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Growth of Psychology and Clinical Psychology Literature: A Comparative Analysis of India, World and European Countries

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Abstract: The present study compares the literature in the disciplines of psychology and clinical psychology from India, the World, and European countries between 1989 and 2023, looking at the expansion of these fields as per the data of the Web of Science. To examine the growth and trend of the literature, various growth models were applied to the dataset from the defined countries and the data was analyzed using MS Excel. Overall an increasing trend of production is seen from all three of them, the maximum papers have been produced during the block 2019-2023 and the minimum during 1989-1993. An increasing trend in Relative Growth Rate is seen among which the world's mean RGR is the highest in both fields i.e., 0.990 and 0.964 in psychology and clinical psychology respectively. The psychology & clinical psychology literature from all defined countries shows a decreasing trend of Dt values over the period. The curve fitting statistics show that except for the literature from European nations which best fit the linear growth model, the others i.e., the world and India show that the exponential growth model fits best to the Psychology literature. On the other hand, clinical psychology literature from the World as well as European nations and India shows that it best fits the exponential growth statistics. The chi-square test statistics show that the European countries' clinical psychology literature follows the logarithmic model and the Indian Psychology literature follows the Linear growth Model as the calculated chi-square values are -95782.4 and -913.53 respectively, which are less than the theoretical chi-

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square values. Except these two none of the datasets follows any of the growth models when tested through chi-square analysis.

Keywords: Psychology; Clinical Psychology; European Countries; Growth Models; Relative Growth Rate; Doubling Time**.**

Introduction: Growth of Literature in a particular domain refers to the change in the size of literature during a given period which further can be used to quantify or define knowledge advancement in a subject. Psychology is a broad academic area that studies the mind and behavior, conscious and unconscious events, and mental processes including emotions, motives, and thoughts. Clinical psychology is a subdiscipline of psychology that is concerned with the application of theory, behavioral and human science, and clinical expertise to study, psychologically based dysfunction and distress, as well as the enhancement of individual growth and subjective well-being.

Psychology, as a discipline, is currently expanding rapidly, and the application of psychological principles is not limited to its scope; rather, other disciplines are benefiting from psychology's theories and principles in achieving day-to-day individual and organizational goals. Psychology has evolved as an autonomous science in recent years. Despite its historical origins, it has seen significant growth and development[1]. Before the emergence of modern psychology in the West, India, like many other developing nations, had its own unique religious and philosophical frameworks that provided substantial viewpoints on human characteristics, behaviors, personality, and links to the world. Despite their great psychological expertise, they relied heavily on seers' intuitions and speculation writings.

Before independence, British universities had a tremendous influence on Indian psychological research and most of the Indian psychologists possessed their training overseas and adhered to Western psychological principles[2]. Even though Wundt's Leipzig laboratory is credited with founding psychology as a field in Europe in 1879, clinical psychology took off in that continent in the 1940s and 1950s when it was rebuilding its health and welfare systems following World War II. The diversity of the European nations, each with

unique social, intellectual, and cultural traditions and histories, is what makes the continent so unique. These differences have influenced the advancement of clinical psychology as a profession[3].

According to specialists, among the most striking elements of present-day research is the enormous increase in scientific discoveries and information which has produced an unprecedented amount of data, and caused major concern among specialists in numerous disciplines, as well as academics and research scientists. As a result, it is necessary to analyze the development of literature on a certain topic. Applying growth models and curve fitting to data from rapidly rising literature and establishing the best fit to reflect the expansion of literature is an important aspect of growth research. The quantity of research in psychology and clinical psychology has grown throughout time, much like that of other scientific disciplines. An examination of publication growth rates may provide important insights into the published literature or research papers, which are used as a gauge for assessing knowledge in a certain field. Thus, a variety of growth models and scientific growth indicators have been applied to analyze the pattern of growth in the psychology and clinical psychology domains. Furthermore, no previous growth analysis research has been done in this subject before, which makes the current study necessary.

Literature Review: Numerous scholars have examined how to apply growth models to literature growth in certain academic areas. El-Shorbagy and El-Refaey[4] studied the impact of preventative measures on mathematical development and the COVID-19 epidemic's propagation using growth models and found that in China, imposing a complete curfew caused the epidemic's spread to shift from an exponential to a logarithmic model while in the Kingdom of Saudi Arabia and the USA COVID-19 expanded significantly without stringent preventative measures, during the early phase. However, adopting reasonable preventive measures had slowed down the epidemic's exponential development rate, in the Kingdom of Saudi Arabia while failing to do so in the

USA. Jozi and Nourmohammadi[5] analysed pathology and forensic medicine literature and found a lack of academic-industry collaboration in pathology and forensic medicine and a positive exponential relationship was observed between the average increase in patents based on publications, the number of articles cited in patents, patent citations, and the typical number of patents issued to an organization in its publications and the article and citation data well-suited for the polynomial, linear and exponential growth models. Singh and Verma[6] used Egghe and Rao's growth rate functions in the field of food science and technology in India and found the growth of the food science and technology literature was feasible in terms of both publications and citations. Elangovan[7] applied the goodness-of-fit test using linear and non-linear growth models to medical literature produced by the faculty of AIIMS and tested the growth using the curve-fitting approach. The exponential growth model best matched the literature. Neelamma and Anandhalli[8] applied growth models to crystallography literature and found that the relative growth rate of publications was falling, while the doubling time was increasing. The literature did not match the exponential or logistic growth models; however, it closely matched the polynomial, power, and linear models, and a steady pattern of growth was observed. Nayak and Bankapur[9] applied growth models to agricultural literature and compared the growth and dynamics of the top 10 countries and found that the literature followed the linear and exponential growth models and there has been a constant tendency toward higher expansion of agricultural literature. Hadagali and Anandhalli[10] analyzed the evolution of neurology literature using growth models, along with relative growth rate and doubling time and found that the literature did not match either of the linear or logistic growth models. However, it closely resembled the exponential growth model as a steady growth was observed over the years. Sangam, Madalli, and Arali[11] studied the growth pattern of the Indian and global genetics literature and concluded that the world's genetics literature followed the logarithmic as well as the linear growth models and the exponential and logistic models fitted well for India. Sharma, Gupta, and Kumar[12] used growth models to examine global literature in physics,

chemistry, and electrical and electronic engineering and found that the outcomes of the analysis were not entirely consistent with the conclusions predicted by Egghe and Rao's technique.

