

## **Bibliometric Analysis of Published Literature on e-Wallet**

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### **Abstract**

The term e-wallet were introduced way back in 1990. First documents regarding e-wallet published in 1995. The research on e-wallet rises drastically after 2017 whereby most people get exposure to the advantages of e-wallet. Banks in Malaysia start offering e-wallet services and e-wallet account since 2018. Thus, the plan of this investigation is analyzing the literature published in the field of e-wallet which are listed in Scopus. The data were exported from Scopus using various methods. Publish or Perish software used to calculate Citation metrics, VOS Viewer used to visualize the data to show the relationship. One of the main tools used is Microsoft Excel to perform data analysis. Standard bibliometric analysis method applied. Based on the search on Scopus, 127 documents were founded in the database, majority of the documents published in English, the number of publications increases after year 2017. One of the main keywords used in the field of e-wallet are digital payment and electronic wallet. Most research related to e-wallet conducted in India while the most cited paper is from France. This study helps to present the development of the scientific literature in e-wallet and helps to identify areas and trends of current research which will lead to potential future research.

### **Keywords**

e-wallet, Bibliometric Analysis, Literature Review.

## **Introduction**

The rapid growth of Information communication technologies (ICT) for past few decades creates a plenty of new systems, applications and many other web-based systems. According to Internet World Stats, there are about 4.5 billion internet users which a growth of 1,157%. In the current development of internet and mobile users, in 2018 Malaysian Communications and Multimedia Commission (MCMC) conducted a survey on devices used by internet user, 93.1% of Malaysian Internet user are using smartphone which marks an increase of 3.7% since 2016 [1].

This rapid growth creates digital uprising which converting physical into digital, one of it is physical wallet was begun to replace with electronic wallet (e-wallet). Back in 1990, Michael Waidner and Birgit Pfitzmann conducted research on Loss-Tolerance of e-wallet, which was a prediction of the future discussing the needs and problems might cause by e-wallet [2]. In 2010, Tamara S. Kingston and his team from United States applied for Patent for their Electronic Wallet which known as eWallet [3].

This is marked as the beginning of digital era whereby internet become the main requirement for all human around the world. One of the most successful electronic payment systems is PayPal whereby it is completely digital and supports all over the world. In Malaysia there are few popular eWallet service providers such as Boost, GrabPay, Lazada Wallet, Samsung Pay, Touch 'N Go eWallet, Maybank eWallet and many more [4]. Nonetheless, e-wallet isn't going to take off like wildfire in markets like Malaysia as most Malaysians have at least one debit card and banks have served the market well. Cash is commonly known and accessible on the market, while debit cards have been the biggest e-wallet competition [5].

E-wallet is an ongoing research with trial and error in the ICT. Thus, the plan of this investigation is to examine the literature published which is related to e-wallet using bibliometric analysis. Bibliometric analysis is a quantitative analysis of academic literature based on metrics [6].

Second section explains the methods used to conduct bibliometric analysis; third section gives the result of the analysis conducted. The final section summaries the result, future research and the limited or problems faced during this research.

## Methods

For this study, the data extracted from Scopus database as at 26<sup>th</sup> April 2020. Scopus is known as largest indexing database and single abstract ever built. According to Judy F Burnhan in 2006, the developers of Scopus claims 14,000 STM and science titles from over 4000 publishers which currently believed to be more than 11,000 publishers with 69 million records [7,8]. For this study, the focus was on all documents related to e-wallet as the title. The analytical result has been obtained are Document Type, Source Type, Year, Language, Subject Area, Country, Keyword, Author Count and Citations. Total number of documents obtained are 127 with the help of search query (TITLE("e-wallet")).

## Result

The data collected were analysed to identify Source Type, Document Type, Year, Language, Subject Area, Country, Keyword, Author Count and Citations. For quantitative analysis, the data were presented as frequency and percentage.

### Document and Source Type

Based on the data obtained, there were six types of document type which are Articles, Conference paper, Conference Review, Book Chapter, Note and Review. Highest number of were. Conference papers on Document Type refers to the papers presented in conference whereas some conference papers will be published on Conference proceedings, but the originality is from conference paper [9].

