FOOD SCIENCE TECHNOLOGY	1.01
462	XU JH	90	301	195	3.34	10	1006.68	10.02	CRYSTALLOGRAPHY	1.00
463	PENG YH	33	46	37	1.39	4	64.12	4.00	MATHEMATICS	1.00
464	CHUAH LS	39	50	47	1.28	4	64.10	4.00	MATERIALS SCIENCE MULTIDISCIPLINARY	1.00

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
465	ARSHAD A	43	73	62	1.7	5	123.93	4.99	CRYSTALLOGRAPHY	1.00
466	ABDULLAH S	82	100	97	1.22	5	121.95	4.96	ENGINEERING	0.99
467	MANDEEP JS	63	115	73	1.83	6	209.92	5.94	BIOTECHNOLOGY APPLIED MICROBIOLOGY	0.99
468	HASSAN Z	195	571	476	2.93	12	1672.01	11.87	MATERIALS SCIENCE	0.99
469	YAHYA A	40	69	64	1.73	5	119.03	4.92	ENGINEERING ENVIRONMENTAL	0.98
470	CHUAH TC	35	46	42	1.31	4	60.46	3.92	ENGINEERING ELECTRICAL ELECTRONIC	0.98
471	HARUN SW	245	1253	575	5.11	19	6408.20	18.57	OPTICS	0.98
472	HASHIM R	174	814	713	4.68	16	3808.02	15.62	CHEMISTRY	0.98
473	QUAH CK	108	185	130	1.71	7	316.90	6.82	CRYSTALLOGRAPHY	0.97
474	TIEKINK ERT	377	503	385	1.33	9	671.11	8.76	CRYSTALLOGRAPHY	0.97
475	FUN HK	2179	10055	6633	4.61	37	46398.82	35.93	CRYSTALLOGRAPHY	0.97
476	ALI HM	186	351	287	1.89	9	662.37	8.72	CRYSTALLOGRAPHY	0.97
477	AHMAD H	321	1523	774	4.74	20	7225.95	19.33	OPTICS	0.97
478	WONG LP	31	119	93	3.84	8	456.81	7.70	PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH	0.96
479	NAING NN	33	99	96	3	7	297.00	6.67	MEDICINE GENERAL INTERNAL	0.95
48	LOH WS	65	83	61	1.28	5	105.98	4.73	POLYMER SCIENCE	0.95

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
0										
481	NG SS	41	109	74	2.66	7	289.78	6.62	MATERIALS SCIENCE MULTIDISCIPLINARY	0.95
482	MOHAMED Z	57	157	144	2.75	8	432.44	7.56	PHARMACOLOGY PHARMACY	0.95
483	LIM KS	43	135	123	3.14	8	423.84	7.51	ENGINEERING ELECTRICAL ELECTRONIC	0.94
484	KHALEDI H	83	91	80	1.1	5	99.77	4.64	CRYSTALLOGRAPHY	0.93
485	DAS S	136	281	228	2.07	9	580.60	8.34	PHARMACOLOGY PHARMACY	0.93
486	NITHINCHANDRA	38	44	21	1.16	4	50.95	3.71	CRYSTALLOGRAPHY	0.93
487	MOHAMED N	69	167	152	2.42	8	404.19	7.39	POLYMER SCIENCE	0.92
488	ISLOOR AM	94	96	76	1.02	5	98.04	4.61	CRYSTALLOGRAPHY	0.92
489	ASIRI AM	69	38	28	0.55	3	20.93	2.76	POLYMER SCIENCE	0.92
490	ALI MAM	35	96	86	2.74	7	263.31	6.41	ENGINEERING ELECTRICAL ELECTRONIC	0.92
491	HASHIM MR	31	52	46	1.68	5	87.23	4.43	MATERIALS SCIENCE MULTIDISCIPLINARY	0.89
492	ABU HASSAN H	94	149	103	1.59	7	236.18	6.18	MATERIALS SCIENCE	0.88
493	OTHMAN M	85	61	39	0.72	4	43.78	3.52	ENGINEERING ELECTRICAL ELECTRONIC	0.88
494	FAIDALLAH HM	38	14	10	0.37	2	5.16	1.73	CRYSTALLOGRAPHY	0.86
495	AL-YOUBI AO	40	14	10	0.35	2	4.90	1.70	CRYSTALLOGRAPHY	0.85
496	ZOUIHRI H	31	22	19	0.71	3	15.61	2.50	CRYSTALLOGRAPHY	0.83

N	Authors	results found	Sum of C	Citing articles	Average Citations per paper or *i*	*h* index	Exergy	*p* index	Subject area	ratio p/h
497	ESSASSI E	54	29	27	0.54	3	15.57	2.50	CRYSTALLOGRAPHY	0.83
498	RAHMAN MM	64	89	80	1.39	6	123.77	4.98	ENGINEERING	0.83
499	NAJAFI E	32	22	16	0.69	3	15.13	2.47	CRYSTALLOGRAPHY	0.82

Appendix B. Fullranking based on h index

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
1	FUN HK	2179	10055	6633	4.61	37
2	HAMEED BH	116	2338	1379	20.16	30
3	NG SW	1953	6935	5055	3.55	28
4	ISHAK ZAM	143	2385	1613	16.68	28
5	LAM SK	65	2726	1709	41.94	27
6	KAM TS	120	1747	539	14.56	25
7	ISMAIL H	269	2462	1481	9.15	24
8	BHATIA S	159	1812	1353	11.4	24
9	AHMAD AL	153	2029	1460	13.26	24
10	YOU XZ	130	2302	1908	17.71	24
11	LEE CK	78	1905	1468	24.42	24
12	GOH KL	139	1909	1585	13.73	23
13	AROF AK	153	1301	785	8.5	22
14	MOHAMED AR	151	1492	1094	9.88	22
15	ISMAIL AF	142	1618	1154	11.39	22
16	MAN YBC	202	1795	1202	8.89	21
17	DAS VGK	99	1331	781	13.44	21
18	CHANTRAPROMMA S	480	2281	1499	4.75	20
19	AHMAD H	321	1523	774	4.74	20
20	ALI AM	93	1115	865	11.99	20
21	YUEN KH	91	1091	963	11.99	20
22	ISHIAKU US	69	1295	944	18.77	20
23	LOW KS	67	1455	1148	21.72	20
24	GOH LY	47	812	405	17.28	20
25	WEI C	46	1050	838	22.83	20
26	HARUN SW	245	1253	575	5.11	19
27	BASRI M	153	1185	889	7.75	19
28	TAN CP	133	1087	798	8.17	19
29	SALLEH AB	120	1159	887	9.66	19
30	LAJIS NH	98	960	832	9.8	19
31	TAN NH	73	893	580	12.23	19
32	ROZMAN HD	70	1005	700	14.36	19
33	POP I	142	1035	559	7.29	18
34	HASHIM I	132	1149	591	8.7	18
35	LOOI LM	75	1239	1139	16.52	18
36	GOH SH	73	1032	828	14.14	18
37	TAN CT	65	1200	833	18.46	18
38	KAMARULZAMAN A	64	1273	1000	19.89	18
39	WONG KT	52	1336	932	25.69	18
40	NASEF MM	49	1007	591	20.55	18
41	CHINNAKALI K	186	1135	878	6.1	17
42	ABDULLAH N	160	1250	930	7.81	17
43	ISMAIL A	148	1224	1022	8.27	17
44	LEE KT	102	785	558	7.7	17
45	KHALID BAK	79	1170	1058	14.85	17
46	RAZAK IA	295	1579	1245	5.35	16
47	HASHIM R	174	814	713	4.68	16
48	RAJ SSS	148	1182	1044	7.99	16
49	KHAN MN	116	854	278	7.36	16
50	AHMAD M	107	816	658	7.63	16
51	YUSOFF K	103	866	696	8.41	16
52	MASJUKI HH	95	913	635	9.61	16
53	GHAZALI HM	79	748	542	9.47	16

