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## **Scientometric Analysis on War and Peace**

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### **ABSTRACT**

The research quantum on peace and war produced worldwide during two different eras; first 1920 to 1938 and second 1946 to 2015, i.e., post world wars have been investigated on various viewpoints. This article precisely discusses the research dimensions on two themes “World Peace” and “World War”. First, I collected, collated and presented the data and second, I gauged and cogitated some major issues for further inquiries. Furthermore, science funding of research has been analyzed to reveal the policy of leading countries. The study focuses on the analysis of statistics, i.e., research quantum, organizational contributions, funded research counts and science of funding research. I measured the chronological research growth from 1946 to 2015 in ten years slot and subsequently, escalation of sequential geographic funding has been figured out. Additionally, I highlighted the research quantum on specific subjects carried out by the aligned leading nations which have the bilateral strategic partnership for decades. This work could be the best substantial ingredient to researchers, policy-architects, sociologists, politicians, and decision-makers those who are hungry for such studies

## KEYWORDS

Research Analysis; Science Funding; Socio-Scientometrics; Strategic Collaboration: War and Peace;

## INTRODUCTION

Nobody can raise question over the significance of war and peace study because both have been the universal inquiry. People across the globe have witnessed two world wars and have perceived drastic consequences. An experiment of mass chemical and biological weapons have demonstrated that the next war would be manifold destructive and will mutilate the political, biological and ecological map of the globe. Worldwide leading think-tanks fear of extinction of many species and significantly eliminating of the world population. Leading peace-loving nations across the globe continue attempts to maintain strategic balance to push away the third world war (IIIWW) and focusing on enduring world peace (*WP*). The study also reviews the role of state policy for peace and war, as Sun Tzu said that war is a matter of vital importance to the State; the province of life or death; the road to survival or ruin. It is mandatory that it be thoroughly studied. (Sun Tzu, 5th century BC). The causes of war may have many hidden dimensions and Stewart has highlighted some significant instincts. “The privileged may do so, fearing loss of position. For example, the prospect of possible loss of political power can act as a powerful motive for state-sponsored violence which occurs with the aim of suppressing opposition and maintaining power. Since the government has access to an organised force (police/army) and to finance, state terrorism is sometimes an important source of humanitarian emergencies. International support for peace has been less in total, and also less effective than

the war financing”. (Stewart, 1998). Most of the people believe that the justifiability of war depends, not just on considerations of actual or expected consequences, but also on what is often called matters of principle. On this view, the rightness or wrongness of an act may be, at least in part, a function of the inherent nature of the act itself, which is independent of what its consequences are. (Jeff, 1991) It is also very true that every state has the conflicts among national interests and international relationships where they always attempt to balance on both failing which prefer to stick by national interests.

## LITERATURE REVIEW

Peace research was born at the intersection of peace activism and the emergence of modern social science. The war and peace have always been the key issues in the field of international relations. (Kant, 1795/1991) The causes-of-war research and its dynamics have also been portrayed by Ohlson. “There is a conceptual gap between causes-of-war research and conflict resolution research. Three arguments are advanced, linked to the three questions, why do people start fighting? Why do people stop fighting? And how can peace be made durable? The first argument is that people take to arms because they have Reasons in the form of grievances and goals, Resources in the form of capabilities and opportunities, and Resolve because they see no alternative to violence in order to address grievances and attain goals. Second, the Triple-R concepts also explain the ‘outbreak of peace’, that is, war termination and peace-building. Third, variations in the dependent variable - different degrees of peace; here termed Triple-M (Mutually hurting stalemate, mutually enticing opportunities and mutually obtained rewards) - are explained by changes within those three clusters of explanatory factors.” (Ohlson, 2008) The end of war corroborates that purpose is fulfilled but undetermined of what degree and that scale of