Methodology and Scope: The data for the study were collected using the Web of Science database. The web of science categories named 'Psychology' and 'Clinical Psychology' were used to get the search results. Filters were applied to refine and limit our search to different countries and years, i.e., the world data, India, and European Nations from the year **1989-2023** which were further divided into seven blocks of five years each. To get the European nations' data total 44 nations data was filtered out which included the countries named Russia, United Kingdom, Germany, France, Italy, Spain, Poland, Ukraine, Romania, Netherlands, Belgium, Sweden, Czech Republic, Greece, Portugal, Hungary, Belarus, Austria, Switzerland, Serbia, Bulgaria, Denmark, Slovakia, Finland, Norway, Ireland, Croatia, Moldova, Bosnia and Herzegovina, Albania, Lithuania, Slovenia, North Macedonia, Latvia, Estonia, Luxembourg, Montenegro, Malta, Iceland, Andorra, Liechtenstein, Monaco, San Marino, and Holy See. The world produced a total of **1472878** publications in psychology and **276720** in clinical psychology. India produced **6039** publications in psychology and **1018** publications in clinical psychology. European nations produced **484621** and **81008** publications respectively in psychology and clinical psychology. The objective of the current study is to analyze the growth pattern and to apply growth models on the literature of psychology and clinical psychology and compare the publications produced from the above-defined nations. The data was analyzed using\ MS Excel software.

Objectives: The main objectives of this study are as follows:

1. To chronologically examine the literature of Psychology and clinical psychology produced by the world, European Nations, and India through the Web of Science database.

2. To observe the growth pattern and find RGR (relative growth rate), and DT (doubling time) of the literature and compare them.
3. To apply various growth models like Linear, Exponential, Logarithmic, and Power models to the literature of psychology and clinical psychology from the world, European nations, and India using curve fit analysis and chi-square test.

Data Analysis

1. **Chronological Distribution of Literature**

Table 1.1: Block-wise Distribution of Psychology Literature

Sr. No.	Year	World	European countries	India
1	1989-1993	122077	21839	323
2	1994-1998	147169	37641	294
3	1999-2003	158027	45810	295
4	2004-2008	191228	63458	545
5	2009-2013	233918	85781	767
6	2014-2018	277177	103753	1281
7	2019-2023	343282	126339	2534
	Total	**1472878**	**484621**	**6039**
	%	**100**	**32.90%**	**0.41%**

Table 1.1 depicts the block-wise distribution of Psychology publications produced by the world, European nations, and India over the period from 1989 to 2023, through seven different blocks of five years each. It can be seen that the world produced a total of 1472878 publications during this period. The European nations produce 32.90% of the total world's share i.e., 484621 papers and India produced only 0.41% of the total publications i.e., 6039. Overall an increasing trend of production is seen from all three of them i.e., the world, European nations, and India, in the field of psychology. Maximum papers have been produced during the block 2019-2023 and the minimum no. of papers have been produced during the block 1989-1993. A number of variables are probably responsible for the growing trend of psychological publications across the globe, particularly in Europe and India. These include greater funding for psychological study, expanded research capacity worldwide, the growing significance of mental health, and the growing appreciation of psychology as a useful discipline. In conclusion, a complex interaction of factors, such as the growth of research capacity, the increasing significance of mental health, the acceptance of psychology as a valuable discipline, and particular trends in various regions, has led to the increasing trend of psychology publications worldwide.

Table 1.2: Block-wise Distribution of Clinical Psychology Literature

Sr. No	Year	World	European Countries	India
1	1989-1993	20790	3148	22
2	1994-1998	25967	5045	21
3	1999-2003	30611	7223	58
4	2004-2008	35098	9815	77
5	2009-2013	46131	15474	138
6	2014-2018	51477	17682	252
7	2019-2023	66646	22621	450
	Total	**276720**	**81008**	**1018**
	%	**100**	**29.27%**	**0.36%**

Table 1.2 depicts the block-wise distribution of Clinical Psychology publications produced by the world, European nations, and India over the period from 1989 to 2023, through seven different blocks of five years each. It can be seen that the world produced a total of 276720 publications during this period. The European nations produce 29.27% of the total world's share i.e., 81008 papers and India produced only 0.36% of the total publications i.e., 1018. Overall an increasing trend of production is seen in the field of clinical psychology. Maximum papers have been produced during the block 2019-2023 and the minimum no. of papers have been produced during the block 1989-1993. There are a number of reasons for the rising trend in clinical psychology publications worldwide, in Europe, and in India, such as the development of professional associations and journals in the field, greater funding for research, and a growing awareness of the need for mental health support. The field was significantly advanced in India with the founding of the Indian Journal of Clinical Psychology in 1974 and the IACP in 1968. Numerous international co-publications are produced by the European Union, demonstrating a significant emphasis on cooperation and information exchange. Publications on mental health and wellbeing research have steadily increased, especially among college students, indicating a growing interest in the topic.

