

# BIBLIOMETRIC ANALYSIS OF THE *INKOM JOURNAL* (ANALISIS BIBLIOMETRIK JURNAL *INKOM*)

Engkos Koswara Natakusumah<sup>1\*</sup>

<sup>1</sup>Pusat Penelitian Informatika, Lembaga Ilmu Pengetahuan Indonesia

\*Korespondensi: koswara@informatika.lipi.go.id

## ABSTRACT

This paper proposed main problems of quantity and quality measurement of the research articles published in *INKOM* journal for 5 years period in informatics, computers and control system. Those three areas have become research missions of The Research Center for Informatics – Indonesia Institute of Sciences. The aim of this paper is to show how to solve research problems above using bibliometric method to analyze bibliography data available in the journal as well as to offer a summary of the research activity in the area including its most important aspects. Bibliographical data are taken from 76 articles published in the journal from May 2007 to November 2011. This paper also discusses how the method is used to measure article distribution, magazine classification category, article subject distribution, authorship patterns, and institutions distribution contributions. Results of the research show that the majority of articles are contributed by multi authors with degree of collaboration 0,553; the journal has already been widely known by the researchers outside LIPI, researchers from non-LIPI institution dominated more on the publication than from LIPI itself. The quantity of research articles increased in 2011 and used more references from scientific articles than the year before. Besides, the research quality also increased and used more cited articles from scientific journal literature than from books.

## ABSTRAK

Makalah ini mengemukakan masalah utama pengukuran kuantitas dan kualitas artikel hasil penelitian yang di publikasi pada jurnal *INKOM* selama periode 5 tahun, di bidang informatika, komputer dan sistem kendali. Kegita bidang tersebut merupakan misi penelitian dari Pusat Penelitian Informatika – Lembaga Ilmu Pengetahuan Indonesia. Tujuan makalah ini adalah untuk memperlihatkan bagaimana menyelesaikan masalah penelitian tersebut diatas dengan menggunakan metoda bibliometrika untuk menganalisis data bibliografi yang tersedia di jurnal, objektifnya adalah menawarkan suatu ringkasan aktivitas penelitian pada bidang tersebut diatas termasuk berbagai aspek pentingnya. Data bibliografi diambil dari 76 makalah yang di publikasi pada jurnal selama bulan Mei 2007 sampai November 2011. Makalah ini juga membahas bagaimana metoda bibliometrik digunakan untuk mengukur distribusi artikel, kategori klasifikasi majalah, distribusi subyek artikel, distribusi subyek yang diinginkan, pola kepengarangan, dan kontribusi distribusi institusi. Hasil penelitian memperlihatkan bahwa kebanyakan artikel di kontribusi oleh para pengarang ganda dengan derajat kolaborasi sebesar 0,553; keberadaan jurnal ini sudah dikenal oleh para peneliti di luar LIPI, peneliti dari institusi non-LIPI sedikit lebih mendominasi publikasi dari pada peneliti LIPI. Kuantitas makalah ilmiah naik di tahun 2011 dan menggunakan banyak referensi dari artikel ilmiah dari pada terbitan tahun sebelumnya. Kualitas makalah penelitian pada tahun tersebut juga meningkat dan menggunakan banyak sitasi artikel berasal dari sumber literatur jurnal ilmiah dari pada buku.

**Keywords:** Bibliometrics; Collaborations, Authorship Patterns

## 1. INTRODUCTION

*INKOM* Journal is a scientific journal, published two volumes yearly, consisting of scientific articles in the area of informatics, computer and control system. This journal is studied bibliometrically, creating a portrait of the journal, providing a description that offers an insight that is beyond the superficial. It can indicate the quantity and quality, maturity and productivity of the journal. It also informs about the research orientation that supports to disseminate and its influence on author's choice as a channel to communicate or retrieve information for their research needs. Almost always, the

journal is regarded important or significant in the area, important enough to be studied, to make inferences that the journal speaks for authors who publishes in the area and somehow reflects the activity of the research. The journal is often assessed on its quality characteristics, the degree of impact it has achieved in the area, its ability to diffuse knowledge, the authorship and collaboration pattern it projects in the area. In other words, this single journal studies have been undertaken for various reasons transcending across various disciplines. Nebelong-Bonnevie and Frandsen (2006) indicated that single journal studies provided a detailed multi-faceted picture of the characteristics of a single journal. The assessment tool used for single journal studies is almost always bibliometric indicators to uncover the characteristics, quantity, quality and status of the journal.