dissatisfaction might cause another war. “The activities of Thompson during the 1840s and 1850s can be usefully explored alongside those of another Benthamite, John Bowring. Their contribution to various organizations, debates, and campaigns is analyzed, and their outlook compared with that of other figures, notably Richard Cobden.” (Turner, 2005) To differentiate war from lesser levels of violence, they generally follow the Correlates of War Project’s operational requirement of an annual minimum of 1000 battle-related fatalities (Singer and Small, 1972). In the twentieth century, developments of comparable magnitude had already taken place in the decade preceding WWI and WWII. (Gilpin, 1981) Inspired by a celebrated study of foreign news published in JPR (Galtung & Ruge, 1965), the term ‘peace journalism’ has also gained considerable popularity, in distinction to ‘violence/war/victory journalism’. (Gleditsch, Nordkvelle, and Strand, 2014) The involvement of each civilian in any form in war and peace has always been appreciated and information professionals are performing their responsibility through such studies, “(1) It is necessary, therefore, that civilians should begin to take a direct interest in military problems, (2) The possession of superior armament has been accompanied, in modern times, by the growing assertion of absolutist theories of government, especially by Fichte and his successors in Germany, (3) The difficulties inseparable from war do not end with the conclusion of peace.” (Teggart, 1941) Sometimes war turns out to be inescapable for survival but contradictory David has mentioned in his article that the war and war funding is profitable to many aggregators. “Wherever there is a war, look for CIA/IMF/private military war profiteers covertly funding and supporting both sides in order to keep the wars raging and the profits rolling in. As former CIA Station Chief John Stockwell explained: “Enemies are necessary for the wheels of the US military machine to turn.” (DeGraw, 2010) A comprehensive compilation of information has always constantly a vital significance

especially in a fiery conflict and is a key input while strategic planning during war or in peace therefore being a knowledge navigator, our role becomes more responsive. In 1969, Vassily V. Nalimov and Z. M. Mulchenko coined the Russian equivalent of the term ‘scientometrics’ (‘naukometriya’) (Nalimov & Mulchenko, 1969). As the name would imply, this term is mainly used for the study of all aspects of the literature of science and technology (William and Wilson, 2001). The study by Jasna Dravec Braun illustrates the impact of war on scientific output “After the War in Croatia a gradual but large increase in the number of published articles was evident, especially in foreign journals. The War diminished technical writing almost to the zero while an increase of scientific production was 9 times greater in 2008 than in 1968”. (Dravec Braun, 2012) The science funding indicates the national interest policies and guidelines of the funding organisation. Therefore, analysis of science funding and inferences draws attention towards future consequences. Science funding, considered as the key public resource in modern academic community, has an irreplaceable function in research development, scientist training and cultural construction (Vardakas, et al., 2015). Various level science funding agencies of leading countries allocate an appropriate capital to gain a competitive edge over counterpart countries. Consequently, the large scale Scientometric analysis of funding and funded papers becomes a hot-spot in recent years. For examples, the funding analysis in Nano research (Shapira and Wang, 2010), the general study of natural science (Wang, et al, 2012) as well as social science (Xu, et al, 2015), and the interesting and in-depth observation in the specific field, mathematics (Zhou and Tian, 2014). Correlated to science funding, an organization has a critical role in decision-making apart from the state policy. Funding organization must ensure the quality of research and peer review-based decision-making procedure (Mutz, Bornmann, and Daniel, 2015) while deciding to fund a research. The pilot study by Grant examined three guidelines and was

able to ascertain that they contained citations of a total of 284 publications (which can be categorized by author, research institution, country, etc.). Grant's results demonstrated the usefulness of his approach to tracing the flow of knowledge from research funding into clinical practice. (Bornmann, 2013)

The state policies of funding research especially coupled to war are clearly defined but an undivulged; these are reflected only through such studies. "One instrument for executive spending flexibility is "reprogramming" of funds within an appropriate – a practice regularly employed by the Department of Defense, Atomic Energy Commission, Department of Interior, Veteran's Administration and other federal agencies. Despite the magnitude of funds involved and the intriguing questions of congressional control and budget priorities, little has been written about reprogramming." (Fisher, 1974) Therefore, think-tanks, policy-makers, and arms business aggregators always keep a close watch on such developments and trends. Consequently, researchers identify current, realistic and exigency issues for investigations. The responsibility of library and information professionals in managing warfare has been significant characteristic for want of war plan strategies to attain affirmative outcomes. "In 1942 the U.S. Office of War Information (OWI) was created by the federal government to increase domestic understanding of America's war effort and to facilitate the flow of American information overseas. As part of this operation, fourteen information libraries were established throughout the aligned and neutral territory." (Richards, 1982)

