Virtual Team Literature: A Bibliometric Evaluation

Mohd Affendi Ahmad Pozin[1]*, Mohd Nasrun Mohd Nawi[2], Aidi Ahmi[3], Aizul Nahar Harun[4], Thida Lapwong[5]

[1]School of Business Innovation and Technopreneurship, Universiti Malaysia Perlis,Malaysia
[2]School of Technology Management and Logistics, Universiti Utara Malaysia, Malaysia
[3]Tunku Puteri Intan Safinaz School of Accountancy, Universiti Utara Malaysia, Malaysia
[4]Malaysia-Japan International Institute of Technology (MJIIT), UniversitiTeknologi Malaysia, Kuala Lumpur
[5]Faculty of Management Science, Princess of Naradhiwas University, Thailand
*Corresponding author E-mail: mohdaffendi@unimap.edu.my

Abstract:
The multiple-disciplinary article has been written belong to the Virtual Team area. Unfortunately, a lack of analysis is not measured by publication trends related to this field. Hence, these studies to demonstrate the trend of "Virtual Team" scientific literature from 1991 until 2020. Specifically, a total number of 1,782 publications were investigated in the SCOPUS database by using Publish and Perish software to collect all the literature. The trend of a virtual team has received considerable attention since 1991, and highly most of the research in the virtual team was published in the computer science field. The top 50 keywords are presented from the growth of the virtual team literature and research interests, thus the potential directions for future research are proposed.

Keywords: Bibliometrics analysis, Virtual team, Research trends

1. INTRODUCTION

A virtual team is growing popular in a multinational company around the global market. The concept of the virtual team offers valuable experience around various organization due to the flexibilities, fluid partnerships to promote multiple projects easily and efficiently, wherever, anywhere and anywhere. The virtual team concept becomes fully well-designedwhen relying on information technology; the internet, computing system, video and voice conferencing services and communication tools. In fact, a dispersed team, distributed team or remote team would be able to share the information, co-operate and collaborate with each other in coordination(Handy, 1995).

In the last decade many articles, books, and documents have been written and a few definitions exist associated with virtual teams. Perhaps the simplest description is that virtual teams are defined in multiple contexts. Traditionally virtual team has identified a group of workers who were geographically dispersed and worked away from traditional office space. According to Anderson et al., (2007) Virtual Team is utilized to cover a lot of technology-supported work activities and methods (Anderson et al., 2007).On the other hand, digital teams defined by Leenders et al. (2003) are groups of individuals working together to carry out a specific project while being dispersed geographically and often temporarily, likely anywhere within (and beyond) their parent organization (Leenders et al., 2003).According to Solomon (2000) "Virtual teams offer tremendous opportunities, and tribulations. Thus companies will allow to recruit talent without the constraints of location, and offered to schedule flexibility such as telecommuting and working at home offices. It also

creates the potential for follow-the-sun 24-hour workdays and the ability to maintain close contact with customers throughout the world".

Nowadays virtual teams have become more prevalent too various organizations, which operated without the structure, roles or forms to support international virtual projects. In fact, this attention thus led to an increasing number of publications in this field. In fact, this topic is proposed to be analysed by using bibliometric analysis. Bibliometrics (sometimes called scientometrics) turns on itself the primary tool of research, quantitative analysis. In fact, bibliometrics is the application of quantitative analysis and statistics to journals such as journal articles and their corresponding quotes (Thomson-Reuters, 2008).

2. METHODS

This section will identify the relevant criteria base on the title Virtual Team where are relevant to the research objectives. Publish and Perish software was used to run the article topic search with the keyword "Virtual Team". Publish and Perish software is a product which developed under Research in International Management, which offers to retrieves and analyses academic research article through the SCOPUS database system. The data was collected on 24 July 2019 from Universiti Utara Malaysia library. The topic search focus on key-phrase within the title, abstract and author keyword. As one of the main databases, SCOPUS provides the largest abstract and indexing database ever created and the largest searchable citation and abstract source for literature finding (Aghaei Chadegani et al., 2013; Ahmi, Elbardan, & Raja Mohd Ali, 2019; Burnham, 2006).Furthermore, the sample has been obtained (n=1782) began from the choice from the collection of a document such as a source title, keywords, affiliation, language, document type, subject area, author name, year of publication and country. Thus, this research focus on all documents related to the Virtual team was based on the title of the document.