This study manages to gather all six document type, as per Table I, the mass publications were Articles which is 48.03%, followed by Conference paper which is 43.31%. The other 4 types were less than 5% of whole frequency of the document type. Notes and Review were the lowest which is 0.79%.

**Table I Document Type**

<i>Document Type</i>	<i>Frequency</i>	<i>%</i>
Article	61	48.03
Conference Paper	55	43.31
Conference Review	6	4.72
Book Chapter	3	2.36
Note	1	0.79
Review	1	0.79
<b>Total</b>	<b>127</b>	<b>100.00</b>

Table II shows the data for Source Type. There are five types of source which are Book Series, Conference Proceeding, Journals, Trade Publication and Book. The majority source contribution is Journals which is 44.88%, followed by Conference Proceeding 38.58%. Two lowest, below 5% are Trade Publication and Books.

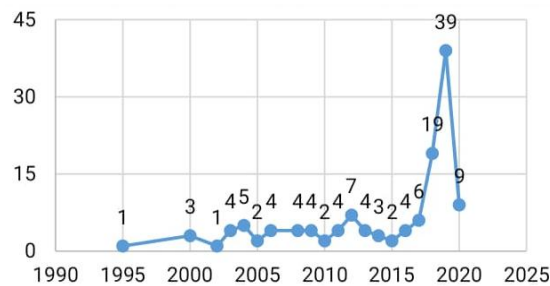
**Table II Source Type**

<i>Source Type</i>	<i>Frequency</i>	<i>%</i>
Book Series	16	12.60
Conference Proceedings	49	38.58
Journals	57	44.88
Trade Publication	4	3.15
Books	1	0.79
<b>Total</b>	<b>127</b>	<b>100.00</b>

### Year of Publications

For year of publications, based on the data collected from Scopus, the first document published was on 1995 which was by Yacobi, Yacov from United States regarding the “Efficient Electronic Money”. Next document was after 5 years which is on 2000. The number of papers on e-wallet was below 5 until 2016 except on 2012 there were 7 papers. Starting 2017 it shows a rapid growth which is more than double from the previous year whereby 2016 was 6, 2018 19 documents was published, in 2019, 39 documents was publish which is the highest. For 2020, during the first quarter there were already 9 documents, which can aspect more to come.

Figure 1 shows the illustration of the documents published since 1995 till first quarter of 2020, in total 127 documents. Based on the line graph, it is clearly showing the drastic increase of numbers from 2017 onwards.



**Figure 1 Total Number of Publications by Year**

### Languages of Documents

Table III shows the languages the documents were published. There are only Three languages which are English, Chinese and Serbian. English is the most published language

which is 97.64% of the documents were in English, followed by Chinese which is 1.57% and Serbian is the least popular languages which is 0.79%. Only 1 document was published which was in 2009 regarding the “Comparison of selected electronic payment methods”. There are two documents in Chinese language which was on 2005 and 2009, the rest of documents were in English.

**Table III Languages**

<i>Language</i>	<i>Frequency</i>	<i>%</i>
English	124	97.64
Chinese	2	1.57
Serbian	1	0.79
<b>Total</b>	<b>127</b>	<b>100.00</b>