## METHODOLOGY AND RESEARCH ANALYSIS

The Scientometrics methods enable us to analyse the information dimensions, i.e., research and funding trend including funding ratio, impacts, and countries indices. The analyzed data

presented in various facets, i.e., research output, funded research, chronological growth with ranking, geographical distribution of publications, most productive institutions, document form-wise distribution, language-wise distribution of publications, subject wise dispersion, quality assessment and ranking, citations and Citation Per Paper (CPP) received by publications, cited and uncited papers, funded research citations and uncited papers. The study revealed certain output and funding trend on the theme, however, both words are antonym and cannot be detached while conducting such investigations. Therefore analysis has been premeditated in such a method to measure research yield and consequences together. The study consciously outlines to ensure the research more focused, analytical and result oriented and limited to, i.e., Scopus: opted as key source for collecting data sets and bibliographical records; confined to specific keywords “*World War*” (WW) and “*World Peace*”(WP) under ‘Article Title, Abstract, Keyword’ option; identified specific period and publications, viz., from 1920 to 1938 (Bt1&2WWs) and from 1946 to 2015 (Af2WW) - Af1&2WW to analysis an appropriate trends and indications of the research. The datasets fetched in excel sheet have been filtered, sorted and presented in the form of textual, table, graph and figure at appropriate places suitable for the study.

**Table - 1 : Major formulas applied in the study**

<b>Indicators</b>	<b>Description</b>	
Formula -1: F% (Funding %)	$F\% = \frac{TF}{T} \times 100$	<p>The % of funded papers to all papers. This indicator is used to measure the funding support for the countries/territories and other scientific entities.</p> <p>T is the total number of papers, and TF represents the total number of funded papers.</p>
Formula -2, CPP (Citation per paper)	$CPP = \frac{C}{CP \text{ or } T \text{ or } FCP}$	<p>This indicator is used to measure the Citation per paper of Scopus cited papers. C represents the total citation counts for cited papers and CP represents the total number of cited papers.</p> <p>T represents the total number of papers. FCP stand for total number of funded cited papers</p>
Formula -3: %FNC (% of funded uncited papers)	$\%FNC = \frac{FNC}{TF} \times 100$	<p>The % of funded uncited papers, which has been calculated.</p> <p>TF represent the number of funded papers and FNC denotes the number of funded uncited papers.</p>

Formula -4 Annual Growth	Annual Average Growth = $\frac{\sum \text{ of } \% \text{ change over year}}{\text{Number of years}}$
Formula -5: %FCP (% Funded cited paper)	$\%FCP = \frac{FCP}{TF} \times 100$ This indicator is used to measure the % of funded cited paper of Scopus cited papers. TF represents the total funded papers and FCP represents the total numbers of funded cited paper.
Formula -6 : %CP (% Cited paper)	$\% \text{ cited papers} = \frac{\sum \text{ of cited papers}}{\sum \text{ of papers}} \times 100$
Formula -7, Periodic average ratio	Periodic average ratio = $\frac{\sum \text{ of records (Af2WW)}}{\sum \text{ of records (Bt1-2WW)}} / \text{No. of years}$
Formula -8, Aggregate ratio of Research output	Aggregate ratio = $\frac{\text{Periodic average ratio (Af2WW)}}{\text{Periodic average ratio (Bt1-2WW)}}$

Figure I: Total research quantum, percentage and funded research counts

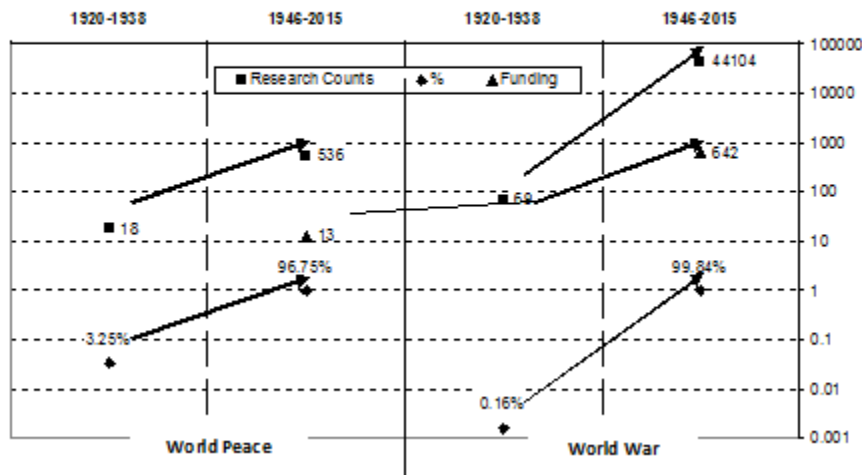


Figure I present the research quantum, percentage and funded research counts. Further, research records have been displayed on 'WP' Bt1&2WW which is 3.35% (18) of (Af1&2WW) (536) and on 'WW' Bt1&2WW are 0.15% (69) of Af1&2WW (44104). Relatively, the research records on 'WP' Af1&2WW are 1.21% (536) of research records (44104) on 'WW' for the same period. Overall, the research records on 'WP' Bt1-2WW are 1.25% (554) of research records on 'WW' for the same period (44173). Additionally, the ratio of records presented on 'WP' Bt1&2WW and