According to Thomson Reuters (2008) a scientific research activity is not complete yet, if the result is not published in a scientific journal with good quality, accredited and indexed by international institution. Actually not only quality but also quantity of the journal articles is very important to a scientific journal. A scientific journal is a serial publication containing primary scientific information, as an important media to communicate among researchers in the R&D institutions, universities and industries to share their experiences and expertises, to increase the quantity and quality of the scientific journal. The scientific journal has an important role to communicate a new method and a research result, contains scientific articles that informs a new creation to contribute a development to the science (Garcia-Lopez, 1999).

Information of a new research results is one of the important resources, as a basic to develop product innovation. This information grows exponential, known as an information explosions, this explosion is difficult to be followed and managed without using tools of information technology. Explosion of the journals information is an indicator for growing literatures in every part of the development of the science. Grown as a main stream to disseminate the data, information and knowledge, but there are still had problems to measure the quantity and quality of the journal articles of the research results (Natakusumah, EK., 2012). Based on the explanation above, it is crucial to have a research in a single journal to measure the quantity and quality of the journal articles using bibliometric analysis method.

Bibliometrics is a set of methods used to study or measure texts and information, has become a standard tool of science policy and research management in the last decades. In particular, academic institutions increasingly rely on citation analysis for making hiring, promotion, tenure, and funding decisions (Weingart, 2005). Bibliometric studies have been applied mainly to scientific fields and are based principally on various metadata elements like author, title, subject, citations, etc. related to scholarly publication within a discipline. This type of analysis provides useful indicators of scientific productivity, trends, the emphasis of research in various facets and researchers' preferences for publication (Jacobs, 2001). Sengupta (1974) has defined bibliometrics as organization, classification and quantitative evaluation of publication pattern of macro-communication along with their authorships by mathematical and statistical calculations.

Development of science is frequently related to scientific productivity, the ability to produce a scientific publication (Franceschet and Costantini, 2011). The publication can be measured through bibliometric indicators (Piro, F.N., 2011). This indicators can be produced by bibliometric analysis method. The method can solve crucial problems in scientific publication, such as, how to measure distribution of articles, category classification of articles, subject distribution of articles, authorship patterns and institutions distribution of contributions. The research carried out by Thanuskodi (2010) discussed similar analysis to the number of articles, authorship pattern, subject distribution of articles,

average number of references per articles, forms of documents cited and year distribution of cited journals.

According to Harande (2001) in scientific community, authorship is one of important aspects that play an important role in communication activities, person that has a first responsibility for publication of the article. Authorship not only covers who is really written, but also who is given more published scientific contribution in the scientific journal of a research. Author is responsible to determinate authorship and to decide its research with two or more another authors to participate given contribution. Research to the authorship is carried out to know the ranks of propductive authors (Park, T.K., 2006). Sources of the research comes from single journal, many journals or database. This paper discusses the research limited to the soures of single journal. In order to measure the quantity and quality of the journal articles, this paper discuss how to measure author productivity by analyzing a number of written articles produced by person as individual in a certain subject area and certain time. Author productivity is also called as scientific productivity, is a number of research produced by researchers. The author productivity is determinated based on a number of scientific contribution by researcher in a certain subject area, such as informatics, computer and control system.

The objectives of present study are: (1) to study annual distribution of articles; (2) to study the authorship pattern; (3) to study degree of collaboration; (4) to study R&D Institutions distribution; (5) to study number of cited articles; and (6) to study the most prolific article contributions.

## **2. METHODOLOGY**

The methodology applicable in the current study to measure the quantity and quallity of the scientific journal articles is bibliometric scrutiny, which is used to analyze in detail the bibliographic attributes of the articles published in *INKOM* Journal from 2007 – 2011 . Five volumes (Vol. 1 to 5) containing nine issues have been taken up for the study. The authors have extracted the information from the *INKOM* Journal. The *INKOM* Journal is devoted to the applications and implications of new technology, informatics, computers and control system all over the world as well as the development of software and hardware for such applications. It provides a vehicle for the latest research and ongoing developments in today's informatics and computer environments in different countries, and offers practical advice, useful information and descriptions of specific applications around the globe. It is published biannually and highly regarded journal, publishes mainly new research, and is known to receive a high number of citations.

## **3. RESULTS AND DISCUSSION**

The *INKOM* Journal has extracted all the details such as author(s), title, year of publication, institutional affiliation, references, number of articles, etc. of all articles published from 2007 to 2011 were recorded for the following analysis.

