

# A Productivity Review Study on Theory of Reasoned Action Literature Using Bibliometric Methodology

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**Abstract.** This study aimed to describe literature growth and author productivity using a bibliometric evaluation - Lotka's Law of the publication output associated with research on Theory of Reasoned Action (TRA) during the 28-year period of 1982–2009. This study is a productivity review on the literature gleaned from SSCI database. The research indicated that the number of literature productions on TRA is still growing. The main research development country is the United States, and from the analysis of the distribution of language, English is the most popular language for TRA literature. The research results show that a relatively large percentage of authors (86.76%) contributed one article, which is a much higher percentage than the 60% found in Lotka's original data. According to the K-S test, the distribution of frequency indexes of author productivity match Lotka's law.

**Keywords:** Theory of Reasoned Action, Lotka's Law, Bibliometrics

## 1. Introduction

In the psychological field, explaining human behavior is always a complicated and important issue (Ajzen, 1985). Ajzen & Fishbin (1980) roposed attitudes, social norms, intentions, and causality of behaviors in the 1970s. After several improvements, revisions, and verifications, the authors adapted the Behavioral Intention Model, which in 1980 was expanded to the Theory of Reasoned Action (TRA). This theory studies how attitudes determine volitional behavior. Much empirical research adopts Ajzen and Fishbein's TRA and applies it to a variety of fields, such as bone marrow donation, dieting, medicines usage, occupational tendency, family planning, learning motivation, and even consumer behavior. The theory is also widely applied to fields such as psychology, education, marketing, management, medical treatment, and technology. Discussion scopes of TRA tend to diversify, and theory application definitely deserves. Because the TRA theory has been applied extensively to the above-mentioned fields, two other theories have been derived from it: the Theory of Planned Behavior (TPB) and the Technology Acceptance Model (TAM). Therefore, the purpose of this research is to analyze the literature of TRA theory by using bibliometrics, carrying on the research in TRA theory. Through analyzing the characteristics of the literature, we intend to achieve the following goals:

- Investigate the distribution of country, language, literature growth, and author productivity, as concrete indicators for objectively understanding TRA theory literature development.
- Use Lotka's law to verify and examine the distributions of authors' productivity and to observe the growth patterns of TRA literature. The Kolmogorov-Smirnov (K-S) is used to test the applicability of Lotka's law.

## 2. Literature Review

### 2.1. Theory of Reasoned Action

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The proposition of TRA is that when behavior is conscious and voluntary, the behavior intention will be affected by attitudes and subjective norms. In other words, people will consider the consequences of their behavior before they engage in it and will determine whether to do it or not. In personal behavior, the most direct influence on human behavior is the behavioral intention. Attitude and the subjective norm (SN) are the main factors in determining behavioral intention. The more an individual exhibits positive behavior, the more the individual has a positive behavioral intention vice versa.

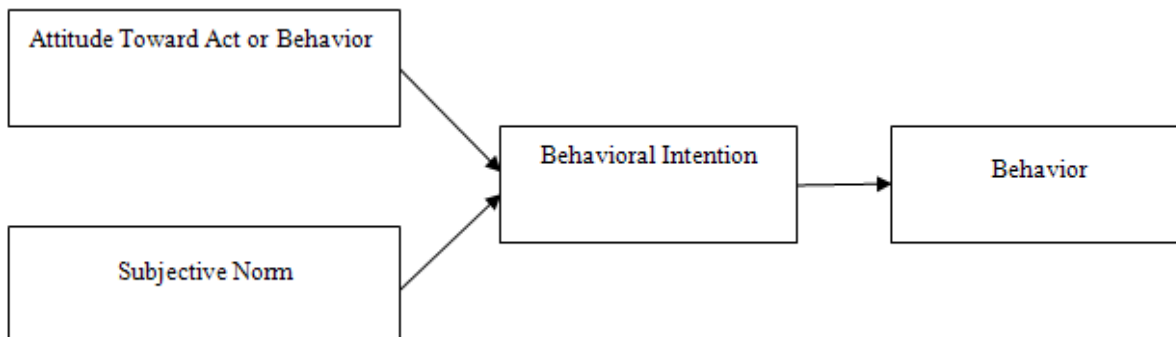


Fig. 1: Theory of Reasoned Action model. Source: (Fishbein & Ajzen, 1975)