Af2WW which is 1:30 respectively and the ratio of records on 'WW' for the same period is 1:64. Similarly, the ratio of records on 'WP' and 'WW' Bt1&2WW is 1:4 respectively and the ratio Af1&2WW is 1:80 respectively. Furthermore, the output based on calculations by period slot, i.e., 19 and 70 years, shows ratio 0.20:1, (Table 1- formula-7) which further come down to 1:6 Af1&2WW respectively {(aggregate ratio, (Table 1- formula-8)}. The research quantum 44104 in 70 years expected to be published in next 111 years Af2WW. Interestingly, no funding was recorded Bf2WW, it was started only Af2WW and recorded ratio with a enormous variance as 1:49 on 'WP' and 'WW' respectively.

**Figure - II: Growth Trend of Research during the study period with ten years slot.**

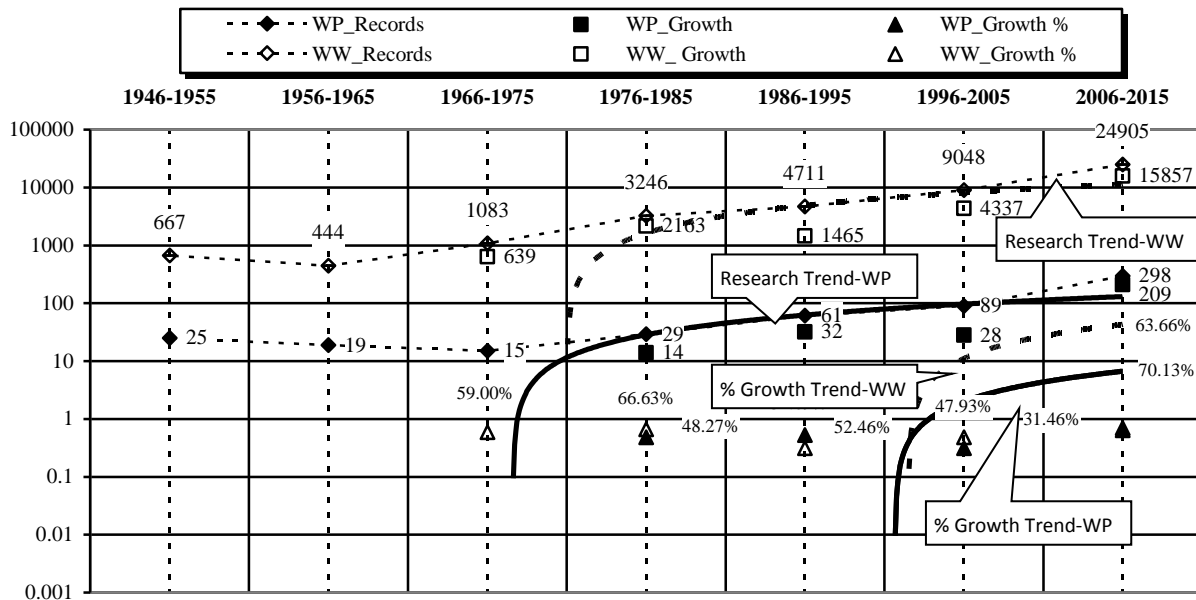


Figure II figured annual growth rates on 'WP' and highlighted the decreasing trend from 1946 to 1975 but increasing from 1976 to 2015 during every ten years slot. The highest count of research (298) pertains to the period 2006 to 2015. Further, it depicts changing percentage of research output reported during 1956 to 2015 where research counts of WP are very less than WW. At the

other side, the figure also presents annual growth rate on 'WW' and highlighted the decreasing trend by 50% from 1956 to 1965 but increasing from 1966 to 2015 during every ten years slot. Additionally, the annual average growth\* have been recorded as 2.41% and 3.63% on WP and WW respectively. (\*Refer Table-1, formula-4) Further, the highest research quantum recorded as 24905 which have been produced during ten years from 2006 to 2015.