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
54	HO YW	77	986	664	12.81	16
55	PUTHUCHEARY SD	74	857	760	11.58	16
56	POH BT	67	670	311	10	16
57	PEH KK	48	699	647	14.56	16
58	MAK TCW	34	614	472	18.06	16
59	MAHDI MA	155	795	477	5.13	15
60	USMAN A	149	938	746	6.3	15
61	DAUD WRW	116	819	726	7.06	15
62	NAZAR R	109	806	463	7.39	15
63	ZAINAL Z	102	925	838	9.07	15
64	YUNUS WMZW	92	685	575	7.45	15
65	TAN SG	86	720	574	8.37	15
66	KHALIL HPSA	79	646	490	8.18	15
67	NOORANI MSM	63	611	354	9.7	15
68	HO CC	58	557	460	9.6	15
69	RAMESH S	58	659	512	11.36	15
70	RUSUL G	46	594	556	12.91	15
71	BURFIELD DR	42	670	560	15.95	15
72	CHOO YM	52	631	445	12.13	15
73	PANG T	40	713	611	17.39	15
74	YADAV M	38	1019	984	26.82	15
75	XIONG RG	31	931	780	30.03	15
76	TEOH SG	179	921	621	5.15	14
77	NG KH	108	555	468	5.14	14
78	ISHAK A	94	604	299	6.43	14
79	HASHIM MA	87	655	560	7.53	14
80	MAK JW	82	660	601	8.05	14
81	SIVAKUMAR K	73	534	425	7.32	14
82	AROUA MK	71	745	600	10.49	14
83	SIAR CH	67	643	497	9.6	14
84	HUSSEIN MZ	62	548	451	8.84	14
85	ISRAF DA	57	520	416	9.12	14
86	MOHAMED S	56	679	630	12.12	14
87	MOHAMMAD AW	54	635	500	11.76	14
88	NAVARATNAM V	55	638	511	11.6	14
89	CHEN XM	45	1439	1265	31.98	14
90	JALALUDIN S	45	821	582	18.24	14
91	MAK JW	82	661	602	8.06	14
92	PEH SC	43	525	493	12.21	14
93	NG WK	42	529	351	12.6	14
94	NGAH WSW	35	983	768	28.09	14
95	KOMIYAMA K	31	445	249	14.35	14
96	SEVENET T	31	660	567	21.29	14
97	YAMIN BM	224	933	664	4.17	13
98	AHMAD A	128	600	514	4.69	13
99	PATIL PS	114	624	320	5.47	13
100	SAAD B	88	636	539	7.23	13
101	SAIDUR R	80	647	338	8.09	13
102	LAI OM	74	552	397	7.46	13
103	TIAN YP	65	520	418	8	13
104	YONG HS	64	539	456	8.42	13
105	PHANG SM	59	568	460	9.63	13
106	TILLEY DR	98	2008	1295	20.49	13
107	RADU S	57	448	428	7.86	13
108	TEO SB	57	507	313	8.89	13

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
109	CHUAH CH	55	548	394	9.96	13
110	FAKHRU'L-RAZI A	54	451	336	8.35	13
111	KAMARUDDIN AH	51	448	369	8.78	13
112	ABUBAKAR S	43	603	475	14.02	13
113	CROUSE KA	43	594	390	13.81	13
114	LIM YY	44	517	434	11.57	13
115	OMAR AKM	38	529	390	13.92	13
116	RAZAK CNA	36	442	375	12.28	13
117	SEOW CC	32	567	497	17.22	13
118	HAMID AA	40	519	425	12.98	13
119	HASSAN Z	195	571	476	2.93	12
120	ISMAIL Z	109	588	542	5.39	12
121	LEE CY	95	416	343	4.38	12
122	OMAR AR	88	468	378	5.32	12
123	HADI AHA	84	396	296	4.71	12
124	SALEH MI	73	528	441	7.23	12
125	AL-MANSOORI MH	72	465	233	6.46	12
126	LEE SL	72	428	293	5.94	12
127	YEAP GY	72	466	269	6.47	12
128	HASSAN MA	70	451	297	6.44	12
129	TAN WS	69	459	264	6.65	12
130	BRADLEY DA	68	493	381	7.25	12
131	KARIM AA	64	436	395	6.81	12
132	CHAN KL	63	366	292	5.81	12
133	AZIZ HA	60	425	303	7.08	12
134	LIM SC	62	506	318	8.16	12
135	SOPIAN K	58	405	348	6.98	12
136	THONG KL	58	534	440	9.21	12
137	RAHMAN RNZRA	52	383	299	7.37	12
138	YIP CH	56	503	409	8.98	12
139	LEE SL	72	444	299	6.17	12
140	YARMO MA	43	337	294	7.84	12
141	KARIM MIA	44	376	304	8.55	12
142	KUMAR RN	41	479	399	11.68	12
143	SHARIFF M	42	511	481	12.17	12
144	MOHAMAD AA	39	303	229	7.77	12
145	RATNAM CT	48	370	192	7.71	12
146	SCHILTHUIZEN M	35	419	307	11.97	12
147	CHENG HM	31	332	270	10.71	12
148	ISMAIL R	130	597	507	4.59	11
149	AWANG K	126	471	331	3.74	11
150	DHARMAPRAKASH SM	101	484	204	4.79	11
151	KASSIM A	79	330	308	4.18	11
152	TOU TY	76	422	365	5.55	11
153	KARALAI C	69	358	213	5.19	11
154	ABDULLAH AZ	64	363	330	5.67	11
155	ZHANG Y	64	438	347	6.84	11
156	SEETHARAMU KN	63	522	468	8.29	11
157	ABDULLAH MZ	59	289	235	4.9	11
158	AMIN N	58	453	354	7.81	11
159	ALI MA	56	538	426	9.61	11
160	SEETHARAMU KN	63	529	473	8.4	11
161	ZULKIFLI I	52	347	230	6.67	11
162	LIM CP	52	272	232	5.23	11
163	RADIMAN S	51	459	397	9	11

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
164	DAUD WMAW	50	556	454	11.12	11
165	YAHAYA AH	49	311	265	6.35	11
166	KADHUM AAH	46	266	210	5.78	11
167	MANSOR SM	47	471	393	10.02	11
168	SUDESH K	46	364	247	7.91	11
169	YUSOF S	46	453	392	9.85	11
170	TENG TT	43	430	367	10	11
171	BOO NY	55	358	346	6.51	11
172	NG KP	41	358	303	8.73	11
173	BAKAR J	40	269	246	6.72	11
174	MANAN ZA	40	501	259	12.52	11
175	DEVI S	39	382	359	9.79	11
176	KAMARUDIN SK	38	410	333	10.79	11
177	LIM KH	45	405	273	9	11
178	SEOW HF	39	306	298	7.85	11
179	MOHAMAD AB	35	304	262	8.69	11
180	LIM PE	33	292	257	8.85	11
181	SUBRAMANIAM G	33	309	165	9.36	11
182	WAHIDDIN MRB	50	316	257	6.32	11
183	ISMAIL J	33	304	281	9.21	11
184	GAO S	169	601	468	3.56	10
185	SAPUAN SM	100	409	353	4.09	10
186	RAHMAN RA	101	422	396	4.18	10
187	XU JH	90	301	195	3.34	10
188	ISMAIL M	84	317	294	3.77	10
189	ABDULLAH MK	79	374	285	4.73	10
190	ARIFFIN A	79	381	313	4.82	10
191	GOSWAMI S	76	294	198	3.87	10
192	HAMOUDA AMS	76	347	261	4.57	10
193	JINAP S	75	386	329	5.15	10
194	HASSAN A	72	272	233	3.78	10
195	CHEONG KY	69	375	226	5.43	10
196	IDRIS A	69	383	350	5.55	10
197	ARIFF AB	62	332	285	5.35	10
198	TEY BT	63	393	254	6.24	10
199	ALIAS Y	62	283	185	4.56	10
200	NG CH	61	317	229	5.2	10
201	YAP CK	50	323	239	6.46	10
202	OTHMAN MR	49	357	282	7.29	10
203	BAHARIN BS	48	299	239	6.23	10
204	KUTHUBUTHEEN AJ	46	320	231	6.96	10
205	ALAM GM	44	528	173	12	10
206	CHEE KK	41	434	387	10.59	10
207	NAWAWI A	41	290	209	7.07	10
208	OSMAN J	42	282	187	6.71	10
209	TEO LP	59	256	142	4.34	10
210	HENG LY	40	296	257	7.4	10
211	SHIRAI Y	40	358	224	8.95	10
212	SIVANESARATNAM V	52	321	302	6.17	10
213	TAN GH	40	264	249	6.6	10
214	ALAM MZ	55	307	200	5.58	10
215	HUANG NM	37	284	243	7.68	10
216	SINNIAH D	36	265	227	7.36	10
217	ABDULLAH MH	35	396	342	11.31	10
218	HASAN M	40	345	279	8.62	10