## 2.2. Lotka's Law

Lotka's law is one of the three major laws of bibliometrics that mainly explain the literature distribution of various authors' productivity in a given field (Lotka, 1926). It finds that most articles are being contributed by a few researchers, with a large proportion of researchers contributing just one publication. Therefore, Lotka summarizes the logarithmic relation between researchers and publication quantities. It states that "... the number (of authors) making  $n$  contributions is about  $1/n^2$  of those making one publication; and the proportion of all contributors, that make a single contribution, is about 60 percent" (Lotka, 1926), as cited in Potter (1988). The general formula is  $XY = C$ , where  $X$  is the number of publications,  $Y$  the relative frequency of authors with  $X$  publications, and  $n$  and  $C$  are constants, depending on the specific field. In brief, the author who publishes two articles accounts, on average, for  $1/4$  of the total number of publications. The authors who publish three articles account for about  $1/9$  of the total number of publications, and so on. Therefore, authors who publish one article account for 60% of all the publications. That is to say, authors who publish  $n$  publications will be  $1/n^2$  of the proportion of total publications. This formula is also called the Inverse Square Law (Tsay, 2003).

## 3. Distribution of author productivity of TRA

This research uses the Social Science Citation Index (SSCI) database, which includes natural science projects and biomedicine. The above database is from the Institute for Scientific Information (ISI). This research probes into the development of research publications related to TRA from the perspective of bibliometrics.

The publications of the top three countries are the United States, which is champion with 311 record counts (59.81%), followed by England and Australia, which achieved record counts of 50 (9.62%) and 35 (6.73%). The most popular language for writing about TRA is English (508 record counts, 97.69%), followed by German (5 record counts, 0.96%). In addition to English and German, the record counts rates of other languages are less than 2.0%. English was the most popular language for TRA literature from 1982 to 2009.

We collected 520 records in this study and showed the results by years. The number of records from 1990 (10 records) is 3.3 times that from 1989 (3 records), and the 1992's records (22 records) are 3 times the number from 1991 (7 records), while the 1995 (37 records) number of records is 2.5 times that of 1994 (15 records). Comparing the number of 1997 records (20 records) to 1987's records (3 records), we see that the 1997 records are 6.67 times the number from 1987. The 35 records from 2007 are 1.8 times those found in 1997 (20 records). In general, from the middle of the 1990s, the amount of TRA literature has been growing each year.

There are 520 records and 1,224 authors in this study, with each author publishing an average of 0.4248 papers; the detailed distribution of authors is shown in Table1. Among the 1,224 authors, 7 published more than 5 articles, with the greatest count being 11. The second greatest number is 10 and the third 9. Only 33 authors have more than 3 records. As a whole, authors publishing fewer than 4 papers amount to more than 99.10% (1,213/1,224). 1,191 (1,224-33) authors have fewer than 3 record counts of publishing, the proportion being 97.30% (1,191/1,224). There are 129 authors publishing 2 papers, 10.54%(129/1,224). In total, 1,062 authors published only 1 paper, the proportion being 86.76% (1,062/1,224). In other words, most TRA papers were published by authors of low productivity, and relatively few authors exhibit high productivity.

Table1: TRA literature by author productivity

Record count	Author count	Author %	Sum of authors' papers	Sum of authors' papers by %	Cumulative records %
1	1,062	86.76%	1062	72.84%	59.19%
2	129	10.54%	258	17.70%	76.81%
3	22	1.80%	66	4.53%	83.23%
4	4	0.33%	16	1.10%	86.18%
5	2	0.16%	10	0.69%	88.46%
8	2	0.16%	16	1.10%	89.30%
9	1	0.08%	9	0.62%	89.79%
10	1	0.08%	10	0.69%	90.35%
11	1	0.08%	11	0.75%	91.30%
Total	1,224	100.00%	1,458	100.00%	

#### 4. Literature Productivity Analysis

To calculate the values of the constant n and c of Lotka's Law, we adopt the least-squares difference method in this study. First of all, we calculate the log values of paper counts and author counts, respectively, as shown in Table2.

Table2: Analysis of author distribution via productivity for TRA literature

Record Count (x)	Author(y)	X=logx	X^2	Y=logy	XY	XX	Record Count (x)	Author(y)	X=logx	X^2	Y=logy	XY	XX
1	1062	0.00	0.00	3.03	0.00	0.00	8	2	0.90	0.82	0.30	0.27	0.82
2	129	0.30	0.09	2.11	0.64	0.09	9	1	0.95	0.91	0.00	0.00	0.91
3	22	0.48	0.23	1.34	0.64	0.23	10	1	1.00	1.00	0.00	0.00	1.00
4	4	0.60	0.36	0.60	0.36	0.36	11	1	1.04	1.08	0.00	0.00	1.08
5	2	0.70	0.49	0.30	0.21	0.49	Total	1,224	5.98	4.98	7.68	2.12	4.98

Secondly, we substitute the following equation with the values in Table2 to obtain the slope n.