**Figure III: Geographical distribution of research quantum Af1&2WW**

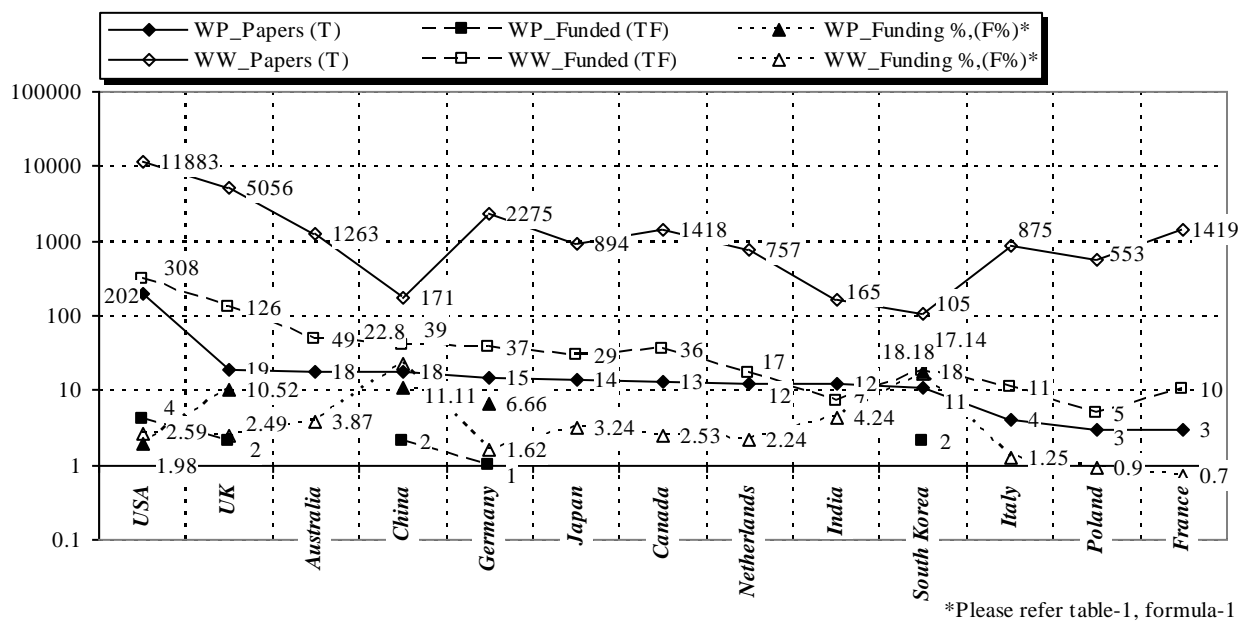


Figure III depicts the research quantum, funded research counts, percentage funding respectively by leading countries. It displayed research quantum on 'WP' in decreasing order from USA to France. The USA has sustained top ranking for highest research output and funding research on both themes 'WP' and 'WW' followed by UK, Australia, China, etc. and on 'WW', again USA is the highest research producer followed by UK, Germany, France, etc. On 'WP', South Korea scored top ranking for funding highest percentile of research with 18.18% followed by China and United Kingdom. At the other side on 'WW', China scored top ranking for funding highest

percentile of research with 22.80% followed by South Korea and India. Comparatively total research quantum recorded (11883 and 202), funding (308 and 4) and percentage funding (2.59 and 1.98) on ‘*WW*’ and ‘*WP*’ respectively which shows a huge difference on both themes. The research infers that ‘*WW*’ has a very large quantum than ‘*WP*’ in all facets.

**Table -II : Yearly distribution of funded research papers on WP**

Period	T	CP	C	TF	F%*1	Cited Papers			Uncited Papers	
						FCP	C	CPP *2	FNC	NCP%*3
2015	33	4	4	8	24.24	1	3	3	7	87.5
2014	24	5	8	1	4.17	1	3	3	0	0
2013	33	6	10	2	6.06	1	7	3	1	50
2012	41	12	40	0	0	0	0	0	0	0
2011	34	10	35	0	0	0	0	0	0	0
2010	39	19	77	0	0	0	0	0	0	0
2009	31	14	112	0	0	0	0	0	0	0
2008	29	11	52	0	0	0	0	0	0	0
2007	18	11	37	0	0	0	0	0	0	0
	282	92	375	11	3.9	3	13	9	8	72.7

(Please refer table-I, formula-1 (\*1), formula-2 (\*2), formula-3 (\*3), )

Table II presents the cited papers, citations, funded counts with percentage and funded cited papers, citations with citation per page and also uncited papers from 2007-2015 on ‘*WP*’. It has displayed total records as 282 including 11 funded research counts and out of that 92 cited papers which got overall 375 citations with 3.9%. There are only 3 funded cited papers out of 11 that a very disappointing figure. On the other hand, there are 8 funded uncited papers with 72.7% ratio which reiterates funding unworthy.