### **3.1 Year Distribution of Articles**

One of the subject coverages in the *INKOM* Journal is computer science articles. According to Franceschet, M. (2010) computer science is an original discipline combining science and engineering. Research in computer science includes theory, developing conceptual frameworks for understanding computations, algorithms, data structures and other aspects of computing. The

nature of computer science is part of its attraction but also complicates the evaluation. The journal period May 2007 to November 2011 have published 76 articles, as mentioned in Table 1. This Table shows that the quantities of articles distribution are different from year to year, there are also steady increase in the numbers of articles from the year 2007 to 2011. Out of total 76 articles, the maximum numbers of articles are in the year 2008 and 2011 contributing 17 articles respectively, which are 22,37% to the total publications respectively. According to the editor of *INKOM* Journal, the reasons that there are maximum numbers existed in 2007 and 2011 because many articles submitted to journal and selected to the maximum articles publication. There are more contributions from the areas of informatics related to software engineering, decision support systems, expert systems and information systems. Those areas closely related to information technology which is the area as a research focus not only in LIPI but also in the universities and the ministry of research and technology including in the national research body. The minimum numbers of articles are in the year 2009 and 2010 with 13 articles respectively, which are 17,11% to the total publications. These minimum numbers of articles published achieved because the numbers of articles submitted to the journal are very limited and also very tightly selected based on the subject coverage in the journal, especially for the areas of computer and control systems. So there are no consistent numbers of articles published each year. This consistency is extremely important to measure the quantity of the journal and also it shows the capacity and capability to manage an excellent scientific journal.

In the case of *INKOM* Journal, the numbers of articles published each year are different. This situation might be caused by poor management of the journal, if it is compared to the *Journal Teknologi Indonesia (JTI)* research carried out by Natakusumah (2014) presented the distribution of articles each year are the same in *JTI* period 2007 up to 2011, there are no higher articles numbers than the others, published in the same numbers, that is 16 articles in two volumes each year, it is a good planning and management of the journal. So that total publication in *JTI* during 5 years are 80 articles compared to *INKOM* Journal only published 76 articles. This different numbers shows that the *JTI* has better in consistency numbers of articles, good planning and managing the scientific publication than *INKOM* Journal.

Table 1. Year Distribution of Articles

No.	Year	Volume (No.)	No. of Publication	No. of Articles	%
1	2007	1 (1,2)	2	16	21.04
2	2008	2 (1,2)	2	17	22.37
3	2009	3 (1,2)	2	13	17.11
4	2010	4 (1,2)	2	13	17.11
5	2011	5 (1,2)	2	17	22.37
	<b>Total</b>		<b>12</b>	<b>76</b>	<b>100</b>

### 3.2 Authorship Patterns

The authorship pattern was analyzed to determine the percentage of single and multiple authorship. According to Harsanyi (1993) different disciplines interpret the order of authorship differently. Most of the engineering discipline has multiple authorship, whereas the social sciences

has high percentage of single authorship. This finding is similar to the research that carried out by Verma, Tamrakar and Sharma (2007) mentioned that the majority of articles in the journal are two-authored. These authorship patterns supported to the research in the articles in INKOM journal, as shown in Table 2.

Table 2 reveals that during 2007-2011 the highest proportion of articles were by single authors (44.74%), followed by articles with 2 authors (27.63%), 3 authors (21.05%), 4 authors (5.26%) and 5 authors (1.32%). The data points out that the large number of articles by single authors means that there are no well-established research groups in the area and the subject is a new and emerging one. This large number percentage of the articles by single authors was also influenced by the education background of the researchers. The authors of scientific research in informatics area focused on developing a software engineering alone, related to continuous activities, started to make context diagram, data flow diagram, entity relationship diagram, input design, output design, dialog design, interface design, write a suitable softwares coding and testing. These serial activities area were carried out by single researcher. That is why, the informatics researcher produced many scientific articles of software engineering by single authors. This result is supported by Singh, Mittal and Ahmad (2006) conducted a bibliometric study of literature on digital libraries. The important findings are that most articles (61 percent) are single-authored.

Many collaborative authors wrote articles published in 2009 and 2010, those are 4 and 5 authors respectively. These collaborations took place in the research area of computer and control systems, not only during doing the research but also during publishing the article. So that, the researchers produced an article together. These area need more than one researcher to carry out the research, they have to develop the system, which has more broad activity than the area of software engineering. Broad activity need more many special researchers to have collaboration to carry out the research and to publish the articles.