$$n = \frac{N \sum XY - \sum X \sum Y}{N \sum X^2 - (\sum X)^2} \quad (N: \text{Observed value})$$

$$n = \frac{9(2.12) - (5.98)(7.68)}{9(4.98) - (5.98)^2} = -2.955$$

We substitute the following equation with the n value to obtain the value c.

$$c = \frac{1}{\sum_{x=1}^{p-1} \frac{1}{x^2} + \frac{1}{(n-1)(p^{n-1})} + \frac{1}{2p^n} + \frac{n}{24(p-1)^{n+1}}}, p=9, x=1,2,\dots,8$$

$$c \cong \frac{1}{\sum_{x=1}^{9-1} \frac{1}{x^2} + \frac{1}{(2.955-1)(9^{2.955-1})} + \frac{1}{2(9)^{2.955}} + \frac{2.955}{24(9-1)^{2.955+1}}}, x=1,2,\dots,8$$

$$= 0.8256$$

According to Lotka's law, the number of authors that published one work is the number of authors publishing one work total, divided by a2. By performing Lotka's law, the slope n value should also be calculated, along with the constant c value, by using the K-S examination to determine whether the distribution is suitable for Lotka's law or not (Tsay, 2003). When we got n=-2.955, c=0.8256, it calculated f(x)=0.8256/x2.955. Tsay (2003) suggested that the absolute value of n should be between 1.2 and 3.8, which was formulated by the generalized Lotka's law, and this outcome is also matched by observation of the reference data. The absolute value of n (2,955) that we calculated is between 1.2 and 3.8. The distribution chart is shown in Fig. 2. Since primitive n is approximately -2, c is 0.6079 as generated by Lotka's law, it is demonstrated that the author's distribution of TRA literature and the primitive Lotka's law are match appropriately. In order to examine the theoretical value and the observation value, we look at the n and c value derived by the formula. We calculate the expected value and the cumulative value of authors, which are followed by the K-S test.

According to the K-S test, Table3 demonstrated  $D_{max}=0.042$ . Because the threshold value  $(1.63 / \sqrt{1224} \cong 0.0466)$  is larger than  $D_{max}$ , the result is that the distribution of author productivity and Lotka's law are matched, which means Lotka's law is suitable for the author productivity distribution in TRA literature.

Table3: The distribution of the percentage of authors

Record count	Observation by author	Accumulated Value (Sn)	Excepted value by author	Accumulated Value (F0)	ABS Value  Sn -F0
1	86.76%	0.8676	0.8256	0.8256	0.0420
2	10.54%	0.9730	0.1065	0.9321	0.0409
3	1.80%	0.9910	0.0321	0.9642	0.0268
4	0.33%	0.9943	0.0137	0.9780	0.0163
5	0.16%	0.9959	0.0071	0.9851	0.0109
8	0.16%	0.9975	0.0018	0.9868	0.0107
9	0.08%	0.9984	0.0013	0.9881	0.0103
10	0.08%	0.9992	0.0009	0.9890	0.0102
11	0.08%	1.0000	0.0007	0.9897	0.0103

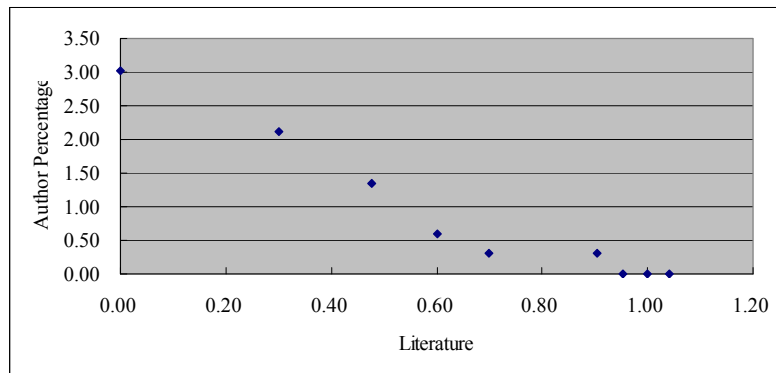


Fig. 2: The distribution of author productivity for TRA literature

## 5. Conclusion

TRA is one of the fastest growing theories in recent years, and this historical review and trend forecast for this research field by each kind of literature characteristic and author productivity distribution is still growing. According to our findings, the current TRA literature continues to grow, with the main research development countries being the United States, England, Canada, and Australia. According to the analysis of the distribution of language, English is the most popular language for TRA literature.

Moreover, by applying bibliometric techniques - Lotka's Law, this study investigated literature growth and author productivity from 1982 to 2009, based on the topic search of the keyword "Theory of Reasoned Action" in SSCI database. The research results are that a relatively high number of authors (86.76%) contributed one article, which is a much higher percentage than the 60% found in Lotka's original data. According to the K-S test, this distribution of author productivity matches with Lotka's law.

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