**Table -III : Yearly distribution of research quantum and funded counts on WW**

Period	Papers T	Cited papers/ Citations	Funded Papers (TF)	% Funding (F%)*1	funded papers on WW					
					Cited Papers			Uncited Papers		
					Funded	Citation	% funded	CPP	Funded	%

					<i>papers (FCP)</i>	<i>(C)</i>	<i>Cited papers (%FCP) *2</i>	<i>*3</i>	<i>papers (FNC)</i>	<i>Uncited papers*4</i>
2015	3037	391/858	266	8.76	135	448	50.75	3.32	131	49.25
2014	3139	777/2128	218	6.94	160	1164	73.39	7.28	58	26.61
2013	2749	948/3688	140	5.09	119	1137	85.00	9.55	21	15.00
2012	2902	1097/6301	5	0.17	5	41	100.00	8.20	0	0.00
2011	2759	1170/12211	3	0.11	1	4	33.33	4.00	2	66.67
2010	2698	1293/9905	2	0.07	2	16	100.00	8.00	0	0.00
2009	2263	1166/11663	3	0.13	3	15	100.00	5.00	0	0.00
2008	1891	1040/9982	1	0.05	1	7	100.00	7.00	0	0.00
2007	1788	1032/10258	1	0.06	0	0	0.00	0	1	100.00
Total	23226	8914/66994	639	2.75	426	2832	66.67	6.65	213	33.33
		38.38%*5 / 7.52 CPP*3	(Please refer table-1, formula-1 (*1), formula-5 (*2), formula-2 (*3), formula-3 (*4), formula-6 (*5))							

Table III displayed the data of cited papers and uncited papers on ‘*WW*’ from 2007-2015. It presented the research quantum as 23226 including 639 funded research counts out of which 426 cited research counts with overall 2832 citations; 66.67% and an average of 6.65 citations per paper during nine years but at the other side, there are 213 funded uncited research counts comprising 33.33%. The percentage of funded research cited counts (66.67%) is very high than the percentage of funded research uncited counts (33.33). Further, it presented an interesting figure that the ratio of funded cited counts are double than the uncited counts which indicated that the fundings on ‘*WW*’ is highly worthy. Such sort of inferences encourages researchers who focuses over micro-sociology; indicates impact on future research sociology and signifies the academic impact on citation analysis. Furthermore, it presented that funding ratio on ‘*WW*’ appears not high but science funding has shown an effective role in promoting research on the subject.

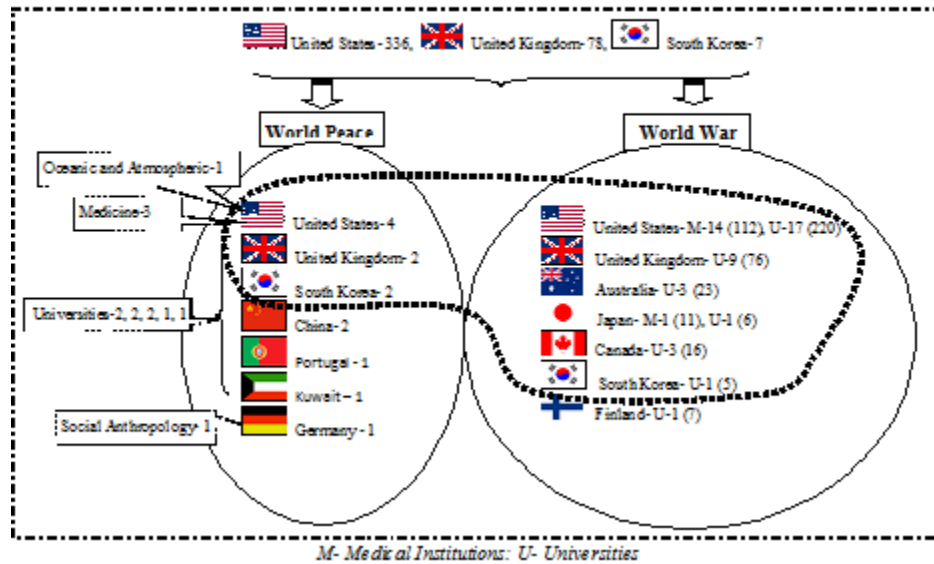
**Table - IV : Top funding organisations**