3. RESULTS

3.1. Scientific Document and VarietiesSource

Firstly, the data obtained will be analysed based on a different type of scientific documents. The document types refer to the types of document based on the originality of the documents either conference paper, article, book chapter, etc. While source type is referred to the source of documents whether it is journal, conference proceedings, book series, and book or trade publication. The result from table 1 shows that the great majority of the publication was a scientific article, making up 43.66% from total publications. Followed by conference paper (41.47%).The other types of documents collectively represented less than 10% of the total documents. It was included Editorial, Book, Note, Short Survey, Erratum, and Undefined document type with less than 1% each.

Table 1: Classification of Scientific document on virtual team research

Document Type	Frequency	% (N=1782)
Article	778	43.66%
Conference Paper	739	41.47%
Book Chapter	156	8.75%
Review	75	4.21%
Editorial	9	0.51%
Book	7	0.39%
Note	7	0.39%
Short Survey	6	0.34%
Erratum	1	0.06%
Undefined	4	0.22%
Total	1782	100.00

As per Table 1, more than half of the total publications are coming from a scientific article represented 778 (43.66%) documents, followed by conference paper739 (41.47%). Although under source type, (see Table 2) there are five types of

sources visibly in the search result. Thus, a journal represented the highest type of source 849 (47.6%) followed by conference proceedings 648 (36.36%). Followed by Book series 114 publication(6.39%), Books 162 (9.1%)and Trade publication 9(0.5%) from the total publication on this area.

Table 2: number of publication by type

Source Type	Frequency	Percentage (%)
Journals	849	47.6%
Conference Proceedings	648	36.36%
Book Series	114	6.39%
Books	162	9.1%
Trade Publications	9	0.5%
Total	**1782**	**100.00**

3.2. Number of Publication by Years

The first research on the Virtual team was publishedin1991, unfortunately, this study does not much popular until 1995 with only one (1) paper published under this title. However, from 1996 to 2010 virtual team publication was increased tremendously from 8 publication to 129 articles in 2010 and drop slowly until 2018 (Figure 1). The first publication which directly refers to the virtual team stated in the year 1991 by (Cohen et al., 1991). As for 2019, while the year is still to come, some publications in the Scopus database have already been published and indexed.

Figure 1: Trend of publication on "Virtual Team"
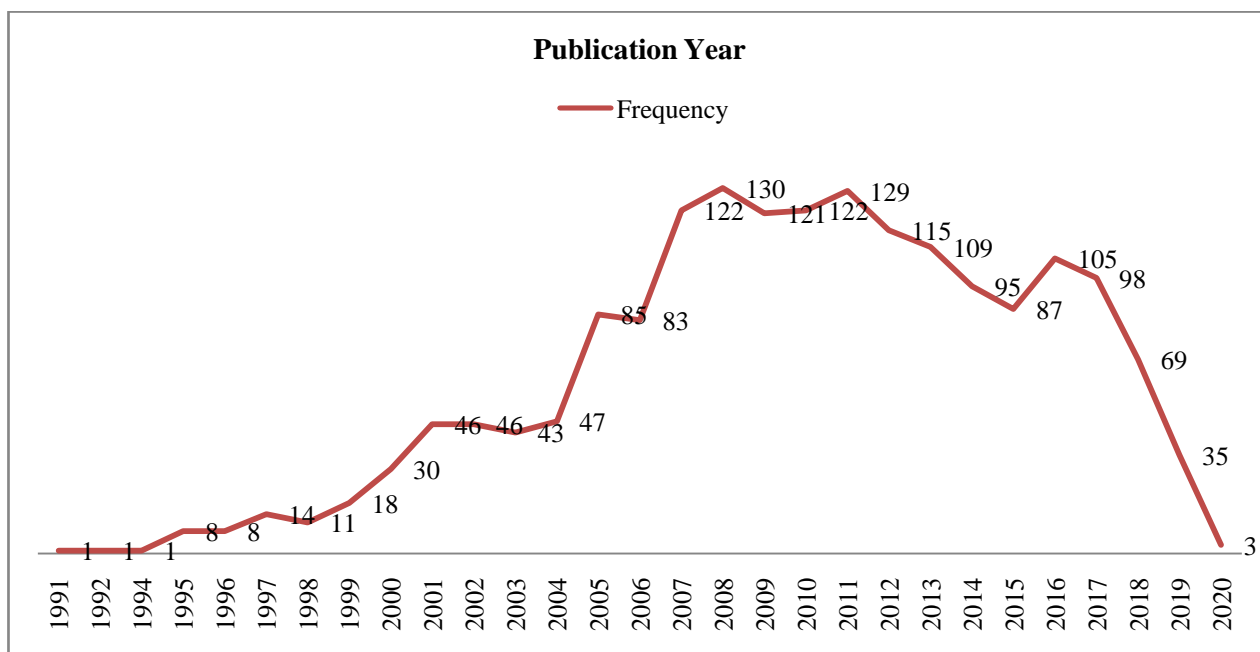
3.3. Languages of Documents