2. **Relative Growth Rate of Publications (RGR):** RGR stands for relative growth rate, which is the increase in the number of papers per unit of time. The growth rate of all articles was determined using Mahapatra's 1985 RGR and Dt model (Mahapatra, 1985). The formula for RGR is:

$$\mathbf{RGR} = \frac{W2-W1}{T2-T1}$$

where, (RGR - rate of growth throughout the span;

W1 = natural log (Log_e) of the initial number of publications;

W2 = natural log (Log_e) of the final number of publications;

T1 = initial time unit;

T2 = final time unit;) (Shilpa and Padmamma, 2020)[13].

Table 2: Relative Growth Rate of Publications

Year	World psychology	World clinical psychology	European Psychology	European clinical psychology	Indian Psychology	Indian Clinical Psychology
1989-1993	0.000	0.000	0.000	0.000	0.000	0.000
1994-1998	0.604	0.588	0.458	0.485	0.741	0.717
1999-2003	0.995	0.927	0.832	0.758	1.129	0.555
2004-2008	1.174	1.165	0.978	0.944	0.983	0.838
2009-2013	1.293	1.235	1.088	0.967	1.065	0.828
2014-2018	1.405	1.406	1.239	1.195	1.007	0.813
2019-2023	1.456	1.424	1.344	1.276	0.868	0.816
Mean RGR	**0.990**	**0.964**	**0.848**	**0.804**	**0.828**	**0.652**

The above table 2 depicts the relative growth rate of publications over the period. The data for the world's psychology literature shows an increasing trend in Relative growth rate from 0.604 during 1994-1998 to 1.456 during 2019-2023 with a mean RGR value of 0.990. The RGR for European nations in the field of psychology also depicts an increasing trend from 0.458 to 1.344 with a mean

RGR equal to 0.848, while Indian psychological literature shows an increasing trend till 2018, i.e., 0.741 to 1.007 and then decrease to 0.868 during the block 2019-2023. On the other hand, the clinical psychology literature of the world shows an increasing RGR from 0.588 to 1.424 with a mean RGR value equal to 0.964, and European nations also show an increasing trend from 0.485 to 1.276 with a mean RGR value of 0.804. While clinical psychology literature of India possesses a fluctuating trend over the period i.e., it first decreases from 0.717 to 0.555, which then increases to 0.838 and then decreases to 0.813 which further increases to 0.816 during the last block period with a mean RGR value of 0.652. It also shows an overall increasing trend in RGR. A wider trend of higher research production, improved knowledge of the discipline, and technological and methodological breakthroughs is reflected through the increasing relative growth rate of psychology literature in the Web of Science database. Together, these elements support a higher volume of published research in the database. There are a number of reasons why the relative growth rate of Indian psychology and clinical psychology literature in Web of Science fluctuates, including shifts in funding priorities, research focus, and the growing relevance of mental health in India. Research indicates that, especially since 2007, there has been an increase in the number of publications about technology-based interventions in these areas.

3. **Doubling Time of the Literature (Dt):** The doubling time, which is inversely related to the Relative Growth Rate (RGR), is the length of time required for a variable to double in size or amount, or the period when the number of articles in a particular category doubles. The amount increases exponentially, and the rate of growth allows for an instantaneous determination of the constant doubling time. Thus, the Doubling time may be calculated as follows:

   Dt = 0.693 / R

Where, (Dt - Doubling time; R- Relative Growth Rate of the publications.)

Table 3: Doubling Time of Literature (Dt)

Year	World psychology	World clinical psychology	European Psychology	European clinical psychology	Indian Psychology	Indian Clinical Psychology
1989-1993						
1994-1998	1.147	1.178	1.515	1.429	0.935	0.967
1999-2003	0.697	0.747	0.833	0.914	0.614	1.249
2004-2008	0.590	0.595	0.709	0.734	0.705	0.827
2009-2013	0.536	0.561	0.637	0.717	0.651	0.836
2014-2018	0.493	0.493	0.559	0.580	0.688	0.853
2019-2023	0.476	0.487	0.515	0.543	0.798	0.849
Mean Dt	**0.563**	**0.580**	**0.681**	**0.702**	**0.627**	**0.797**

Table 3 depicts the doubling time for the publications of psychology and clinical psychology produced by the World, European nations, and India from 1939 to 2023. The doubling time is inversely proportional to the relative growth rate of the publications which is depicted in the above table as the doubling time for the psychology literature of World and European countries shows a decreasing trend of Dt values with a mean doubling time equal to 0.563 and 0.681 respectively, while the doubling time of psychology literature for India fluctuate in between but have an overall decreasing trend of Dt values from 0.935 to 0.798, with a mean Dt value equal to 0.627. It first decreased from 0.935 to 0.614 from 1994-1998 to 1999-2003 then increased to 0.705 during 2004-2008 which further decreased to 0.651 in 2009-2013 and kept increasing to 0.798 during the block period 2019-2023.

On the other hand, the Dt values for the world's clinical psychology literature show a decreasing trend, from 1.178 to 0.487 with a mean Dt value equal to 0.580, European literature shows a decreasing trend from 1.429 to 0.543 with a mean Dt value of 0.702 and India shows a fluctuating trend in-between but an overall decreasing trend of values from 0.967 to 0.849 with a mean Dt equal to

0.797. The mean Doubling time of publications in the field of clinical psychology is more for India, followed by the European nations and the world having the least value of Dt. More is the value of Dt for a specific region, more is the time that it will take to double its production in a particular area. While in the field of psychology, the European nations have the greatest value, followed by India and the world. The doubling time of publications in clinical psychology is probably higher in India than in other regions because of a number of factors, including a relatively recent growth in the field as indicated by research on publication trends, a lower overall productivity of research, and possibly a higher proportion of publications that focus on local contexts. Nations with more developed research ecosystems, funding, infrastructure, and the availability of qualified researchers are some of the reasons behind this. Since the majority of Indian clinical psychology articles may concentrate on topics unique to the Indian environment, research growth may be slower overall since it may be more difficult to generalize to other areas.