<i>WP</i>		<i>WW</i>		
<i>Organizations</i>	<i>Papers</i>	<i>Organizations</i>	<i>Papers</i>	<i>Rank</i>
The Catholic University of Korea - South Korea	1	VA Medical Center - USA	17	1

Duke University School of Medicine - USA	1	University College London - UK	12	2
ISCTE-IUL - Portugal	1	The University of Sydney - Australia	12	2
Jinan University - China	1	University of Oxford - UK	12	2
Lawrence Berkeley National Laboratory - USA	1	Johns Hopkins Bloomberg School of Public Health - USA	11	3
MPI for Social Anthropology - Germany	1	Shiga University of Medical Science - Japan	11	3
National Oceanic and Atmospheric Administration-USA	1	Duke University - USA	11	3
Seoul National University - South Korea	1	King's College London - UK	11	3
University of Kent - UK	1	Uni. of California, Davis - USA	11	3
University of Glasgow - UK	1	University of Cambridge - UK	11	3
University of Kuwait - Kuwait	1	National Institute of Allergy and Infectious Diseases - USA	10	4
University of North Carolina School of Medicine-USA	1	National Institutes of Health, Bethesda - USA	9	5
Zhejiang University - China	1	University of Pittsburgh Graduate School of Public Health - USA	8	6

Table IV presents the top funding organisations on ‘*WP*’ and ‘*WW*’ Af2WW. All organisations presented under ‘*WP*’ have funded equal number of research therefore these have been listed in alphabetical order. At the other side on ‘*WW*’, the funding organisations have been listed in order; from highest to lowest funding organisations, i.e., VA Medical Center of USA stands at the top position and others are listed in decreasing order. The USA stands at top as highest funding country with three and six organisations on ‘*WP*’ and ‘*WW*’ respectively followed by UK. Overall, comparative figure shows that the organisational funding on ‘*WW*’ is much higher than ‘*WP*’.

**Figure – IV: Top research funding organisations from strategic aligned nations focused on specific subject area (Af2WW)**



The figure IV presents an additional dimension on focused research subject area and organisations, i.e. medical institutions & universities of strategically aligned nations. Only selected organisations which has produced minimum five funded researches have been taken into considerations for analysis. The analysis depicts that there are three common countries, i.e., US, UK and South Korea which have funded on both themes ‘WP’ and ‘WW’. It presents that 13 institutions from 7 countries have produced 13 research counts of different subject areas on ‘WP’ out of which 3 research counts in Medicine which are the highest counts in a subject. Therefore, Medicine has been identified as the most favorite funded subject area. Similarly, Medicine again is the most favorite funded subject area with highest research fundings counts under ‘WW’. Further, it presents a quantum of 366 funded counts from top 50 institutions. Overall, universities have produced highest funded research counts, i.e., 253 followed by medical institution with 113 records. Here important to note that the universities have produced research in numerous subject areas which includes medicine also; therefore, medicine appears the most preferred subject area

with highest researches. This inference raise supplementary issues as why medicine is the most preferred funding subject under the theme of ‘WP’ and ‘WW’? The US has emerged as a highest research producer state which has tied with diverse strategic alliances to strengthen its network with other leading research producers. The US has unique strategic association with UK and Canada for being the NATO founding members. It has a treaty of mutual cooperation and security with Japan since 1952; a strategic cooperation agreement with Israel since 1981 and a military alliance with South Korea and Australia. The UK and Australia have a multilateral defense relationships agreement under ‘five power defense arrangements’. The inferences endorsed that aforementioned strategic aligned nations have produced the highest research quantum.