### Subject Area

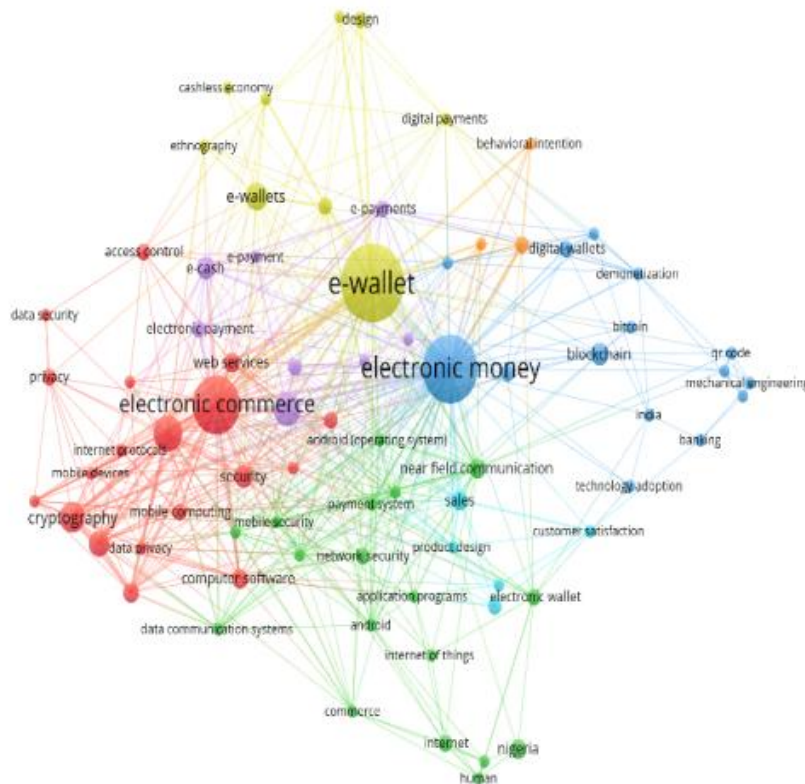
This is one of the most interesting section since we can visualize on which area or field research have been done regarding e-wallet. Generally, e-wallet is related to computer science, using this analysis it shows a lot other Subject Area that conducted or published document regarding e-wallet. In total there are Eighteen Subject Areas. Most studies on e-wallet were in Computer Science which is 35.62%, followed by 21.89% in Engineering, other areas were less than 10% contribution. The four least popular areas were Chemical Engineering, Chemistry, Earth and Planetary Science and last one Health Professions which are only 0.40% with 1 document each. The complete Subject Areas covered for e-wallet are tabulated in Table IV.

**Table IV Subject Area**

<i>Subject Area</i>	<i>Frequency</i>	<i>%</i>
Computer Science	83	33.33
Engineering	51	20.48
Business, Management and Accounting	23	9.24
Mathematics	19	7.63
Physics and Astronomy	13	5.22
Social Sciences	13	5.22
Economics, Econometrics and Finance	11	4.42
Decision Science	10	4.02
Agricultural and Biological Sciences	5	2.01
Energy	5	2.01
Medicine	5	2.01
Environmental Science	3	1.20
Biochemistry, Genetics and Molecular Science	2	0.80
Materials Science	2	0.80
Chemical Engineering	1	0.40
Chemistry	1	0.40
Earth and Planetary Science	1	0.40
Health Professions	1	0.40

## Keywords Analysis

For this study, 160 keywords produce by Scopus which is consider quite a lot for 127 documents. Based on the data produce by Scopus, using VOSviewer which one of the well-known tools for creating and visualizing bibliometric networks. Figure 2 shows a network visualization of the author keywords. The image visualizes the keywords in coloured circle, the font size of the keywords shows the frequency of appearance compare to other keywords and the lines represent the relationship with another keywords. For example, the keywords with same colours will be pointed together to show the connections. In this study, the main keyword is “e-wallet”” which has a close relation with digital payment, electronic wallet or cashless economy.



**Figure 2 Keyword Map**

Based on the number of occurrences, three most common keywords which occurred more than 20 occurrences of the Top 20 is Electronic Money, E-wallet and Electronic Commerce. Table V listed the Top 20 keywords which is commonly used in e-wallet research documents.

**Table V Keywords**

<i>Rank</i>	<i>Keyword</i>	<i>Frequency</i>
1	Electronic Money	26
2	E-wallet	24
3	Electronic Commerce	21
4	Smart Cards	11
5	Cryptography	9
6	E-commerce	8
7	E-Wallet	7
8	Security of Data	7
9	Blockchain	6
10	E-wallets	6
11	Security	6
12	Computer Software	5
13	E-cash	5
14	Near Field Communication	5
15	Network Protocols	5
16	Nigeria	5
17	Sales	5
18	Web Services	5
19	Access Control	4
20	Authentication	4