4. Application of Growth Models to the Literature:

i. Linear Growth Model: The linear growth model can be used to mimic shorter periods of growth. In this case, the progression rate is linear, hence the continuous increase per unit of time is shown as follows:

$$\mathbf{y = mx + b}$$

where, m = slope

b = intercept.

ii. Exponential Growth Model: An exponential model fits the dataset where the rate of expansion or growth is proportionate to the increase of publications per unit of time. The following equation, which represents the exponential growth pattern, is used to determine the least squares fit via points:

$$\mathbf{y = ce^{bx}}$$

where, (c & b = constants and e = base of the natural log).

iii. **Power Growth Model:** According to Ravichandra Rao (2010), a functional relation between two quantities varies depending on the magnitude or power of the other. The Power Growth model's equation is utilized to determine the least-squares fit across points: $y = cx^b$

where, (c & b = constants).

iv. **Logarithmic Growth Model:** With c and b being constant numbers and ln standing for the natural log function, the logarithmic growth model's equation is **y = c ln x + b.** (Nayak & Bankapur, 2017, p.102)[9].

4.1 Application of Growth Models using Curve Fit Values:

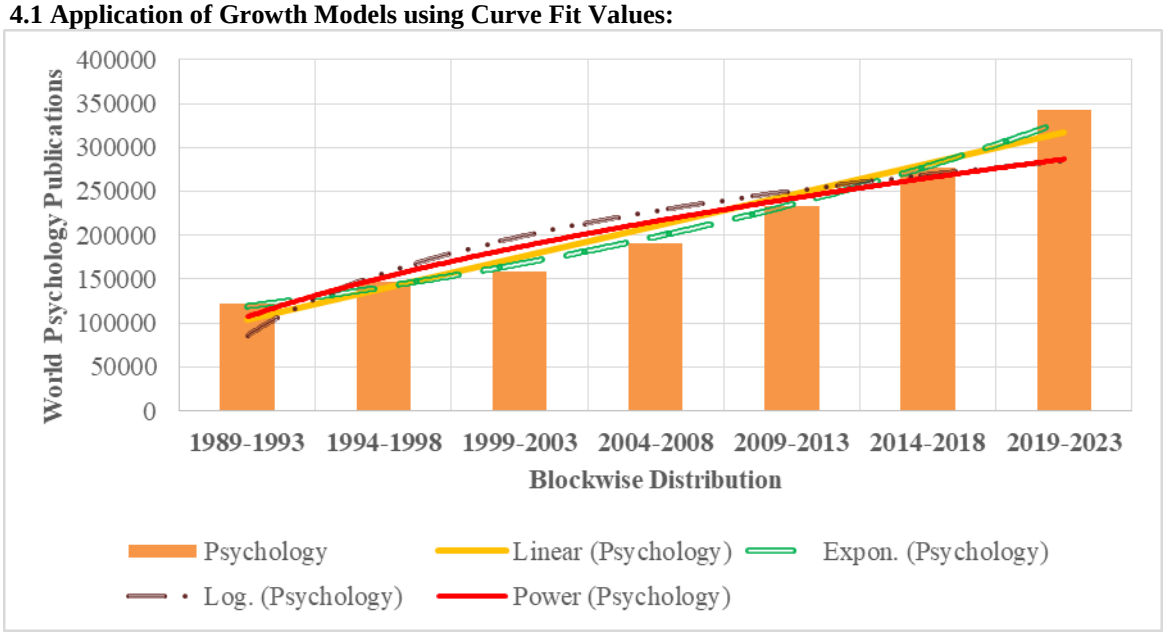

Fig: 4.1.1 World's Psychology Literature Curve Fitting Analysis

Table 4.1.1 World's Psychology Literature Curve Fitting Analysis

Growth Models	Equation	R^2	F values	Fitting analysis
Linear	y = 35697x + 67622	0.9495	0.952375	2

Exponential	$y = 100493e^{0.17x}$	0.9896	0.998259	1 (Best fit)
Logarithmic	$y = 102364\ln(x) + 85744$	0.7846	0.758697	4
Power	$y = 107070x^{0.5063}$	0.8821	0.66193	3

The above table and Figure 4.1.1 represent the curve-fitting analysis of the World's psychology literature as reflected in the Web of Science database. The R^2 is the coefficient of regression, Y is the equation of the growth model, and the F values have been calculated using Excel F Test statistics which represents that the variance between the observed and expected values are not significantly different.

It is very clear from the table and figure that the data best suits the exponential growth model with an R^2 value equal to 0.9896 i.e., (98% variance). Reduced discrepancy between actual and predicted values is indicated by a greater coefficient of regression (R^2) value for the given set of data. Significant discrepancies between the actual and predicted values are noticed when the (R^2) value for any given set of data is lower. In this case, there is less of a discrepancy between the actual and predicted values because of the high coefficient of regression (R^2) value. A quantity's growth over time can be described mathematically using the exponential growth model, in which the rate of growth is proportionate to the initial quantity. This indicates that, in the case of psychological papers, the number of new articles added year is not constant but rather rises in tandem with the overall number of publications.

The exponential growth of world's psychological papers is caused by a number of factors like,

growing financing, which in turn has sparked more studies and publications, advances in research methods, globalization of research, growing number of researchers and research institutes worldwide, as well as the ease of communication and collaboration.