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
219	CHONG CS	33	244	201	7.39	10
220	DAUD AR	34	254	215	7.47	10
221	LU ZL	33	325	245	9.85	10
222	YUSOFF MSA	37	291	242	7.86	10
223	ZAIDUL ISM	33	246	181	7.45	10
224	ARIFIN Z	32	270	134	8.44	10
225	ISA MH	33	321	240	9.73	10
226	WONG RCS	32	307	140	9.59	10
227	RAHMAN ARA	32	270	245	8.44	10
228	YIP BC	31	296	275	9.55	10
229	CHEAH PL	32	221	207	6.91	10
230	TIEKINK ERT	377	503	385	1.33	9
231	ALI HM	186	351	287	1.89	9
232	DAS S	136	281	228	2.07	9
233	OSMAN H	115	353	324	3.07	9
234	HUO LH	90	369	281	4.1	9
235	ISMAIL N	83	282	258	3.4	9
236	RAHMAN NA	82	315	299	3.84	9
237	RAHIM RA	81	274	226	3.38	9
238	ZAKARIA ZA	77	294	217	3.82	9
239	SULAIMAN S	69	300	275	4.35	9
240	VELMURUGAN D	64	262	229	4.09	9
241	SULAIMAN MR	63	305	216	4.84	9
242	CHAN KL	39	273	210	7	9
243	RAHMAN MBA	57	280	224	4.91	9
244	SALLEH MM	58	213	190	3.67	9
245	RAHIM NA	56	262	211	4.68	9
246	LIM LHS	53	324	156	6.11	9
247	ISMAIL S	54	286	247	5.3	9
248	AHMAD N	55	261	250	4.75	9
249	MUSTAFA MR	49	326	281	6.65	9
250	MORITA H	47	233	156	4.96	9
251	ISMAIL BS	46	249	204	5.41	9
252	POH BL	46	292	185	6.35	9
253	MOHAMED M	49	326	308	6.65	9
254	NGAH WZW	44	222	184	5.05	9
255	MIRHOSSEINI H	42	177	132	4.21	9
256	CHOW WS	41	490	353	11.95	9
257	LEE WS	42	317	293	7.55	9
258	CHOUDHURY PK	40	205	124	5.12	9
259	BOEY PL	39	330	220	8.46	9
260	CHUAH TG	40	442	409	11.05	9
261	RAO MVC	42	285	280	6.79	9
262	YUSOFF FM	38	204	186	5.37	9
263	LIONG MT	36	208	144	5.78	9
264	MAHDI E	37	221	131	5.97	9
265	RAHMAN MZA	36	214	186	5.94	9
266	RATNAVELU K	36	261	216	7.25	9
267	SINGH R	56	328	297	5.86	9
268	MOHAMED R	39	242	224	6.21	9
269	VIKINESWARY S	34	215	197	6.32	9
270	OSMAN A	35	217	205	6.2	9
271	RAHMAT A	34	198	179	5.82	9
272	WU JY	33	268	245	8.12	9
273	SHAMSHUDDIN J	33	201	156	6.09	9

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
274	LO KM	169	326	278	1.93	8
275	AHMAD S	91	301	262	3.31	8
276	AHMAD R	82	263	210	3.21	8
277	SULAIMAN O	74	239	201	3.23	8
278	MOHAMED N	69	167	152	2.42	8
279	AHMAD F	66	196	189	2.97	8
280	ALI A	64	261	238	4.08	8
281	LING TC	64	208	123	3.25	8
282	ABU BAKAR A	63	266	221	4.22	8
283	AKIL HM	62	206	176	3.32	8
284	HANAFI MM	66	199	176	3.02	8
285	TAUFIQ-YAP YH	60	289	202	4.82	8
286	ALI A	64	269	245	4.2	8
287	OTHMAN R	57	236	210	4.14	8
288	IBRAHIM H	56	225	199	4.02	8
289	MARIATTI M	51	216	198	4.24	8
290	ZAKARIA S	51	226	166	4.43	8
291	MOHAMED Z	57	157	144	2.75	8
292	ONG SH	54	503	395	9.31	8
293	IBRAHIM NA	50	211	148	4.22	8
294	ADNAN R	47	192	164	4.09	8
295	SAHARI BB	45	184	115	4.09	8
296	HAIR-BEJO M	44	205	154	4.66	8
297	IBRAHIM MH	47	183	141	3.89	8
298	ALI RM	46	174	127	3.78	8
299	LOW WY	43	194	169	4.51	8
300	ABDULLAH AH	46	424	402	9.22	8
301	DIMYATI K	42	172	152	4.1	8
302	TSO CP	42	189	163	4.5	8
303	LIM KS	43	135	123	3.14	8
304	SADIKUN A	41	188	149	4.59	8
305	WONG CS	41	192	156	4.68	8
306	SHAARI K	45	215	194	4.78	8
307	ASMAWI MZ	40	202	191	5.05	8
308	SAARI N	43	151	142	3.51	8
309	ARIFFIN H	37	350	334	9.46	8
310	HARON MJ	38	309	291	8.13	8
311	TAN PC	40	204	160	5.1	8
312	ZULKIFLI MZ	38	178	117	4.68	8
313	JAMILAH B	36	189	170	5.25	8
314	GAN SN	35	202	185	5.77	8
315	MATSUURA T	37	184	158	4.97	8
316	YAHYA MZA	35	222	173	6.34	8
317	LEE KH	38	227	203	5.97	8
318	LIM TK	36	208	110	5.78	8
319	STANSLAS J	34	226	195	6.65	8
320	AHMAD SH	33	257	236	7.79	8
321	LEE HL	58	219	202	3.78	8
322	LIM KP	36	158	128	4.39	8
323	SHARIF S	38	192	172	5.05	8
324	SOMCHIT MN	33	210	169	6.36	8
325	RAHMAN AA	34	240	234	7.06	8
326	RAHMAN IA	33	209	177	6.33	8
327	TAN SC	35	201	192	5.748	8
328	ZAKARIA R	32	203	169	6.34	8

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
329	ANG HH	31	162	107	5.23	8
330	ANJUM S	31	168	132	5.42	8
331	BOONNAK N	31	188	108	6.06	8
332	CHAI SP	31	227	173	7.32	8
333	MUNIANDY SV	31	228	192	7.35	8
334	SELAMAT J	31	236	224	7.61	8
335	WONG LP	31	119	93	3.84	8
336	ABDULLAH MP	34	319	299	9.38	8
337	ADAM F	30	179	102	5.97	8
338	FONG MY	31	278	266	8.97	8
339	HAMDAN H	37	184	172	4.97	8
340	HO CL	34	186	161	5.47	8
341	NGEOW YF	32	577	575	18.04	8
342	QUAH CK	108	185	130	1.71	7
343	KIA R	106	222	149	2.09	7
344	KALLURAYA B	103	218	169	2.12	7
345	AHMAD Z	96	210	203	2.19	7
346	ABU HASSAN H	94	149	103	1.59	7
347	IBRAHIM K	91	231	183	2.54	7
348	MOHAMED A	85	204	180	2.4	7
349	ABD-SHUKOR R	80	230	154	2.88	7
350	CHUAH HT	76	231	193	3.04	7
351	ZAKARIA Z	65	271	252	4.17	7
352	AHMAD ZA	60	173	143	2.88	7
353	YAM FK	56	196	175	3.5	7
354	ABDULLAH A	56	201	196	3.59	7
355	ELTAYEB NE	54	171	93	3.17	7
356	NG SL	54	203	160	3.76	7
357	RAHMAN SA	59	264	251	4.47	7
358	ABDULLAH M	51	190	186	3.73	7
359	HUSSAIN MA	48	361	314	7.52	7
360	TAN KW	48	166	143	3.46	7
361	RAHMANI M	45	156	126	3.47	7
362	BHAT R	45	192	171	4.27	7
363	OTHMAN N	46	170	166	3.7	7
364	HASHIM M	44	136	125	3.09	7
365	TEH JBJ	43	211	122	4.91	7
366	KILICMAN A	43	127	78	2.95	7
367	MAJID SR	41	138	91	3.37	7
368	SATTAR MA	42	152	93	3.62	7
369	NG SS	41	109	74	2.66	7
370	YUNUS WMM	41	128	119	3.12	7
371	YUSOF NA	40	153	136	3.83	7
372	ZHAO H	39	185	159	4.74	7
373	MUHAMAD MR	38	141	120	3.71	7
374	SAMSUDIN AR	41	121	114	2.95	7
375	AWANG R	42	132	110	3.14	7
376	CHOONG TSY	38	278	253	7.32	7
377	HA ST	38	212	121	5.58	7
378	ZHENG LS	37	171	153	4.62	7
379	IBRAHIM N	42	172	169	4.1	7
380	MURUGESAN T	37	203	134	5.49	7
381	TAN SH	40	198	197	4.95	7
382	LOCKMAN Z	36	184	144	5.11	7
383	ALI MAM	35	96	86	2.74	7