Based on Table 3, the only 9 languages are used in this study. The majority of retrieved documents were published in English with the total number 1739 article and equal to 97.6%.The second higher is the German language (1.06%) and the other's language is less than 1% such as French, Chinese, Spanish, Portuguese, Malay, Polish, and Slovak.

Table 3: Languages Used for Publications

Language	Frequency	Percentage (%)
English	1739	97.60%

German	19	1.06%
French	9	0.50%
Chinese	5	0.28%
Spanish	4	0.22%
Portuguese	3	0.17%
Malay	1	0.06%
Polish	1	0.06%
Slovak	1	0.06%
Total	**1782**	**100.00**

3.4.Subject Area

Table 4 shows the total number of subject are as published under the article title virtual team. Most of the studies on Virtual Team is published in the area of Computer Sciencewhich demonstrating(832: 27.44%) of the total articles,continued by Business, Management and Accounting(596: 19.66%), Social Sciences (454: 14.97%) and Engineering (429:14.15%). The other subject areas are illustrated in Table 4.

Table 4: Subject Area

Subject Area	Frequency	Percentage (%)
Computer Science	832	27.44%
Business, Management, and Accounting	596	19.66%
Social Sciences	454	14.97%
Engineering	429	14.15%
Decision Sciences	190	6.27%
Psychology	145	4.78%
Mathematics	103	3.40%
Arts and Humanities	89	2.94%
Economics, Econometrics and Finance	77	2.54%
Medicine	41	1.35%
Environmental Science	12	0.40%
Health Professions	9	0.30%
Materials Science	8	0.26%
Physics and Astronomy	8	0.26%
Earth and Planetary Sciences	7	0.23%
Energy	7	0.23%
Biochemistry, Genetics and Molecular Biology	5	0.16%
Nursing	4	0.13%
Agricultural and Biological Sciences	3	0.10%
Chemical Engineering	3	0.10%
Undefined	3	0.10%
Chemistry	2	0.07%
Neuroscience	2	0.07%
Pharmacology, Toxicology, and Pharmaceutics	2	0.07%
Multidisciplinary	1	0.03%

3.5. Journals

As illustrated in figure 2, the total number of top-cited articles were published in 15 journals. 76 were published in international conference proceedings (8.5%). Out of the 160 papers reviewed, 42 were published in international conference proceedings (84.2%) and the remaining 6 in Lecture Notes in Computer Science (4.7%). While only a few studies

focus on other disciplines, such as Human Resource Management, Teaching, and Education, Phycology, Trans-disciplinaryEngineering. The top rank publication journal islisted in table 5.

Figure 2: Top 15 journals with higher number publication in Virtual Team from 1991 to 2020.

Table 5: Percentage number of publication in top rank Journal

| Source Title	Frequency	Percentage
Proceedings of the Annual Hawaii International Conference on System Sciences	76	8.50%
Lecture Notes in Computer Science Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics	42	4.70%
IEEE Transactions on Professional Communication	26	2.91%
Computers in Human Behavior	24	2.68%
International Journal of Networking and Virtual Organisations	18	2.01%
Team Performance Management	17	1.90%
Small Group Research	14	1.57%
IEEE International Professional Communication Conference	13	1.45%
IFIP Advances in Information and Communication Technology	13	1.45%
International Journal of E-Collaboration	13	1.45%
Journal of Management Information Systems	12	1.34%
ACM International Conference Proceeding Series	11	1.23%
Group Decision and Negotiation	11	1.23%
Proceedings of The Hawaii International Conference on System Sciences	10	1.12%
ASEE Annual Conference and Exposition Conference Proceedings	9	1.01%