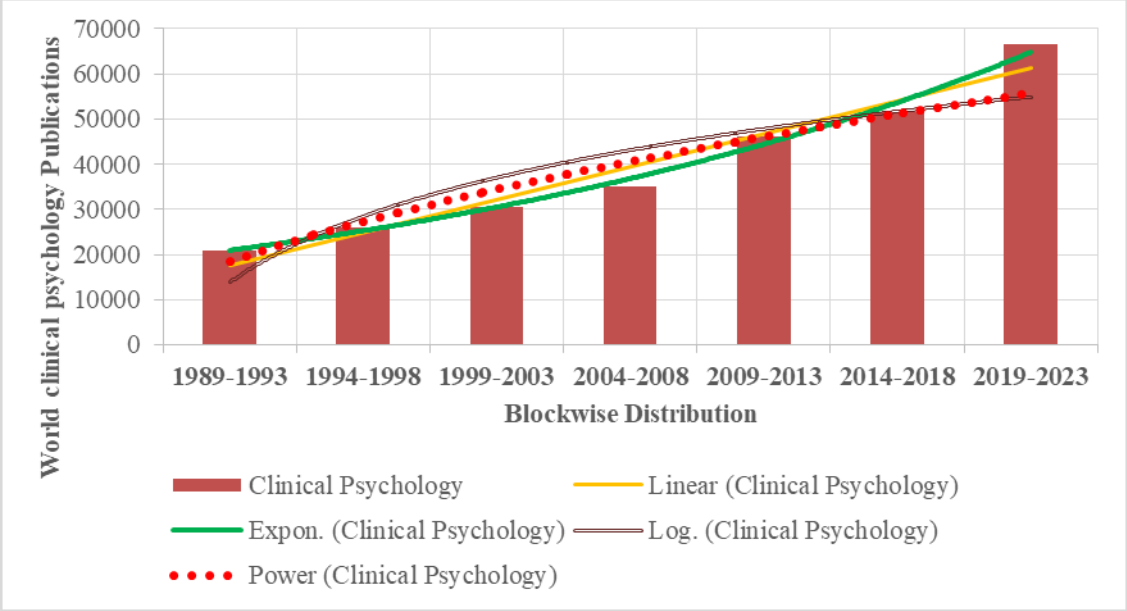

Fig. 4.1.2: World's Clinical Psychology Literature Curve Fitting Analysis

Table 4.1.2: World's Clinical Psychology Literature Curve Fitting Analysis

Growth Models	Equation	R^2	F values	Fitting analysis
Linear	y = 7289.6x + 10373	0.9563	0.852043	2
Exponential	$y = 17336e^{0.1883x}$	0.993	0.928892	1 (Best Fit)
Logarithmic	y = 21124ln(x) + 13805	0.807	0.6841	4
Power	$y = 18376x^{0.5707}$	0.9163	0.848611	3

The above table and Figure 4.1.2 depict the curve-fitting values of the World's clinical psychology literature. It is very clear from the table and figure that the clinical psychology literature too best suits the exponential growth model with an R^2 value equal to 0.993 i.e., (99% variance) with an F value equal to 0.9288.

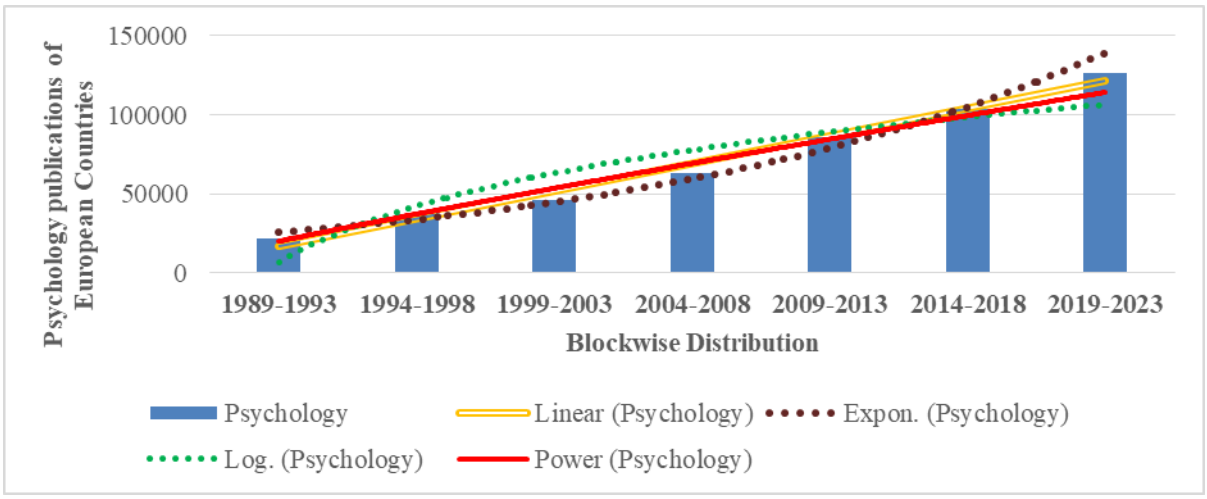

Fig. 4.1.3: European Countries Psychology Data Curve Fitting

Table 4.1.3: European Countries Psychology data curve fitting

Growth Models	Equation	R^2	F value	Fitting analysis
Linear	y = 17346x - 153.43	0.9851	0.969153	1 (Best Fit)
Exponential	$y = 19239e^{0.2829x}$	0.9756	0.789073	3
Logarithmic	y = 51170ln(x) + 6913.2	0.8614	0.822925	4
Power	$y = 20098x^{0.8933}$	0.9776	0.817539	2