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
384	HUANG RB	34	147	130	4.32	7
385	ABOUL-ENEIN HY	37	144	117	3.89	7
386	LIM MH	36	179	131	4.97	7
387	OMAR SZ	34	144	110	4.24	7
388	AHMAD MN	35	215	189	6.14	7
389	NAING NN	33	99	96	3	7
390	YAHAYA M	33	138	117	4.18	7
391	SHAMAAN NA	31	131	97	4.23	7
392	SOSROSENO W	39	171	108	4.38	7
393	ABDULLAH Z	76	138	112	1.82	6
394	JEBAS SR	73	143	123	1.96	6
395	RAHMAN MM	64	89	80	1.39	6
396	MANDEEP JS	63	115	73	1.83	6
397	VIJAYAKUMAR V	62	131	74	2.11	6
398	SARVESWARI S	52	127	72	2.44	6
399	IBRAHIM S	57	132	121	2.32	6
400	HUSSAIN A	50	140	124	2.8	6
401	OTHMAN F	49	122	117	2.49	6
402	BABA I	48	125	82	2.6	6
403	ISMAIL MR	47	112	100	2.38	6
404	SASIDHARAN S	47	107	82	2.28	6
405	AZIZ AA	50	144	129	2.88	6
406	KARGAR H	44	107	81	2.43	6
407	MOHAMAD R	42	146	140	3.48	6
408	KASSIM MB	40	101	52	2.53	6
409	ZAIN SM	40	111	110	2.78	6
410	ADIKAN FRM	39	124	108	3.18	6
411	LATIFF AA	40	103	89	2.58	6
412	SUKARI MA	41	137	114	3.34	6
413	YAHYA AK	38	103	62	2.71	6
414	ABDULLAH NA	37	119	48	3.22	6
415	RATNAM MM	37	104	78	2.81	6
416	FARINA Y	34	119	79	3.5	6
417	LIANG JB	37	127	109	3.43	6
418	SHUHAIMI M	34	108	98	3.18	6
419	CHUA KH	35	170	138	4.86	6
420	JOHNS EJ	33	127	54	3.85	6
421	LONG LS	33	140	126	4.24	6
422	OZTURK S	33	134	97	4.06	6
423	MOHAMAD H	36	190	174	5.28	6
424	SEKARAN SD	32	100	87	3.12	6
425	ARIFF A	32	126	102	3.94	6
426	MOGHAVVEMI M	32	108	86	3.38	6
427	RAVICHANDRAN M	33	107	95	3.24	6
428	ROBINSON WT	31	88	84	2.84	6
429	AHMAD D	32	141	118	4.41	6
430	HEMAMALINI M	186	160	100	0.86	5
431	YEAP CS	129	137	126	1.06	5
432	AMINI MM	94	149	105	1.59	5
433	ISLOOR AM	94	96	76	1.02	5
434	GOH JH	86	125	92	1.45	5
435	KHALEDI H	83	91	80	1.1	5
436	ABDULLAH S	82	100	97	1.22	5
437	WARDELL JL	76	113	58	1.49	5
438	WARDELL SMSV	68	106	51	1.56	5

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
439	LOH WS	65	83	61	1.28	5
440	MISRAN N	56	88	71	1.57	5
441	ISLAM MT	56	86	67	1.54	5
442	YUSOF MSM	50	137	102	2.74	5
443	AHMAD I	49	131	126	2.67	5
444	MAAH MJ	43	91	84	2.12	5
445	SHAARI S	44	116	103	2.64	5
446	ARSHAD A	43	73	62	1.7	5
447	BASIRUN WJ	40	84	73	2.1	5
448	MUSTAFA S	41	77	73	1.88	5
449	FU YL	37	85	64	2.3	5
450	JAAFAR MS	37	82	47	2.22	5
451	MUKHTAR MR	36	82	56	2.28	5
452	TAHIR MIM	36	85	66	2.36	5
453	SIM KS	37	86	70	2.32	5
454	YAHYA A	40	69	64	1.73	5
455	CHAN KY	34	98	84	2.88	5
456	YAM MF	34	75	63	2.21	5
457	ABDULLA MA	33	144	141	4.36	5
458	LOH TC	33	115	85	3.48	5
459	TALIB ZA	33	102	96	3.09	5
460	YUNUS R	38	86	78	2.26	5
461	HASHIM MR	31	52	46	1.68	5
462	ZAKARIA A	33	103	102	3.12	5
463	ABU BAKAR F	30	88	83	2.93	5
464	ALI BM	31	114	109	3.68	5
465	DE SOUZA MVN	30	67	29	2.23	5
466	BIN SHAWKATALY O	59	71	55	1.2	4
467	ROSLI MM	60	83	77	1.38	4
468	OTHMAN M	85	61	39	0.72	4
469	MAJLIS BY	46	66	60	1.43	4
470	ALI J	50	73	54	1.46	4
471	EE GCL	42	118	99	2.81	4
472	CHUAH LS	39	50	47	1.28	4
473	NITHINCHANDRA	38	44	21	1.16	4
474	RAGHUNATHAN R	38	86	64	2.26	4
475	DARUS M	37	73	57	1.97	4
476	CHUAH TC	35	46	42	1.31	4
477	JEMAIN AA	36	66	40	1.83	4
478	JEFFERY J	34	68	66	2	4
479	NOORDIN MM	35	70	66	2	4
480	ANUAR AR	33	61	59	1.85	4
481	CHANAWANNO K	32	78	43	2.44	4
482	PENG YH	33	46	37	1.39	4
483	ZENG MH	31	100	95	3.23	4
484	ASIRI AM	69	38	28	0.55	3
485	ESSASSI E	54	29	27	0.54	3
486	OMAR K	38	168	162	4.42	3
487	KADIR MA	34	36	34	1.06	3
488	SUBRAMANIAM S	36	80	68	2.22	3
489	ALIMON AR	34	37	34	1.09	3
490	NAJAFI E	32	22	16	0.69	3
491	RAHIM ASA	32	44	25	1.38	3
492	SHETTY P	31	36	32	1.16	3
493	ZOUIHRI H	31	22	19	0.71	3

N	Authors	Records found	Sum of C	Citing articles	Average citations per item	h index
494	ARMAN HD	30	34	28	1.13	3
495	AL-YOUBI AO	40	14	10	0.35	2
496	FAIDALLAH HM	38	14	10	0.37	2
497	KHAN IA	38	29	21	0.76	2
498	HASSALI MA	39	29	28	0.74	2
499	SHAH MR	33	25	20	0.76	2

Appendix C. Full ranking based on *p* index

N	Authors	results found	Sum of C	Citing articles	Average citations per item	Exergy	p
1	LAM SK	65	2726	1709	41.94	114324.25	48.53
2	HAMEED BH	116	2338	1379	20.16	47122.79	36.12
3	LEE CK	78	1905	1468	24.42	46525.96	35.97
4	FUN HK	2179	10055	6633	4.61	46398.82	35.93
5	CHEN XM	45	1439	1265	31.98	46016.02	35.83
6	TILLEY DR	98	2008	1295	20.49	41143.51	34.52
7	YOU XZ	130	2302	1908	17.71	40763.11	34.42
8	ISHAK ZAM	143	2385	1613	16.68	39777.80	34.14
9	WONG KT	52	1336	932	25.69	34324.92	32.50
10	LOW KS	67	1455	1148	21.72	31597.39	31.61
11	XIONG RG	31	931	780	30.03	27960.03	30.35
12	NGAH WSW	35	983	768	28.09	27608.26	30.22
13	YADAV M	38	1019	984	26.82	27325.29	30.12
14	AHMAD AL	153	2029	1460	13.26	26907.46	29.97
15	GOH KL	139	1909	1585	13.73	26217.85	29.71
16	KAM TS	120	1747	539	14.56	25433.41	29.41
17	KAMARULZAMAN A	64	1273	1000	19.89	25320.77	29.36
18	NG SW	1953	6935	5055	3.55	24625.82	29.09
19	ISHIAKU US	69	1295	944	18.77	24304.71	28.97
20	WEI C	46	1050	838	22.83	23967.39	28.83
21	ISMAIL H	269	2462	1481	9.15	22533.25	28.24
22	TAN CT	65	1200	833	18.46	22153.85	28.09
23	NASEF MM	49	1007	591	20.55	20694.88	27.45
24	BHATIA S	159	1812	1353	11.4	20649.96	27.44
25	LOOI LM	75	1239	1139	16.52	20468.28	27.35
26	ISMAIL AF	142	1618	1154	11.39	18436.08	26.42
27	DAS VGK	99	1331	781	13.44	17894.56	26.16
28	KHALID BAK	79	1170	1058	14.85	17327.85	25.88
29	MAN YBC	202	1795	1202	8.89	15950.62	25.17
30	JALALUDIN S	45	821	582	18.24	14978.69	24.65
31	MOHAMED AR	151	1492	1094	9.88	14742.15	24.52
32	GOH SH	73	1032	828	14.14	14589.37	24.43
33	ROZMAN HD	70	1005	700	14.36	14428.93	24.35
34	SEVENET T	31	660	567	21.29	14051.61	24.13
35	GOH LY	47	812	405	17.28	14028.60	24.12
36	ALI AM	93	1115	865	11.99	13368.01	23.73
37	YUEN KH	91	1091	963	11.99	13080.01	23.56
38	PANG T	40	713	611	17.39	12709.23	23.34
39	HO YW	77	986	664	12.81	12625.92	23.29
40	SALLEH AB	120	1159	887	9.66	11194.01	22.37