3.6. Keywords Analysis

VOS viewer, a software tool for developing and visualizing bibliometric networks, has mapped the author keywords (see Fig. 3).Figure 3 presented the top 50 keywords by relevance based on 1,782 "Virtual Team" publication. Network representation of the writer keywords used to show the relationship with other keywords in colour, circle width, font size and thickness of the connecting lines.For example, keywords with the same colour were commonly are in close relation. So, in this study, Virtual teams, project management, computer-supported cooperation, information technology,

virtual reality, trust, leadership, collaboration, and communication is related in color to recommend

which these keywords are closely related and usually co-occur with each other.
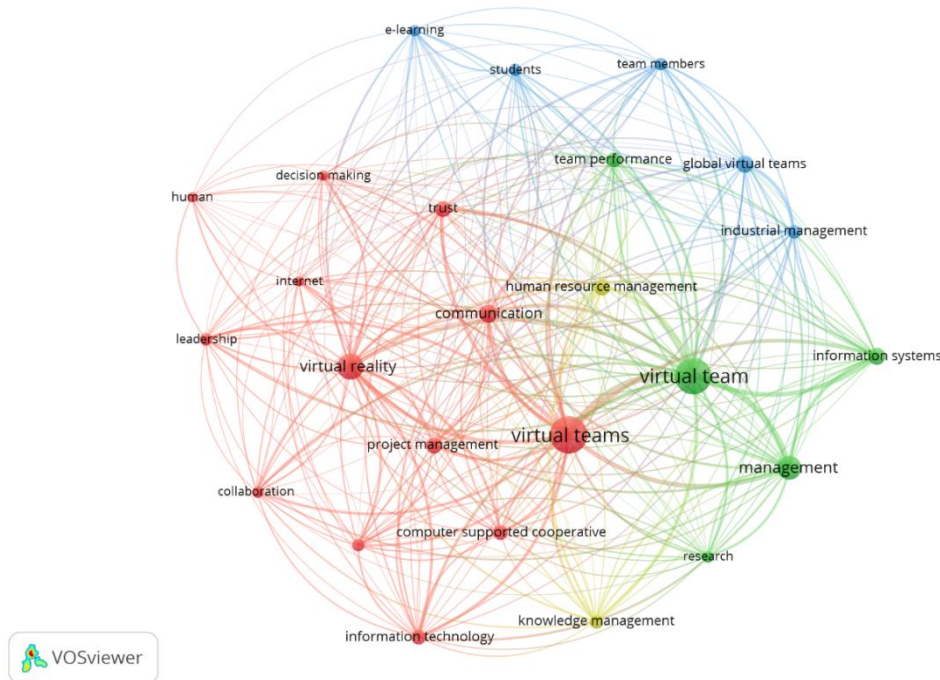
Figure 3: Network visualization map of the author keywords

Keywords such as the Virtual Teams and the Virtual Team are found as the most widely used keywords in the analysis of the Virtual Team based on the

number of occurrences (after data cleaning process on the author keywords). Table 5 shows the top 20 keywords used in analysis on the Virtual Group.

Table 5: Keywords

Keyword	Frequency	%(N=6576)
Virtual Teams	556	8.45%
Virtual Team	519	7.89%
Virtual Reality	294	4.47%
Management	244	3.71%
Communication	148	2.25%
Information Systems	140	2.13%
Global Virtual Teams	129	1.96%
Human Resource Man-agement	117	1.78%
Trust	117	1.78%
Project Management	114	1.73%
Information Technology	107	1.63%
Computer Supported Cooperative Work	103	1.57%
Team Performance	98	1.49%
Industrial Management	94	1.43%
Knowledge Management	87	1.32%

Team Members	80	1.22%
Leadership	76	1.16%
Societies and Institu-tions	75	1.14%
Students	73	1.11%
Collaboration	70	1.06%

3.7.   Geographical Distribution of Publications - Most Influential Countries

The distribution of the top 20 countries based on an amount of publication in the virtual team was presented in figure 4. The United States of America was ranked with a total of 789 documents, followed by United Kingdom (142), and Germany (117). Yet, the lowers virtual team document goes to Hong Kong (20), New Zealand (20) and Norway (23)publications.