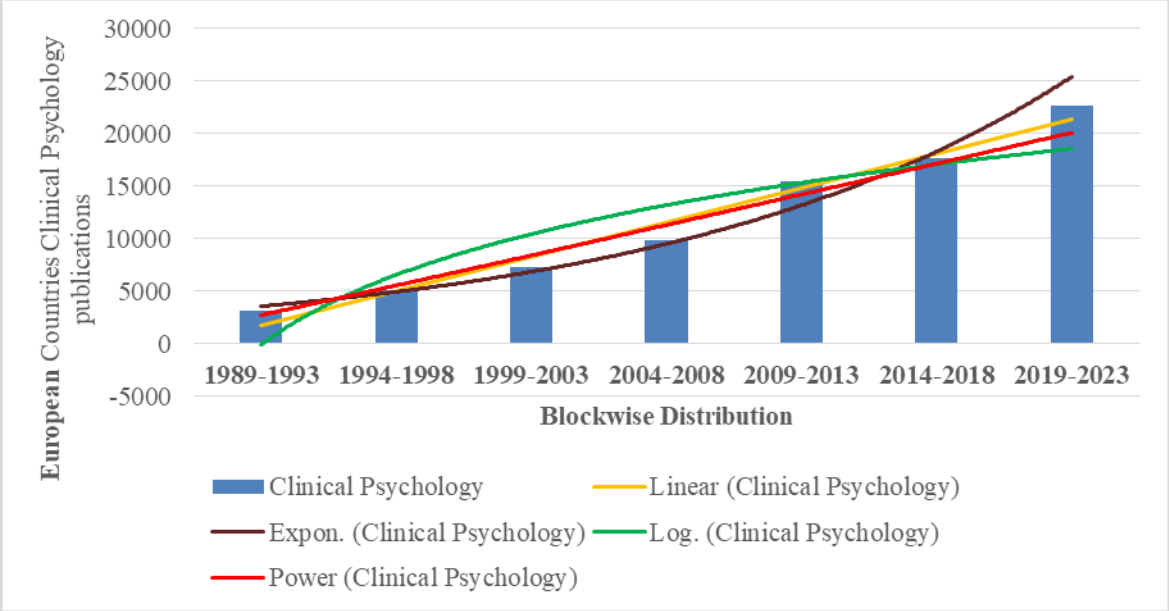

Fig. 4.1.4: European Countries Clinical Psychology Data Curve Fitting

Table 4.1.4: European Countries Clinical Psychology Data Curve Fitting

Growth Models	Equation	R^2	F value	Fitting analysis
Linear	y = 3283.7x - 1562.3	0.9733	0.849623	2
Exponential	$y = 2556.5e^{0.3281x}$	0.9807	0.875419	1 (Best Fit)
Logarithmic	y = 9590.2ln(x) - 107.16	0.8343	0.697652	4
Power	$y = 2713.2x^{1.0287}$	0.9689	0.661676	3

Table and Figure 4.1.3 and 4.1.4 represent the curve-fitting analysis of the psychology and clinical psychology literature of European nations respectively. It can be depicted from the graph and Table 4.1.3 that the psychology literature of European nations follows best the Linear growth model with an R^2 value equal to 0.9851 i.e., (98% variance). A number of elements, such as steady funding, well-established institutions, the general acceptance of psychology, and international cooperation, all contribute to the linear growth pattern in psychology publications in European countries. While the clinical psychology literature follows the exponential growth model best with an R^2 value of 0.9807

i.e., (98% variance), which further indicates that the literature of clinical psychology is increasing exponentially over the period.