N	Authors	results found	Sum of C	Citing articles	Average citations per item	Exergy	p
41	MAK TCW	34	614	472	18.06	11088.12	22.30
42	AROF AK	153	1301	785	8.5	11062.75	22.28
43	TAN NH	73	893	580	12.23	10923.96	22.19
44	CHANTRAPROMMA S	480	2281	1499	4.75	10839.50	22.13
45	BURFIELD DR	42	670	560	15.95	10688.10	22.03
46	NGEOW YF	32	577	575	18.04	10404.03	21.83
47	PEH KK	48	699	647	14.56	10179.19	21.67
48	ISMAIL A	148	1224	1022	8.27	10122.81	21.63
49	SEOW CC	32	567	497	17.22	10046.53	21.58
50	HASHIM I	132	1149	591	8.7	10001.52	21.55
51	PUTHUCHEARY SD	74	857	760	11.58	9924.99	21.49
52	ABDULLAH N	160	1250	930	7.81	9765.63	21.37
53	RAJ SSS	148	1182	1044	7.99	9440.03	21.13
54	LAJIS NH	98	960	832	9.8	9404.08	21.11
55	BASRI M	153	1185	889	7.75	9177.94	20.94
56	TAN CP	133	1087	798	8.17	8883.98	20.71
57	MASJUKI HH	95	913	635	9.61	8774.41	20.63
58	ABUBAKAR S	43	603	475	14.02	8456.02	20.37
59	RAZAK IA	295	1579	1245	5.35	8451.66	20.37
60	ZAINAL Z	102	925	838	9.07	8388.48	20.32
61	MOHAMED S	56	679	630	12.12	8232.88	20.19
62	CROUSE KA	43	594	390	13.81	8205.49	20.17
63	AROUA MK	71	745	600	10.49	7817.25	19.85
64	RUSUL G	46	594	556	12.91	7670.35	19.72
65	CHOO YM	52	631	445	12.13	7656.94	19.71
66	POP I	142	1035	559	7.29	7543.84	19.61
67	RAMESH S	58	659	512	11.36	7487.60	19.56
68	MOHAMMAD AW	54	635	500	11.76	7467.13	19.55
69	NAVARATNAM V	55	638	511	11.6	7400.80	19.49
70	OMAR AKM	38	529	390	13.92	7364.24	19.46
71	YUSOFF K	103	866	696	8.41	7281.13	19.38
72	AHMAD H	321	1523	774	4.74	7225.95	19.33
73	GHAZALI HM	79	748	542	9.47	7082.33	19.20
74	CHINNAKALI K	186	1135	878	6.1	6925.94	19.06
75	HAMID AA	40	519	425	12.98	6734.03	18.88
76	POH BT	67	670	311	10	6700.00	18.85
77	NG WK	42	529	351	12.6	6662.88	18.82
78	PEH SC	43	525	493	12.21	6409.88	18.58
79	HARUN SW	245	1253	575	5.11	6408.20	18.57
80	KOMIYAMA K	31	445	249	14.35	6387.90	18.55
81	ALAM GM	44	528	173	12	6336.00	18.50
82	KHAN MN	116	854	278	7.36	6287.21	18.46

N	Authors	results found	Sum of C	Citing articles	Average citations per item	Exergy	p
83	MANAN ZA	40	501	259	12.52	6275.03	18.44
84	AHMAD M	107	816	658	7.63	6222.95	18.39
85	SHARIFF M	42	511	481	12.17	6217.17	18.39
86	DAUD WMAW	50	556	454	11.12	6182.72	18.35
87	SIAR CH	67	643	497	9.6	6170.88	18.34
88	LIM YY	44	517	434	11.57	6074.75	18.25
89	LEE KT	102	785	558	7.7	6041.42	18.21
90	TAN SG	86	720	574	8.37	6027.91	18.20
91	NAZAR R	109	806	463	7.39	5959.96	18.13
92	NOORANI MSM	63	611	354	9.7	5925.73	18.10
93	USMAN A	149	938	746	6.3	5904.99	18.07
94	CHOW WS	41	490	353	11.95	5856.10	18.02
95	DAUD WRW	116	819	726	7.06	5782.42	17.95
96	KUMAR RN	41	479	399	11.68	5596.12	17.75
97	PHANG SM	59	568	460	9.63	5468.20	17.62
98	CHUAH CH	55	548	394	9.96	5460.07	17.61
99	RAZAK CNA	36	442	375	12.28	5426.78	17.57
100	HO CC	58	557	460	9.6	5349.12	17.49
101	MAK JW	82	661	602	8.06	5328.30	17.47
102	MAK JW	82	660	601	8.05	5312.20	17.45
103	KHALIL HPSA	79	646	490	8.18	5282.48	17.42
104	SAIDUR R	80	647	338	8.09	5232.61	17.36
105	ALI MA	56	538	426	9.61	5168.64	17.29
106	YUNUS WMZW	92	685	575	7.45	5100.27	17.21
107	SCHILTHUIZEN M	35	419	307	11.97	5016.03	17.12
108	HASHIM MA	87	655	560	7.53	4931.32	17.02
109	THONG KL	58	534	440	9.21	4916.48	17.00
110	CHUAH TG	40	442	409	11.05	4884.10	16.97
111	HUSSEIN MZ	62	548	451	8.84	4843.61	16.92
112	ISRAF DA	57	520	416	9.12	4743.86	16.80
113	TEOH SG	179	921	621	5.15	4738.78	16.80
114	MANSOR SM	47	471	393	10.02	4720.02	16.77
115	ONG SH	54	503	395	9.31	4685.35	16.73
116	SAAD B	88	636	539	7.23	4596.55	16.63
117	CHEE KK	41	434	387	10.59	4594.05	16.62
118	YONG HS	64	539	456	8.42	4539.39	16.56
119	YIP CH	56	503	409	8.98	4518.02	16.53
120	TEO SB	57	507	313	8.89	4509.63	16.52
121	ABDULLAH MH	35	396	342	11.31	4480.46	16.49
122	YUSOF S	46	453	392	9.85	4461.07	16.46
123	SEETHARAMU KN	63	529	473	8.4	4441.92	16.44
124	KAMARUDIN SK	38	410	333	10.79	4423.68	16.42