Figure4: Countries contributed to the publications
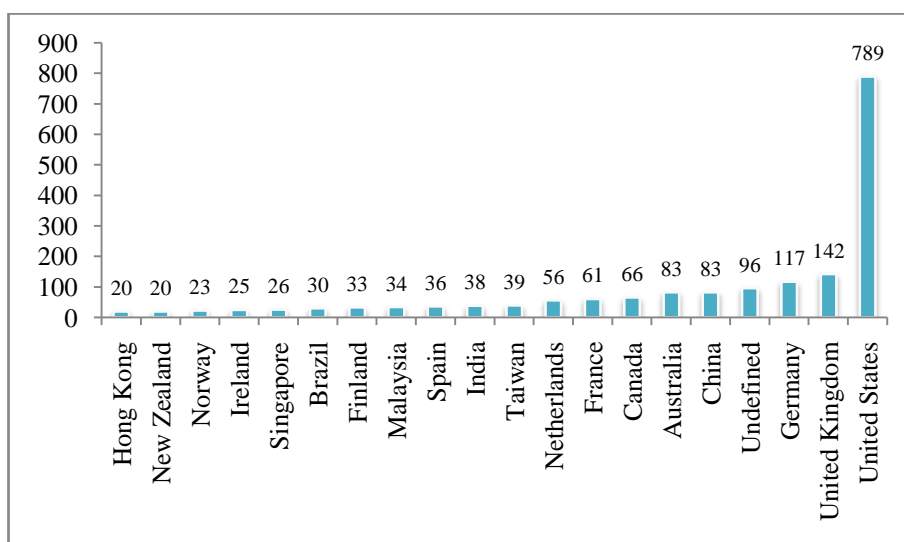
3.8.   Citation Analysis

Table 7 summaries the citation metrics for the retrieved documents as of 17/06/2018. The software Harzing's Publish or Perish software was used to seek the citation metric for the retrieved data from the SCOPUS database. The summary includes the total number of citations with their citations per year, citations per paper, and citations per author.

Table 8: Citations Metrics

Metrics	Data
Reference date	24/07/201909:10:13
Publication years	1991-2020
Citation years	28 (1991-2020)
Papers	1782
Citations	34201
Citations/year	1221.46
Citations/paper	19.19
Citations/author	2.64
Papers/author	
Authors/paper	2.64
Hirsch h-index	84
Egghe g-index	156
PoPhI,norm	54
PoPhI, annual	1.93

Besides that, the most productive authors in the field of Virtual Team were listed in table 9. The highest citation article by Jarvenpaa & Leidner, (1999) receive 1474 citation (73.5 citations per year) from a total of 34201 citations from SCOPUS database.

The number of citations is not equal to their number of publications rank. Thus, a researcher should have strategies to increase their research visibility and impact both before and after publications.