The collaborations were conducted by researchers, teachers and students of the universities, or among the researchers. Basically they have several educational background that can be collaborated to do a certain research topic. For example research in control system needs the researchers with expertise in hardware, software and control. They have to make close collaboration among them, to solve the problem of the research. Expertise of the hardware come from the researcher or teacher who has an educational background in electronic engineering, expertise of the software come from the researcher or teacher who has ability in software engineering, and expertise of control system come from the researcher or teacher who has ability in electronic and electrical engineering. The researchers from LIPI and non-LIPI have collaboration in several focus group discussion to have more input to the research method, the processes, the results and to the draft of published scientific article in a certain research area.

Table 2. Authorship Patterns

No	Authors	2007		2008		2009	2010		2011		Number of Articles	%
		1 (1)	1(2)	2(1)	2(2)	3(1,2)	4(1)	4(2)	5(1)	5(2)		
1	Single	5	3	5	6	6	3	2	2	2	34	44.74
2	2 authors	2	2	2	2	1	1	2	3	6	21	27.63
3	3 authors	1	3	1	1	2	2	3	1	2	16	21.05
4	4 authors	0	0	0	0	3	1	0	0	0	4	05.26
5	5 authors	0	0	0	0	1	0	0	0	0	1	01.32
	<b>Total</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>9</b>	<b>13</b>	<b>7</b>	<b>7</b>	<b>6</b>	<b>10</b>	<b>76</b>	<b>100</b>

### 3.3 Degree of Collaboration in the *INKOM* Journal

To determine degree of collaboration in quantitative terms, the formula given by K. Subramanyam (1983) was used.

$$T \text{ formula is } C = \frac{NM}{NM + NS}$$

Where

C = Degree of collaboration

NM = Number of multi authored articles

NS = Number of single authored articles

In the present study the value of C is  $\frac{42}{42+34} = 0.553$

As a result, the degree of collaboration in the *INKOM* Journal is 0.553, which indicates its slight dominance by multi authors contributions. These contributions come from the sum of the 2, 3, 4, and 5 authors wrote in a single article in the area of computer and control system. But in the area of informatics alone the articles are dominated by single authors. This result is similar to the research result in library and scientific information carried out by Chen and Chen (2005) showing the maximum articles are published by single authors. This proves that there are some similar subject area, educational background and knowledge of informatics and information science.

### 3.4 R&D Institutions Distribution

The Research and Development (R&D) institutions consist of Indonesian Institute of Science (LIPI), Universities, and Industries. They are divided into two groups: LIPI and non-LIPI as shown in Table 3. This Table shows institution distribution of authors in the *INKOM* Journal during the period under study. Authors from LIPI contributed 71 (49.65%) and from non-LIPI contributed 72 (50,35%). There are a slight dominations of the authors from non-LIPI in the journal, this indicated that the journal is already known by researchers outside LIPI, collaborations research among non-LIPI who have university background in the area of informatics, computers and control systems. Most researchers from university published their articles in the journal accredited by Directorate General of Higher Education. On the contrary, most researchers from LIPI published their articles in the journal accredited by LIPI. So, up to now, there are two types of journal



acreditations in Indonesia, the first is the journal accredited by LIPI and the second accredited by Directorate General of Higher Education. Both accredited journals have a different purpose. The first one is allocated for researcher who want to have higher accretided numbers to increase the rank of functional position, especially to get senior research expert and research professor. The second one is for the university teacher who want to increase the position in the university, especially to get university professor. This situation will not last long, because in 2015 there will be a merger of two big institutions ;the Ministry of Research and Technology (RISTEK) which coordinates 7 institutions non-ministry including LIPI and the Directoreate General of Higher Education which accredits the universities journal. Both institutions will be under one coordination of The Ministry of RISTEK and Higher Education. Currently, the process is still underway to have a single number of journal accreditation in Indonesia. This is very important to recognize by the reserchers, they can publish the articles in the journal accredited with high rank of journal grade regardless the type of institutions, LIPI or non-LIPI.