N	Authors	results found	Sum of C	Citing articles	Average citations per item	Exergy	p
125	SEETHARAMU KN	63	522	468	8.29	4325.14	16.29
126	TENG TT	43	430	367	10	4300.00	16.26
127	TIAN YP	65	520	418	8	4160.00	16.08
128	RADIMAN S	51	459	397	9	4131.00	16.05
129	LIM SC	62	506	318	8.16	4129.61	16.04
130	LAI OM	74	552	397	7.46	4117.62	16.03
131	MAHDI MA	155	795	477	5.13	4077.58	15.98
132	KAMARUDDIN AH	51	448	369	8.78	3935.37	15.79
133	ABDULLAH AH	46	424	402	9.22	3908.17	15.75
134	SIVAKUMAR K	73	534	425	7.32	3906.25	15.75
135	YAMIN BM	224	933	664	4.17	3886.11	15.72
136	ISHAK A	94	604	299	6.43	3881.02	15.72
137	SALEH MI	73	528	441	7.23	3818.96	15.63
138	HASHIM R	174	814	713	4.68	3808.02	15.62
139	FAKHRU'L-RAZI A	54	451	336	8.35	3766.69	15.56
140	DEVI S	39	382	359	9.79	3741.64	15.52
141	LIM KH	45	405	273	9	3645.00	15.39
142	BRADLEY DA	68	493	381	7.25	3574.25	15.29
143	CHENG HM	31	332	270	10.71	3555.61	15.26
144	AMIN N	58	453	354	7.81	3538.09	15.24
145	RADU S	57	448	428	7.86	3521.12	15.21
146	PATIL PS	114	624	320	5.47	3415.58	15.06
147	ARIFFIN H	37	350	334	9.46	3310.81	14.90
148	KARIM MIA	44	376	304	8.55	3213.09	14.76
149	SHIRAI Y	40	358	224	8.95	3204.10	14.74
150	LU ZL	33	325	245	9.85	3200.76	14.74
151	ISMAIL Z	109	588	542	5.39	3171.96	14.69
152	NG KP	41	358	303	8.73	3125.95	14.62
153	ISA MH	33	321	240	9.73	3122.45	14.62
154	TAN WS	69	459	264	6.65	3053.35	14.51
155	YEAP GY	72	466	269	6.47	3016.06	14.45
156	AZIZ HA	60	425	303	7.08	3010.42	14.44
157	AL-MANSOORI MH	72	465	233	6.46	3003.13	14.43
158	ZHANG Y	64	438	347	6.84	2997.56	14.42
159	ABDULLAH MP	34	319	299	9.38	2992.97	14.41
160	HASAN M	40	345	279	8.62	2975.63	14.38
161	KARIM AA	64	436	395	6.81	2970.25	14.37
162	WONG RCS	32	307	140	9.59	2945.28	14.33
163	HASSAN MA	70	451	297	6.44	2905.73	14.27
164	SUBRAMANIAM G	33	309	165	9.36	2893.36	14.25
165	SUDESH K	46	364	247	7.91	2880.35	14.23
166	NG KH	108	555	468	5.14	2852.08	14.18

N	Authors	results found	Sum of C	Citing articles	Average citations per item	Exergy	p
167	RATNAM CT	48	370	192	7.71	2852.08	14.18
168	SOPIAN K	58	405	348	6.98	2828.02	14.14
169	YIP BC	31	296	275	9.55	2826.32	14.14
170	RAHMAN RNZRA	52	383	299	7.37	2820.94	14.13
171	AHMAD A	128	600	514	4.69	2812.50	14.12
172	ISMAIL J	33	304	281	9.21	2800.48	14.10
173	BOEY PL	39	330	220	8.46	2792.31	14.08
174	ISMAIL R	130	597	507	4.59	2741.61	14.00
175	LEE SL	72	444	299	6.17	2738.00	13.99
176	HUSSAIN MA	48	361	314	7.52	2715.02	13.95
177	YARMO MA	43	337	294	7.84	2641.14	13.82
178	MOHAMAD AB	35	304	262	8.69	2640.46	13.82
179	OTHMAN MR	49	357	282	7.29	2601.00	13.75
180	LIM PE	33	292	257	8.85	2583.76	13.72
181	LEE SL	72	428	293	5.94	2544.22	13.65
182	HARON MJ	38	309	291	8.13	2512.66	13.59
183	FONG MY	31	278	266	8.97	2493.03	13.56
184	OMAR AR	88	468	378	5.32	2488.91	13.55
185	TEY BT	63	393	254	6.24	2451.57	13.48
186	SEOW HF	39	306	298	7.85	2400.92	13.39
187	LEE WS	42	317	293	7.55	2392.60	13.37
188	MOHAMAD AA	39	303	229	7.77	2354.08	13.30
189	TOU TY	76	422	365	5.55	2343.21	13.28
190	BOO NY	55	358	346	6.51	2330.25	13.26
191	DHARMAPRAKASH SM	101	484	204	4.79	2319.37	13.24
192	ZULKIFLI I	52	347	230	6.67	2315.56	13.23
193	YUSOFF MSA	37	291	242	7.86	2288.68	13.18
194	ARIFIN Z	32	270	134	8.44	2278.13	13.16
195	RAHMAN ARA	32	270	245	8.44	2278.13	13.16
196	KUTHUBUTHEEN AJ	46	320	231	6.96	2226.09	13.06
197	HENG LY	40	296	257	7.4	2190.40	12.99
198	HUANG NM	37	284	243	7.68	2179.89	12.97
199	WU JY	33	268	245	8.12	2176.48	12.96
200	MUSTAFA MR	49	326	281	6.65	2168.90	12.94
201	MOHAMED M	49	326	308	6.65	2168.90	12.94
202	GAO S	169	601	468	3.56	2137.28	12.88
203	CHAN KL	63	366	292	5.81	2126.29	12.86
204	IDRIS A	69	383	350	5.55	2125.93	12.86
205	YAP CK	50	323	239	6.46	2086.58	12.78
206	ABDULLAH AZ	64	363	330	5.67	2058.89	12.72

N	Authors	results found	Sum of C	Citing articles	Average citations per item	Exergy	p
207	NAWAWI A	41	290	209	7.07	2051.22	12.71
208	CHEONG KY	69	375	226	5.43	2038.04	12.68
209	CHOONG TSY	38	278	253	7.32	2033.79	12.67
210	AHMAD SH	33	257	236	7.79	2001.48	12.60
211	WAHIDDIN MRB	50	316	257	6.32	1997.12	12.59
212	JINAP S	75	386	329	5.15	1986.61	12.57
213	SIVANESARATNAM V	52	321	302	6.17	1981.56	12.56
214	LIM LHS	53	324	156	6.11	1980.68	12.56
215	YAHAYA AH	49	311	265	6.35	1973.90	12.54
216	SINNIAH D	36	265	227	7.36	1950.69	12.49
217	RAO MVC	42	285	280	6.79	1933.93	12.46
218	SINGH R	56	328	297	5.86	1921.14	12.43
219	CHAN KL	39	273	210	7	1911.00	12.41
220	DAUD AR	34	254	215	7.47	1897.53	12.38
221	OSMAN J	42	282	187	6.71	1893.43	12.37
222	RATNAVELU K	36	261	216	7.25	1892.25	12.37
223	HADI AHA	84	396	296	4.71	1866.86	12.31
224	BAHARIN BS	48	299	239	6.23	1862.52	12.30
225	KARALAI C	69	358	213	5.19	1857.45	12.29
226	POH BL	46	292	185	6.35	1853.57	12.28
227	ARIFFIN A	79	381	313	4.82	1837.48	12.25
228	ZAIDUL ISM	33	246	181	7.45	1833.82	12.24
229	LEE CY	95	416	343	4.38	1821.64	12.21
230	BAKAR J	40	269	246	6.72	1809.03	12.18
231	CHONG CS	33	244	201	7.39	1804.12	12.17
232	SELAMAT J	31	236	224	7.61	1796.65	12.16
233	ARIFF AB	62	332	285	5.35	1777.81	12.11
234	ABDULLAH MK	79	374	285	4.73	1770.58	12.10
235	RAHMAN RA	101	422	396	4.18	1763.21	12.08
236	AWANG K	126	471	331	3.74	1760.64	12.08
237	TAN GH	40	264	249	6.6	1742.40	12.03
238	ALAM MZ	55	307	200	5.58	1713.62	11.97
239	RAHMAN AA	34	240	234	7.06	1694.12	11.92
240	MUNIANDY SV	31	228	192	7.35	1676.90	11.88
241	SAPUAN SM	100	409	353	4.09	1672.81	11.87
242	HASSAN Z	195	571	476	2.93	1672.01	11.87
243	CHAI SP	31	227	173	7.32	1662.23	11.85
244	NG CH	61	317	229	5.2	1647.36	11.81
245	HAMOUDA AMS	76	347	261	4.57	1584.33	11.66
246	KADHUM AAH	46	266	210	5.78	1538.17	11.54