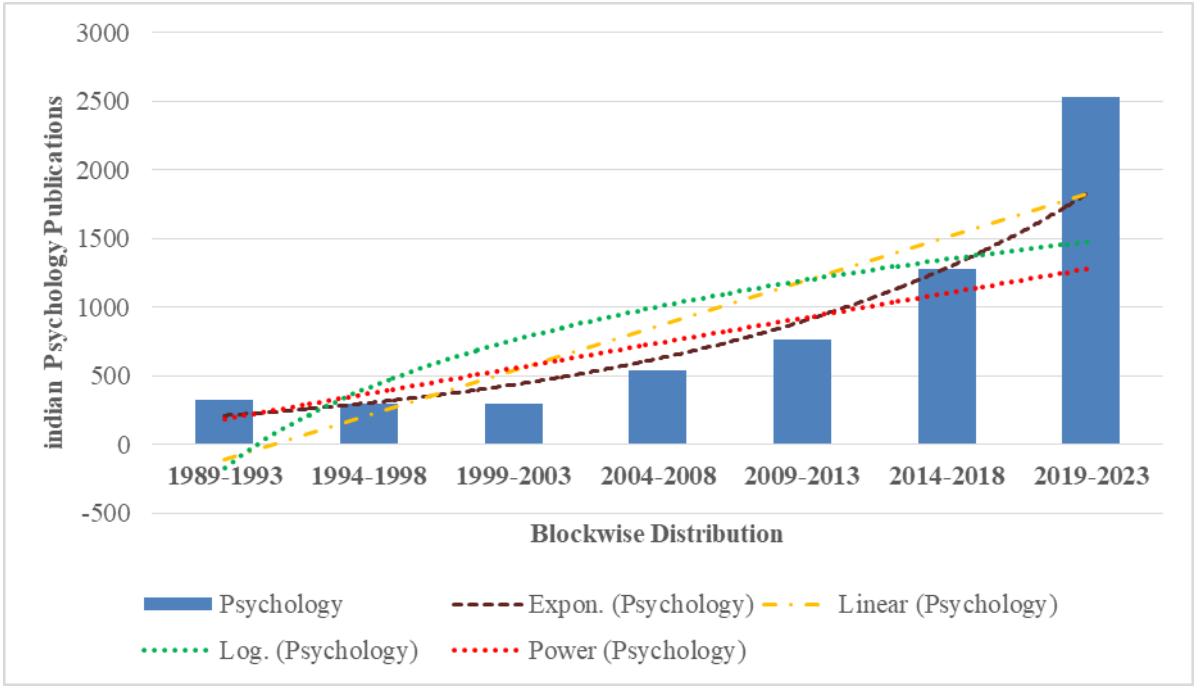

Fig. 4.1.5: Indian Psychology Data Curve Fitting Analysis

Table 4.1.5: Indian Psychology Data Curve Fitting Analysis

Growth Models	Equation	R^2	F values	Fitting analysis
Linear	y = 324.25x - 434.29	0.7332	0.498853	2
Exponential	$y = 148.53e^{0.36x}$	0.8842	0.295554	1 (Best Fit)
Logarithmic	y = 849.1ln(x) - 171.39	0.5052	0.28892	4
Power	$y = 188.41x^{0.987}$	0.668	0.058786	3

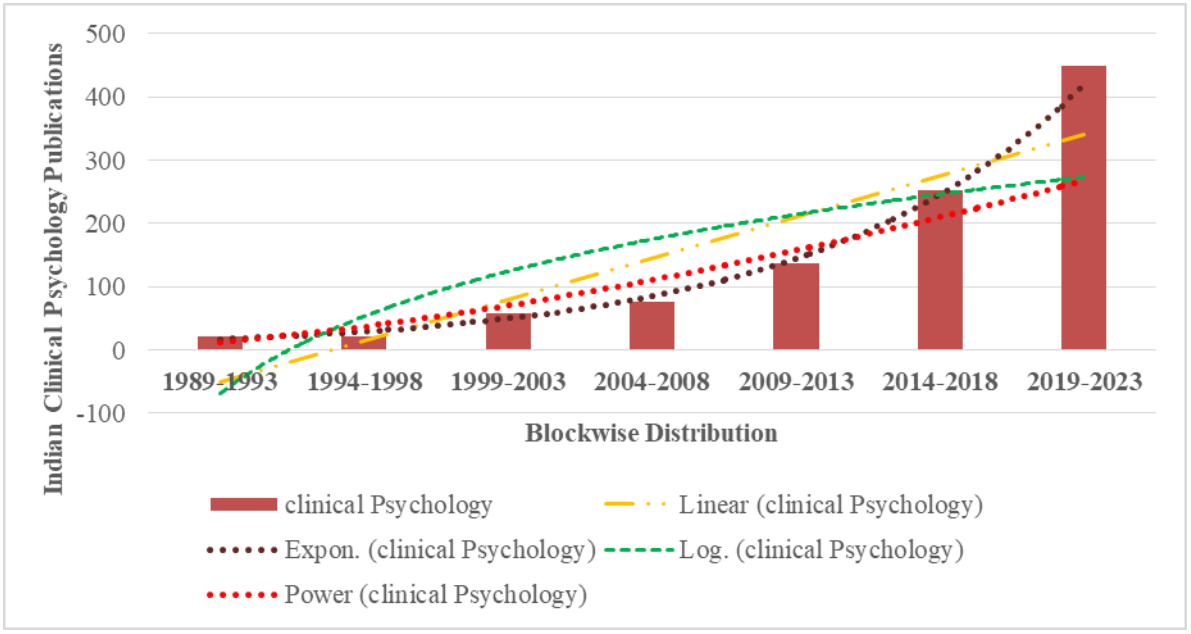

Fig. 4.1.6: Indian Clinical Psychology Data Curve Fitting Analysis

Table 4.1.6: Indian Clinical Psychology Data Curve Fitting Analysis

Growth Model	Equation	R^2	F values	Fitting analysis
Linear	y = 65.214x - 115.43	0.8089	0.519036	3
Exponential	$y = 10.139e^{0.5318x}$	0.974	0.652476	1 (Best Fit)
Logarithmic	y = 175.74ln(x) - 68.601	0.5903	0.337665	4
Power	$y = 12.478x^{1.5763}$	0.8599	0.150529	2

Table and Figure 4.1.5 and 4.1.6 represent the curve fit analysis of Indian psychology and clinical psychology data respectively. It is observed that both the psychology as well the clinical psychology literature best fit the exponential growth model with R^2 values equal to 0.8842 and 0.974 respectively.

Table 4.1.7: Combined Analysis Using Curve Fitting

Growth Model	World Psychology	World clinical psychology	European Countries Psychology	European Countries Clinical Psychol	Indian Psychology	Indian Clinical Psychology

				ogy		
R^2 values						
Linear	0.9495	0.9563	**0.9851**	0.9733	0.7332	0.8089
Exponential	**0.9896**	**0.993**	0.9756	**0.9807**	**0.8842**	**0.974**
Logarithmic	0.7846	0.807	0.8614	0.8343	0.5052	0.5903
Power	0.8821	0.9163	0.9776	0.9689	0.668	0.8599

Table 4.1.7 depicts the combined analysis using curve fitting and represents the R^2 values obtained as a result of testing the curve. It is very important to compare the literature statistics between the countries under study which is visible in the above table. Except for the psychology literature produced from European nations which shows the linear growth model best fit to the literature, the others including the world and India show that the exponential growth model fits best to the Psychology literature over the period from 1989 to 2023 as depicted in the Web of Science database. This is perhaps because psychology as a discipline has developed and established differently in different places. Europe may have a better developed research culture and infrastructure due to its longer history of structured psychological research, which could result in a more steady, linear development in output. On the other hand, psychology may be developing quickly in other parts of the world, such as India, which would result in a higher exponential rise in the amount of literature produced.