### **Geographical Distribution**

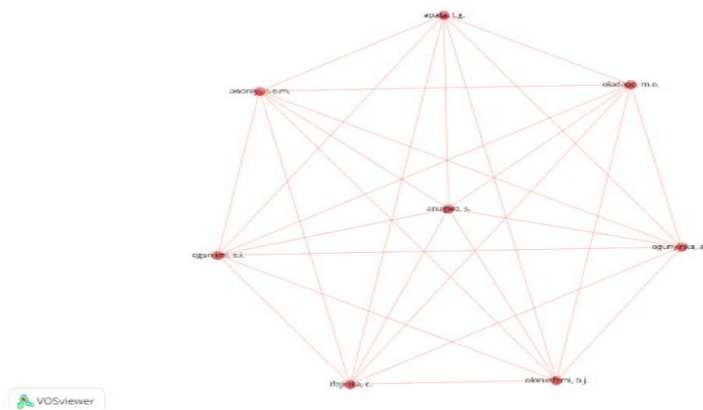
Based on data given, researchers and academicians from 33 different countries contributed for research or publication related to e-wallet. Table VI, Top 20 Countries contributed publications related to e-wallet listed. Based on the data, the greatest number of documents published is India with 41 documents, followed by United States 12 documents and Indonesia 10 documents. In terms of number of citations, the highest number will be France which is with 127 citations, Italy on the second place with 92 Citation and United States 87 citations. France with only 2 published documents has a highest number of citations, from this data we can predict that the impact of produced documents.

**Table VI Top 20 Countries Contributed To The Publication**

<b>Rank</b>	<b>Country</b>	<b>Total Publication</b>	<b>Total Citation</b>
1	India	41	15
2	United States	12	87
3	Indonesia	10	9
4	Nigeria	9	67
5	China	6	2
6	Malaysia	5	2
7	Italy	4	92
8	Denmark	3	15
9	Fiji	3	11
10	Iran	3	16
11	Lithuania	3	5
12	Canada	2	12
13	France	2	127
14	Germany	2	9
15	New Zealand	2	18
16	Russian Federation	2	0
17	Taiwan	2	2
18	United Kingdom	2	0
19	Australia	1	8
20	Croatia	1	0

### Number of Authors

Number of authors is to calculate the number of authors per documents. Using VOSviewer, relationship between the authors were created to analysis it. Figure 3 shows the relationship between authors from different documents. There were eight authors who had relationship or collaboration together.



**Figure 3 Authors Relationship**



Table VII shows the number of authors for each document. For single author, 11 (8.66%) which is the second highest. The highest percentage is 31.50% which is three authors per documents in total 40 documents. The highest number of authors per document is eight authors which is only 1 document (0.79%).

**Table VII Author Count**

<i>Author Count</i>	<i>Frequency</i>	<i>%</i>
0	6	4.72
1	11	8.66
2	37	29.13
3	40	31.50
4	16	12.60
5	12	9.45
6	4	3.15
7	0	0.00
8	1	0.79
9	0	0.00
<b>Total</b>	<b>127</b>	<b>100.00</b>

### **Citation Analysis**

This section is one of the complicated sections since must analyse all 127 documents and its citations. Harzing's Publish or Perish software was used to produce the Citation Metrics. Research Information System (.ris) format file downloaded from Scopus selecting all the 127 documents founded. Import the .ris file into the Publish or Perish software to analyse the data. The total number of citations for each one of the document based on Google Scholar citations. Table VIII shows the summary of citation metrics for all the 127 documents retrieved as per 27<sup>th</sup> April 2020, 0100. The summary includes the Citation per year, citation per paper and Author per paper. The data analysed is from year 1995 till 2020, in total 731 citations for 25 years. The h-index is 11.