N	Authors	results found	Sum of C	Citing articles	Average citations per item	Exergy	p
247	CHEAH PL	32	221	207	6.91	1526.28	11.51
248	ISMAIL S	54	286	247	5.3	1514.74	11.48
249	HUO LH	90	369	281	4.1	1512.90	11.48
250	STANSLAS J	34	226	195	6.65	1502.24	11.45
251	MOHAMED R	39	242	224	6.21	1501.64	11.45
252	SULAIMAN MR	63	305	216	4.84	1476.59	11.39
253	LIM CP	52	272	232	5.23	1422.77	11.25
254	ABDULLAH MZ	59	289	235	4.9	1415.61	11.23
255	YAHYA MZA	35	222	173	6.34	1408.11	11.21
256	TAUFIQ-YAP YH	60	289	202	4.82	1392.02	11.17
257	KASSIM A	79	330	308	4.18	1378.48	11.13
258	RAHMAN MBA	57	280	224	4.91	1375.44	11.12
259	VIKINESWARY S	34	215	197	6.32	1359.56	11.08
260	LEE KH	38	227	203	5.97	1356.03	11.07
261	ISMAIL BS	46	249	204	5.41	1347.85	11.05
262	OSMAN A	35	217	205	6.2	1345.40	11.04
263	SOMCHIT MN	33	210	169	6.36	1336.36	11.01
264	RAHMAN IA	33	209	177	6.33	1323.67	10.98
265	AHMAD MN	35	215	189	6.14	1320.71	10.97
266	MAHDI E	37	221	131	5.97	1320.03	10.97
267	SULAIMAN S	69	300	275	4.35	1304.35	10.93
268	ALIAS Y	62	283	185	4.56	1291.76	10.89
269	ZAKARIA R	32	203	169	6.34	1287.78	10.88
270	RAHMAN MZA	36	214	186	5.94	1272.11	10.84
271	AHMAD N	55	261	250	4.75	1238.56	10.74
272	RAHIM NA	56	262	211	4.68	1225.79	10.70
273	SHAMSHUDDIN J	33	201	156	6.09	1224.27	10.70
274	RAHMAN NA	82	315	299	3.84	1210.06	10.66
275	LIONG MT	36	208	144	5.78	1201.78	10.63
276	LIM TK	36	208	110	5.78	1201.78	10.63
277	ISMAIL M	84	317	294	3.77	1196.30	10.62
278	HA ST	38	212	121	5.58	1182.74	10.58
279	RAHMAN SA	59	264	251	4.47	1181.29	10.57
280	GAN SN	35	202	185	5.77	1165.83	10.52
281	MORITA H	47	233	156	4.96	1155.09	10.49
282	TAN SC	35	201	192	5.748	1154.31	10.49
283	RAHMAT A	34	198	179	5.82	1153.06	10.49
284	BOONNAK N	31	188	108	6.06	1140.13	10.45
285	GOSWAMI S	76	294	198	3.87	1137.32	10.44
286	ALI A	64	269	245	4.2	1130.64	10.42
287	ZAKARIA Z	65	271	252	4.17	1129.86	10.42

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288	ABU BAKAR A	63	266	221	4.22	1123.11	10.39
289	ZAKARIA ZA	77	294	217	3.82	1122.55	10.39
290	NGAH WZW	44	222	184	5.05	1120.09	10.39
291	MURUGESAN T	37	203	134	5.49	1113.76	10.37
292	TEO LP	59	256	142	4.34	1110.78	10.36
293	YUSOFF FM	38	204	186	5.37	1095.16	10.31
294	OSMAN H	115	353	324	3.07	1083.56	10.27
295	VELMURUGAN D	64	262	229	4.09	1072.56	10.24
296	ADAM F	30	179	102	5.97	1068.03	10.22
297	ALI A	64	261	238	4.08	1064.39	10.21
298	CHOUDHURY PK	40	205	124	5.12	1050.63	10.17
299	TAN PC	40	204	160	5.1	1040.40	10.13
300	TEH JBJ	43	211	122	4.91	1035.37	10.12
301	HASSAN A	72	272	233	3.78	1027.56	10.09
302	SHAARI K	45	215	194	4.78	1027.22	10.09
303	ASMAWI MZ	40	202	191	5.05	1020.10	10.07
304	HO CL	34	186	161	5.47	1017.53	10.06
305	XU JH	90	301	195	3.34	1006.68	10.02
306	MOHAMAD H	36	190	174	5.28	1002.78	10.01
307	ZAKARIA S	51	226	166	4.43	1001.49	10.00
308	AHMAD S	91	301	262	3.31	995.62	9.99
309	JAMILAH B	36	189	170	5.25	992.25	9.97
310	TAN SH	40	198	197	4.95	980.10	9.93
311	OTHMAN R	57	236	210	4.14	977.12	9.92
312	SHARIF S	38	192	172	5.05	970.11	9.90
313	ISMAIL N	83	282	258	3.4	958.12	9.86
314	HAIR-BEJO M	44	205	154	4.66	955.11	9.85
315	LOCKMAN Z	36	184	144	5.11	940.44	9.80
316	RAHIM RA	81	274	226	3.38	926.86	9.75
317	MATSUURA T	37	184	158	4.97	915.03	9.71
318	HAMDAN H	37	184	172	4.97	915.03	9.71
319	MARIATTI M	51	216	198	4.24	914.82	9.71
320	ANJUM S	31	168	132	5.42	910.45	9.69
321	IBRAHIM H	56	225	199	4.02	904.02	9.67
322	WONG CS	41	192	156	4.68	899.12	9.65
323	IBRAHIM NA	50	211	148	4.22	890.42	9.62
324	LIM MH	36	179	131	4.97	890.03	9.62
325	ZHAO H	39	185	159	4.74	877.56	9.57
326	LOW WY	43	194	169	4.51	875.26	9.57
327	SADIKUN A	41	188	149	4.59	862.05	9.52

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328	TSO CP	42	189	163	4.5	850.50	9.47
329	ANG HH	31	162	107	5.23	846.58	9.46
330	AHMAD R	82	263	210	3.21	843.52	9.45
331	ZULKIFLI MZ	38	178	117	4.68	833.79	9.41
332	LEE HL	58	219	202	3.78	826.91	9.39
333	CHUA KH	35	170	138	4.86	825.71	9.38
334	BHAT R	45	192	171	4.27	819.20	9.36
335	ZHENG LS	37	171	153	4.62	790.30	9.25
336	ADNAN R	47	192	164	4.09	784.34	9.22
337	SALLEH MM	58	213	190	3.67	782.22	9.21
338	SULAIMAN O	74	239	201	3.23	771.91	9.17
339	NG SL	54	203	160	3.76	763.13	9.14
340	SAHARI BB	45	184	115	4.09	752.36	9.10
341	SOSROSENO W	39	171	108	4.38	749.77	9.08
342	MIRHOSSEINI H	42	177	132	4.21	745.93	9.07
343	OMAR K	38	168	162	4.42	742.74	9.06
344	ABDULLAH A	56	201	196	3.59	721.45	8.97
345	IBRAHIM MH	47	183	141	3.89	712.53	8.93
346	ABDULLAH M	51	190	186	3.73	707.84	8.91
347	DIMYATI K	42	172	152	4.1	704.38	8.90
348	IBRAHIM N	42	172	169	4.1	704.38	8.90
349	CHUAH HT	76	231	193	3.04	702.12	8.89
350	LIM KP	36	158	128	4.39	693.44	8.85
351	YAM FK	56	196	175	3.5	686.00	8.82
352	AKIL HM	62	206	176	3.32	684.45	8.81
353	LING TC	64	208	123	3.25	676.00	8.78
354	TIEKINK ERT	377	503	385	1.33	671.11	8.76
355	ALI HM	186	351	287	1.89	662.37	8.72
356	ABD-SHUKOR R	80	230	154	2.88	661.25	8.71
357	ALI RM	46	174	127	3.78	658.17	8.70
358	HUANG RB	34	147	130	4.32	635.56	8.60
359	LO KM	169	326	278	1.93	628.85	8.57
360	ABDULLA MA	33	144	141	4.36	628.36	8.57
361	OTHMAN N	46	170	166	3.7	628.26	8.56
362	AHMAD D	32	141	118	4.41	621.28	8.53
363	OMAR SZ	34	144	110	4.24	609.88	8.48
364	HANAFI MM	66	199	176	3.02	600.02	8.43
365	LONG LS	33	140	126	4.24	593.94	8.41
366	IBRAHIM K	91	231	183	2.54	586.38	8.37
367	YUSOF NA	40	153	136	3.83	585.23	8.36