Table 3. Institutions Distribution of Authors

No	R&D Institutions	2007		2008		2009	2010		2011		Number of Authors	%
		1 (1)	1(2)	2(1)	2(2)	3(1,2)	4(1)	4(2)	5(1)	5(2)		
1	LIPI	6	4	5	6	13	9	9	7	12	71	49.65
2	Non-LIPI	6	11	7	7	18	6	3	6	8	72	50.35
	<b>Total</b>	<b>12</b>	<b>15</b>	<b>12</b>	<b>13</b>	<b>31</b>	<b>15</b>	<b>12</b>	<b>13</b>	<b>20</b>	<b>143</b>	<b>100</b>

### 3.5 Number of Cited Articles

The research retrieves production and citation data from bibliography and citation sources and computes performance indicators to measure the quality of research of the bibliometric unit under evaluation. Table 4 shows that during 2007-2011 the highest proportion of cited articles in 2011 were 129 (23.76%), followed by 119 (21,92%) cited articles in 2009, then in 2007 were 107 (19.70%) cited articles, in 2008 and 2010 were 94 (17.31%) respectively. The data point out that the large number of cited articles in 2011 means that there are increasing referencs used by the researchers to support the literature background, especially to show the latest research and to prove the relevant contributions to the science in the area of research. The researcher also used cited articles to combine the research methods to produce a certain relevant and new methods. Knowledge of the researchers to cited articles from another literature is significant increasing in 2011, compared to the year before that. In a single journal *INKOM*, there are 129 number of articiel cited, this situation is very good to produce an excellent research supported by strong literature reviews.

Similar research to many journals are conducted by Yeoh and Kaur (2008) who analyzes the publication output of Research in Higher Education for subject support in collection development in the light of growing interest in diversified domains of research in higher education. Consequently, analysis of 40 issues of publications revealed a diversified usage pattern of bibliographic reference sources by contributing researchers, with a cumulative total of citations being 8,374. A positive trend in research collaboration of contributing authors, and a steady growth in the use of reference sources, periodicals and web documents in the citations signify the trend of scholarly communication of research works in the electronic age. Similar to other disciplines of research

findings, journals and books were the most cited source materials for researchers.

Tabel 4. Numbers of Citation and Articles in the Journal

No.	Year	Volume (Number) Month	Number of cited articles	%	Note
1	2007	1 (1) May, (2) November	107	19.70	-
2	2008	2 (1) May, (2) November	94	17.31	-
3	2009	3 (1-2) November	119	21.92	-
4	2010	4 (1) May, (2) November	94	17.31	1 english language
5	2011	5 (1) May, (2) November	129	23.76	-
<b>Total</b>			<b>543</b>	<b>100</b>	<b>-</b>

### 3.6 Prolific Authors

It was observed that there are a total of 143 of contributors for 76 articles. Hari Satrio Basuki and Wiwin Suwarningsih from the Research Centre for Informatics – Indonesian Institute of Sciences have contributed seven articles and six articles each; Folin Oktafiani has contributed five articles, whereas 5 authors have contribution of four articles each. The data showed that authors contributions of 3 times contributed 6 articles, while authors have 1 and 2 times contributed 82 articles, which have published in the *INKOM* Journal during 2007 to 2011. The researcher from LIPI has higher contribution to the journal articles, the major important research is that many researchers did the research in three subject ares, like, informatics, computers and control systems. These three subjects have a close relation to the area of information technology which is very important research for LIPI, not only in software application but also in operating system development using open source. LIPI develops IGOS Nusantara (IGN) from version 1 up to now version 10 based on open source software, this IGN not only operating system for computer desktop but also for the server. All of the products development are available accessed freely through the internet. Another reason, why LIPI researchers have higher contribution to the journal, most of the auctors who submits articles to the journal have to revise the articles. According to the journal editor, the revision time of LIPI researcher is faster than non-LIPI researchers, So that the acticles can be published on time. Many articles of this journal are mainly supported by two big research institutions in LIPI, namely the Research Center for Informatics and the Research Center for Electronics and Telecommunications, that is why many contributions to the articles journals come from these two institutions.

## 4. CONCLUSION

The publishing trend totally depends on the output of contributors, patterns of contributions, the quantity and quality of research articles. The quantity of articles distribution in *INKOM* Journal is poor, it is different from year to year, there are not consistant in a number of articles published. In the year 2011 shows achievement of maximum numbers of contributions and increasing numbers of cited articles. This situation indicates the quality of research is good and it is supported by many scientific journal references. The study reveals that the categories of article distributions are remarkable in this research journal. Degree of collaboration in the journal is 0.553, which indicates it is slightly dominated



by multi authors contributions. Authors from LIPI contributed 49.65% and from non-LIPI contributed 50,35%. it indicates that the *INKOM* Journal is well known by researchers from universities and industries. There are 9 issues published during 2007-2011, including only one special issues in 2009. It is registered that Hari Satrio Basuki, Wiwin Suwarningsih, Folin Oktafiani were the most proliferate authors who have contributed seven articles, six articles and five articles each respectively. The *INKOM* Journal is notably a scholarly journal that stipulates or induces fruitful research for the informatics, computer and control systems professions.

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