Table 9: Highly cited articles - Most Influential Papers

No	Authors	Title	Year	Cites	Cites/ Year	Cites/ Author
1	S.L. Jarvenpaa, D.E. Leidner	Communication and Trust in Global Virtual Teams	1999	1474	73.7	737
2	S.L. Jarvenpaa, K. Knoll, D.E. Leidner	Is anybody out there? Antecedents of trust in global virtual teams	1998	1087	51.76	362
3	M.L. Maznevski, K.M. Chu-doba	Bridging Space over Time: Global Virtual Team Dynamics and Effectiveness	2000	1019	53.63	510
4	A. Powell, G. Piccoli, B. Ives	Virtual Teams: A Review of Current Literature and Directions for Future Research	2004	746	49.73	249
5	L.L. Martins, L.L. Gilson, M.T. Maynard	Virtual teams: What do we know and where do we go from here?	2004	685	45.67	228
6	A. Majchrzak, R.E. Rice, A. Malhotra, N. King, S. Ba	Technology adaptation: The case of a computer-supported inter-organizational virtual team	2000	600	31.58	120
7	A.M. Townsend, S.M. De-Marie, A.R. Hendrickson	Virtual teams: Technology and the workplace of the future	1998	588	28	196
8	B.S. Bell, S.W.J. Kozlowski	A typology of virtual teams: Implications for effective leadership	2002	563	33.12	282
9	M.M. Montoya-Weiss, A.P. Massey, M. Song	Getting it together: Temporal coordination and conflict management in global virtual teams	2001	480	26.67	160
10	G. Hertel, S. Geister, U. Konradt	Managing virtual teams: A review of current empirical research	2005	479	34.21	160
11	S.L. Jarvenpaa, D.E. Leidner	Communication and trust in global virtual teams	1998	465	22.14	233
12	B.L. Kirkman, B. Rosen, P.E. Tesluk, C.B. Gibson	The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction	2004	446	29.73	112
13	S.L. Jarvenpaa, T.R. Shaw, D.S. Staples	Toward contextualized theories of trust: The role of trust in global virtual teams	2004	406	27.07	135
14	T.R. Kayworth, D.E. Leidner	Leadership effectiveness in global virtual teams	2001	374	20.78	187
15	M.E. Warkentin, L. Sayeed, R. Hightower	Virtual teams versus face-to-face teams: An exploratory study of a Web-based conference system	1997	373	16.95	124
16	E.F. McDonough III, K.B. Kahn, G. Barczak	An investigation of the use of global, virtual, and collocated new product development teams	2001	342	19	114
17	P. Kanawattanachai, Y. Yoo	The impact of knowledge coordination on virtual team performance over time	2007	337	28.08	169
18	M. Alavi, A. Tiwana	Knowledge integration in virtual teams: The potential role of KMS	2002	305	17.94	153
19	G. Piccoli, B. Ives	Trust and the unintended effects of behavior control in virtual teams	2003	275	17.19	138
20	P. Kanawattanachai, Y. Yoo	Dynamic nature of trust in virtual teams	2002	275	16.18	138

4. CONCLUSION

The rapid development of information technologies has resulted in the world rapidly changing into virtual convergence. In this study, we aim to examine the trend of virtual team publication for the 28 years with determining the keyword associated with the research title. This paper presented the various keyword, institutions, authors, journals, countries related to the "Virtual Team" published research indexed from SCOPUS database. This study also reveals that the areas mostly covered in the virtual team research are related to Virtual team,

Virtual teams and Virtual reality based on the keywords used by authors. Other interest topics can be discovering include Project management, Information system, and Leadership. The result increases steadily by year but the publication was decrease starting from 2017. In this research area, the United State of America was leading compare to other developed countries such as the UK, China, and German. This study suggests that the research on the virtual team should be conducted in other developing countries such as Malaysia, as the impact on the technologies were globally affected. In the future, researchers should collect more bibliometric information from other scholarly databases such as Web of Science, Google Scholar, and Dimensions.Aifor amore in-depth analysis. On top of that, researchers suggested combining bibliometric analysis and Systematic Literature Review (SLR) to narrow down into the scope of research.

REFERENCES

[1] Aghaei Chadegani, A., Salehi, H., Md Yunus, M. M., Farhadi, H., Fooladi, M., Farhadi, M., & Ale Ebrahim, N. (2013). A comparison between two main academic literature collections: Web of Science and Scopus databases. *Asian Social Science*, *9*(5), 18–26.

[2] Ahmi, A., Elbardan, H., & Raja Mohd Ali, R. H. (2019). Bibliometric analysis of published literature on industry 4.0. *ICEIC 2019 - International Conference on Electronics, Information, and Communication*, *0*, 1–6.

[3] Anderson, A. H., McEwan, R., Bal, J., & Carletta, J. (2007). Virtual team meetings: An analysis of communication and context. *Computers in Human Behavior*, *23*(5), 2558–2580.

[4] Burnham, J. F. (2006). Scopus database: A review. *Biomedical Digital Libraries*, *3*, 1–8.

[5] Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and Trust in Global Virtual Teams. *Organization Science*, *10*(6), 791–815.

[6] Leenders, R. T. A. J., Van Engelen, J. M. L., & Kratzer, J. (2003). Virtuality, communication, and new product team creativity: A social network perspective. *Journal of Engineering and Technology Management - JET-M*.

[7] Thomson-Reuters. (2008). Whitepaper Using Bibliometrics : A guide to Evaluating Research Performance with Citation Data. In *Thomson Reuters*.