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368	AHMAD F	66	196	189	2.97	582.06	8.35
369	DAS S	136	281	228	2.07	580.60	8.34
370	YAHAYA M	33	138	117	4.18	577.09	8.33
371	TAN KW	48	166	143	3.46	574.08	8.31
372	ABOUL-ENEIN HY	37	144	117	3.89	560.43	8.24
373	SHAMAAN NA	31	131	97	4.23	553.58	8.21
374	SATTAR MA	42	152	93	3.62	550.10	8.19
375	OZTURK S	33	134	97	4.06	544.12	8.16
376	ELTAYEB NE	54	171	93	3.17	541.50	8.15
377	RAHMANI M	45	156	126	3.47	540.80	8.15
378	SAARI N	43	151	142	3.51	530.26	8.09
379	MUHAMAD MR	38	141	120	3.71	523.18	8.06
380	MOHAMAD R	42	146	140	3.48	507.52	7.98
381	AHMAD ZA	60	173	143	2.88	498.82	7.93
382	ARIFF A	32	126	102	3.94	496.13	7.92
383	MOHAMED A	85	204	180	2.4	489.60	7.88
384	JOHNS EJ	33	127	54	3.85	488.76	7.88
385	KIA R	106	222	149	2.09	464.94	7.75
386	MAJID SR	41	138	91	3.37	464.49	7.74
387	KALLURAYA B	103	218	169	2.12	461.40	7.73
388	AHMAD Z	96	210	203	2.19	459.38	7.72
389	SUKARI MA	41	137	114	3.34	457.78	7.71
390	WONG LP	31	119	93	3.84	456.81	7.70
391	LIANG JB	37	127	109	3.43	435.92	7.58
392	MOHAMED Z	57	157	144	2.75	432.44	7.56
393	LIM KS	43	135	123	3.14	423.84	7.51
394	HASHIM M	44	136	125	3.09	420.36	7.49
395	ALI BM	31	114	109	3.68	419.23	7.48
396	FARINA Y	34	119	79	3.5	416.50	7.47
397	AWANG R	42	132	110	3.14	414.86	7.46
398	AZIZ AA	50	144	129	2.88	414.72	7.46
399	MOHAMED N	69	167	152	2.42	404.19	7.39
400	LOH TC	33	115	85	3.48	400.76	7.37
401	YUNUS WMM	41	128	119	3.12	399.61	7.37
402	ADIKAN FRM	39	124	108	3.18	394.26	7.33
403	HUSSAIN A	50	140	124	2.8	392.00	7.32
404	ABDULLAH NA	37	119	48	3.22	382.73	7.26
405	YUSOF MSM	50	137	102	2.74	375.38	7.21
406	KILICMAN A	43	127	78	2.95	375.09	7.21
407	MOGHAVVEMI M	32	108	86	3.38	364.50	7.14

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408	SAMSUDIN AR	41	121	114	2.95	357.10	7.09
409	AHMAD I	49	131	126	2.67	350.22	7.05
410	RAVICHANDRAN M	33	107	95	3.24	346.94	7.03
411	SHUHAIMI M	34	108	98	3.18	343.06	7.00
412	EE GCL	42	118	99	2.81	331.52	6.92
413	BABA I	48	125	82	2.6	325.52	6.88
414	ZENG MH	31	100	95	3.23	322.58	6.86
415	ZAKARIA A	33	103	102	3.12	321.48	6.85
416	QUAH CK	108	185	130	1.71	316.90	6.82
417	TALIB ZA	33	102	96	3.09	315.27	6.81
418	SEKARAN SD	32	100	87	3.12	312.50	6.79
419	SARVESWARI S	52	127	72	2.44	310.17	6.77
420	ZAIN SM	40	111	110	2.78	308.03	6.75
421	SHAARI S	44	116	103	2.64	305.82	6.74
422	IBRAHIM S	57	132	121	2.32	305.68	6.74
423	OTHMAN F	49	122	117	2.49	303.76	6.72
424	NAING NN	33	99	96	3	297.00	6.67
425	RATNAM MM	37	104	78	2.81	292.32	6.64
426	NG SS	41	109	74	2.66	289.78	6.62
427	CHAN KY	34	98	84	2.88	282.47	6.56
428	JEBAS SR	73	143	123	1.96	280.12	6.54
429	YAHYA AK	38	103	62	2.71	279.18	6.54
430	VIJAYAKUMAR V	62	131	74	2.11	276.79	6.52
431	ISMAIL MR	47	112	100	2.38	266.89	6.44
432	LATIFF AA	40	103	89	2.58	265.23	6.42
433	ALI MAM	35	96	86	2.74	263.31	6.41
434	KARGAR H	44	107	81	2.43	260.20	6.38
435	ABU BAKAR F	30	88	83	2.93	258.13	6.37
436	KASSIM MB	40	101	52	2.53	255.03	6.34
437	ABDULLAH Z	76	138	112	1.82	250.58	6.30
438	ROBINSON WT	31	88	84	2.84	249.81	6.30
439	SASIDHARAN S	47	107	82	2.28	243.60	6.25
440	AMINI MM	94	149	105	1.59	236.18	6.18
441	ABU HASSAN H	94	149	103	1.59	236.18	6.18
442	MANDEEP JS	63	115	73	1.83	209.92	5.94
443	TAHIR MIM	36	85	66	2.36	200.69	5.85
444	SIM KS	37	86	70	2.32	199.89	5.85
445	FU YL	37	85	64	2.3	195.27	5.80
446	RAGHUNATHAN R	38	86	64	2.26	194.63	5.80
447	YUNUS R	38	86	78	2.26	194.63	5.80
448	MAAH MJ	43	91	84	2.12	192.58	5.77

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449	CHANAWANNO K	32	78	43	2.44	190.13	5.75
450	MUKHTAR MR	36	82	56	2.28	186.78	5.72
451	JAAFAR MS	37	82	47	2.22	181.73	5.66
452	GOH JH	86	125	92	1.45	181.69	5.66
453	SUBRAMANIAM S	36	80	68	2.22	177.78	5.62
454	BASIRUN WJ	40	84	73	2.1	176.40	5.61
455	WARDELL JL	76	113	58	1.49	168.01	5.52
456	YAM MF	34	75	63	2.21	165.44	5.49
457	WARDELL SMSV	68	106	51	1.56	165.24	5.49
458	DE SOUZA MVN	30	67	29	2.23	149.63	5.31
459	YEAP CS	129	137	126	1.06	145.50	5.26
460	MUSTAFA S	41	77	73	1.88	144.61	5.25
461	DARUS M	37	73	57	1.97	144.03	5.24
462	NOORDIN MM	35	70	66	2	140.00	5.19
463	MISRAN N	56	88	71	1.57	138.29	5.17
464	HEMAMALINI M	186	160	100	0.86	137.63	5.16
465	JEFFERY J	34	68	66	2	136.00	5.14
466	ISLAM MT	56	86	67	1.54	132.07	5.09
467	ARSHAD A	43	73	62	1.7	123.93	4.99
468	RAHMAN MM	64	89	80	1.39	123.77	4.98
469	ABDULLAH S	82	100	97	1.22	121.95	4.96
470	JEMAIN AA	36	66	40	1.83	121.00	4.95
471	YAHYA A	40	69	64	1.73	119.03	4.92
472	ROSLI MM	60	83	77	1.38	114.82	4.86
473	ANUAR AR	33	61	59	1.85	112.76	4.83
474	ALI J	50	73	54	1.46	106.58	4.74
475	LOH WS	65	83	61	1.28	105.98	4.73
476	KHALEDI H	83	91	80	1.1	99.77	4.64
477	ISLOOR AM	94	96	76	1.02	98.04	4.61
478	MAJLIS BY	46	66	60	1.43	94.70	4.56
479	HASHIM MR	31	52	46	1.68	87.23	4.43
480	BIN SHAWKATALY O	59	71	55	1.2	85.44	4.40
481	PENG YH	33	46	37	1.39	64.12	4.00
482	CHUAH LS	39	50	47	1.28	64.10	4.00
483	RAHIM ASA	32	44	25	1.38	60.50	3.93
484	CHUAH TC	35	46	42	1.31	60.46	3.92
485	NITHINCHANDRA	38	44	21	1.16	50.95	3.71
486	OTHMAN M	85	61	39	0.72	43.78	3.52
487	SHETTY P	31	36	32	1.16	41.81	3.47

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488	ALIMON AR	34	37	34	1.09	40.26	3.43
489	ARMAN HD	30	34	28	1.13	38.53	3.38
490	KADIR MA	34	36	34	1.06	38.12	3.37
491	KHAN IA	38	29	21	0.76	22.13	2.81
492	HASSALI MA	39	29	28	0.74	21.56	2.78
493	ASIRI AM	69	38	28	0.55	20.93	2.76
494	SHAH MR	33	25	20	0.76	18.94	2.67
495	ZOUIHRI H	31	22	19	0.71	15.61	2.50
496	ESSASSI E	54	29	27	0.54	15.57	2.50
497	NAJAFI E	32	22	16	0.69	15.13	2.47
498	FAIDALLAH HM	38	14	10	0.37	5.16	1.73
499	AL-YOUBI AO	40	14	10	0.35	4.90	1.70

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