On the other hand, clinical psychology literature from the World as well as European nations and India shows that the literature best fits the exponential growth statistics.

4.2 Application of Growth Models Using Chi-square Test

Various growth models have been applied to the literature of psychology and clinical psychology of the stated countries under study using the chi-square test. The theoretical chi-square value at the degree of freedom (df) 6 has been noted as 12.592 at a level of significance of 0.05.

Degree of Freedom (df) = 6

Level of Significance = 0.05

Critical value = 12.592

Table 4.2 Calculated Values from the Application of Growth Models Using Chi-Square Test

Growth Model	World Psychology	World clinical psychology	European Countries Psychology	European Countries Clinical Psychology	Indian Psychology	Indian Clinical Psychology
Calculated Chi-square values						
Linear	10586.27	2917.635	3785.782	2152.732	**-913.53**	29.63175
Exponential	4107.749	2223.938	7953.392	2334.097	585.5299	41.86396
Logarithmic	39199.62	8991.119	42689.16	**-95782.4**	188.4621	180.6222
Power	17479.97	199521.2	3236.759	1581.879	1934.684	226.8344
				Follows Logarithmic Growth Model	**Follows Linear Growth Model**	

The above table 4.2 depicts the application of the chi-square goodness of fit test to the datasets of psychology and clinical psychology literature of the World, European nations, and India using various growth models. The chi-square test was performed using MS Excel. The calculated chi-square values are shown in the above table and compared to the theoretical chi-square value i.e., 12.592 at degree of freedom equal to 6 and level of significance 0.05. It is observed that the European countries' clinical psychology literature follows the logarithmic

model as the calculated chi-square value is -95782.4, which is found to be less than the theoretical chi-square value. Also, the Indian Psychology literature follows the Linear growth Model as the calculated value i.e., -913.53 is much smaller than the theoretical chi-square value. Except these two none of the datasets follows any of the growth models when tested through chi-square analysis.

Discussion: Europe has a rich and well-established history in psychology, with a large number of academic programs, research facilities, and funding possibilities. A linear trend in research output is made possible by this well-established infrastructure, which makes growth more predictable and consistent.On the other hand, with new research institutes, more financing, and a wider range of research topics being investigated, psychology may be expanding quickly both globally and in India. The amount of literature increases more exponentially as a result of this quick development.

European research objectives might be more narrowly concentrated, which would result in a constant flow of papers in particular areas of psychology. With academics examining a wide range of psychological disorders and demographics, a wider choice of research subjects may emerge in India and around the world. The output of literature may rise more exponentially as a result of this scope of study and more funding.

There may be a more established pattern of research output since European researchers have been more active in international collaboration for a longer length of time. As researchers collaborate on projects and exchange ideas, the world and India may be witnessing a recent upsurge in international collaboration, which is causing the output of literature to grow more quickly.

The findings through chi-square analysis that clinical psychology literature in Europe grows logarithmically, whereas the psychology literature of India grows linearly is probably due to variations in research methods, data gathering, and the particular areas of focus of each region's studies. These clear patterns are revealed by comparing observed and expected data using chi-square analysis.

Limitations:

1. This study analyzed the data using only one scientific database i.e., Web of Science.
2. The study period is limited to 1989 – 2023.
3. The study analyzed only the data pertaining to psychology and clinical psychology of the world and compared it to the specified nations like European nations and India.

   Similar studies including other nations can be performed discussing various other parameters of this particular subject area.

Results and conclusion:

The field of psychology and its subdisciplines like clinical psychology has continued to grow tremendously over the years. Treating complicated human issues with the use of psychological knowledge is the focus of the clinical psychology specialization. Clinical psychology is a science that not only treats mental health issues but additionally promotes groups, performs research, and provides training to help individuals of every age and background maintain their mental health. In psychology and clinical psychology, the maximum papers have been produced during the block 2019-2023 and the minimum no. of papers have been produced during the block 1989-1993. Overall an increasing trend of production is seen from all three of them i.e., the world, European nations, and India, in the field of psychology and clinical psychology. The data for the world, European nations, and India for psychology and clinical psychology literature shows an increasing trend in Relative Growth Rate among which the world's mean RGR is the highest in both fields i.e., 0.990 and 0.964 in psychology and clinical psychology respectively. On the other hand doubling time for the psychology literature of World and European countries shows a decreasing trend of Dt values with a mean doubling time equal to 0.563 and 0.681 respectively, while the doubling time of psychology literature for India fluctuates in between but has an overall decreasing trend of Dt values from 0.935 to 0.798, with a mean Dt value equal to 0.627. The mean Doubling time of publications in the field of clinical psychology is higher for India (0.797),

followed by the European nations (0.702) and the world (0.580) having the lowest value of Dt.

When the literature is analyzed using curve fitting it is found that except for the psychology literature produced from European nations which shows that the linear growth model best fits the literature, the others i.e., the world and India show that the exponential growth model fits best to the Psychology literature over the period from 1989 to 2023. On the other hand, clinical psychology literature from the World as well as European nations and India shows that the literature best fits the exponential growth statistics. When the growth models were applied using the chi-square test to the literature it is found that the European countries' clinical psychology literature follows the logarithmic model as the calculated chi-square value is -95782.4, which is found to be less than the theoretical chi-square value. Also, the Indian Psychology literature follows the Linear growth Model as the calculated value i.e., -913.53 is much smaller than the theoretical chi-square value. Except these two none of the datasets follows any of the growth models when tested through chi-square analysis. In comparison to India and Europe, this analysis shows distinct growth patterns in the literature on psychology and clinical psychology worldwide. Similar research can be carried out in other medical specialties and library science fields as well to learn about the fascinating data and information related to the topic.

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