**Figure – V: Subject dispersion of research quantum on WP and WW (Af1&2WW)**

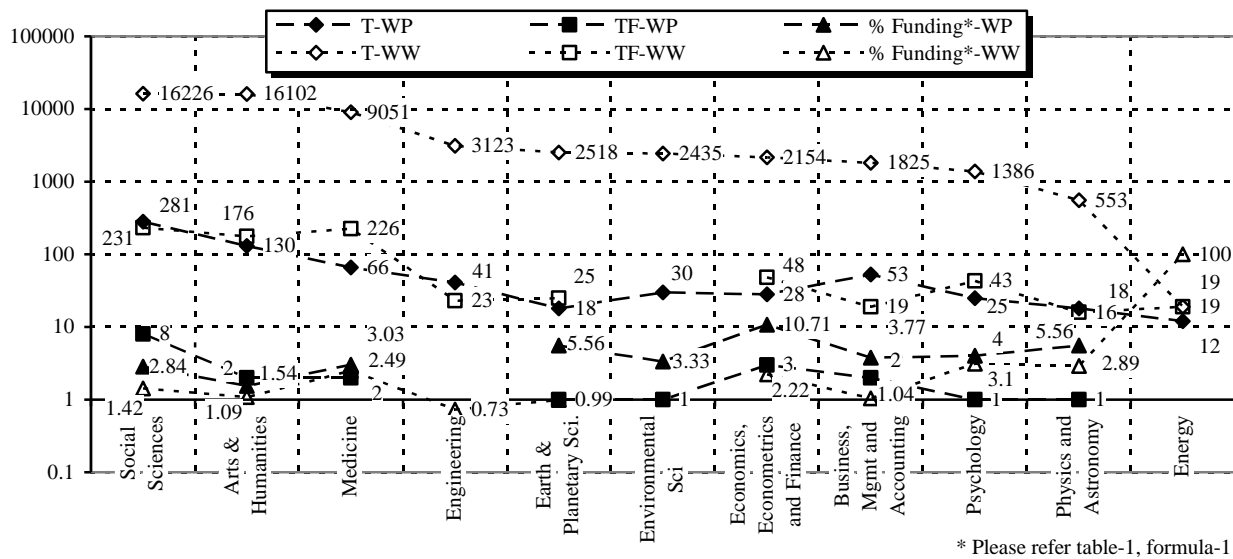


Figure V depicted the top subject areas in terms of research quantum, funded research counts and percentage funding. It displayed research counts in decreasing order from Social Sciences to Energy on ‘WW’. Overall, there are major four core subject categories in Scopus, i.e., Life

Sciences which consist of more than 4,300 titles; Health Sciences having more than 6,800 titles including Medline, Physical Sciences includes 7,200 titles and Social Sciences and Humanities having more than 5,300 titles. The Scopus covers the distribution of publications spread out in 27 areas of research. On 'WP', The figure presented that Social Sciences is the most preferred area of research with 281 counts out of which 8 funded counts with 2.84% fundings; but Economics, Econometrics and Finance has been ranked first under percentage funding of research followed by Earth & Planetary Science and Physics & Astronomy. At the contrary side on 'WW', Social Sciences has been identified at top position for most preferred area of research having 16226 counts out of which 231 funded counts with 1.42 % fundings; but Energy has been ranked first with 100% funding under percentage funding of research followed by Psychology and Physics & Astronomy. Surprisingly observed that the Medicine has emerged the most preferred research funding discipline consisting 226 funded counts out of 9051 records but not surprisingly, as expected overall fundings on 'WW' is much higher than 'WP' in all subject disciplines.

## CONCLUSION AND DISCUSSION

The research quantum on 'WP' and 'WW' produced during two eras, i.e., post world wars have been analyzed. By understanding the requirements of basic strategies for sustainable peace, vivid dimensions of research have been gauged to compile a comprehensive collection of facts to support strategists on the theme. A continuous comparative growth of research quantum and funding counts have been examined to draw research trends and calculative indications for future perspectives. The study inferred that research quantum on 'WW' is manifold higher than 'WP' and an overall ratio is 1:80 but collapsed to 1:5.83 while calculated by 19 and 70 years Af1&2WW respectively. Further, an overall highest research quantum and funding research on



'WP' and 'WW' has been produced by the USA; followed by UK, Australia, and China on 'WP' and similarly followed by UK, Germany and France on 'WW'. Being Medicine the most preferred research funding discipline has raised many abundant queries and issues, i.e., how medical science is involved in peace and war? ; what is the multidisciplinary approach to medical research in peace and war? ; are anxious nations evolving biological weapons? ; are biological weapons supplementing and adding more destructive value or replacing traditional war weapons? Presently, an answers of these queries are still excavated but beyond doubt that medical science has a vital impact impending peace and war. While analysing funding of research by strategically aligned nations, apparently observed that US, UK, and South Korea have funded on both 'WP' and 'WW' themes. Overall, universities have produced the highest quantum of funded research consisting 263 counts followed by medical institution consisting 113 counts and speculations indicated that universities also produced much-funded research in medical sciences which might have enhanced the quantum of medical funded research. Furthermore, it is inferred that leading strategic aligned countries, i.e., USA, UK, Australia, Japan, Canada and South Korea are still the leader in producing the highest research and as well funding of research which reiterates their vital strategic impact on peace and war.

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