**Table VIII Citation Metrics**

<i>Metrics</i>	<i>Information</i>
Reference date	27/4/2020 1:00
Pulication years	1995-2020
Citation years	25 (1955-2020)
Papers	127
Citations	731
Citations/year	29.24
Citations/paper	5.76
Authors/paper	2.84
h-index	11
g-index	25
PoP hI,norm	9
PoP hI,annual	0.36

Beside citation metric, Top 20 Cited documents in the field of “e-wallet” listed in Table IX. Document title “Semantic Web Technologies to reconcile privacy and context awareness” by F.L. Gandon and N.M. Sadeh on 2004 is the highest number of citations which is 127 citations with Google Scholar Rank (GSRank) 116. Document titled “Contextual Marketing – the real business of the internet on 2000 by D.Kenny and J.F. Marshall holds the highest GSRank which is 124 even the total number of citation for this specific document is only 110 which is about 17 less compare to the successor of it.

**Table IX Top 20 Cited documents in the field of “e-wallet”**

<i>No</i>	<i>Document Title</i>	<i>Authors</i>	<i>Year</i>	<i>Source</i>	<i>Cites</i>	<i>Cites Per Year</i>	<i>GS Rank</i>
1	Semantic web technologies to reconcile privacy and context awareness	F.L. Gandon, N.M. Sadeh	2004	Web Semantics	127	7.94	116
2	Contextual marketing--the real business of the Internet.	D. Kenny, J.F. Marshall	2000	Harvard Business Review	110	5.5	124
3	Software abstractions for trusted sensors	H. Liu, S. Saroiu, A. Wolman, H. Raj	2012	MobiSys'12 - Proceedings of the 10th International Conference on Mobile Systems, Applications, and Services	64	8	89
4	Virtual monotonic counters and count-limited objects using a TPM without a trusted OS	L.F.G. Sarmenta, M. Van Dijk, C.W. O'Donnell, J. Rhodes, S. Devadas	2006	Proceedings of the First ACM Workshop on Scalable Trusted Computing, STC'06. A workshop held in conjunction with the 13th ACM Conference on Computer and Communications Security, CCS'06	60	4.29	108
5	A Smart Parking System based on IoT protocols and emerging enabling technologies	L. Mainetti, L. Patrono, M.L. Stefanizzi, R. Vergallo	2015	IEEE World Forum on Internet of Things, WF-IoT 2015 - Proceedings	42	8.4	79
6	Integration of RFID and WSN technologies in a Smart Parking System	L. Mainetti, L. Palano, L. Patrono, M.L. Stefanizzi, R. Vergallo	2014	2014 22nd International Conference on Software, Telecommunications and Computer Networks, SoftCOM 2014	38	6.33	82

7	Young rural women's participation in the e-wallet programme and usage intensity of modern agricultural inputs in Nigeria	J.I. Uduji, E.N. Okolo-Obasi	2018	Gender, Technology and Development	30	15	63
8	From meiwaku to tokushita! lessons for digital money design from Japan	S.D. Mainwaring, W. March, B. Maurer	2008	Conference on Human Factors in Computing Systems - Proceedings	26	2.17	104
9	A Semantic e-Wallet to reconcile privacy and context awareness	F.L. Gandon, N.M. Sadeh	2003	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	25	1.47	119
10	Adoption of improved crop varieties by involving farmers in the e-wallet program in Nigeria	J.I. Uduji, E.N. Okolo-Obasi	2018	Journal of Crop Improvement	23	11.5	54
11	On-line E-wallet system with decentralized credential keepers	S.F. Mjalsnes, C. Rong	2003	Mobile Networks and Applications	13	0.76	121
12	The impact of e-wallet on informal farm entrepreneurship development in rural Nigeria	J.I. Uduji, E.N. Okolo-Obasi, S.A. Asongu	2019	Electronic Journal of Information Systems in Developing Countries	11	11	41
13	Three kinds of E-wallets for a NetPay micro-payment system	X. Dai, J. Grundy	2004	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	11	0.69	115
14	Pseudonym technology for e-services	R. Song, L. Korba, G. Yee	2006	Privacy Protection for E-Services	11	0.79	109
15	Enhancing security and confidentiality on mobile devices by location-based data encryption	R. Karimi, M. Kalantari	2011	ICON 2011 - 17th IEEE International Conference on Networks	10	1.11	94

16	Designing digital payment artifacts	M. Olsen, J. Hedman, R. Vatrapu	2012	ACM International Conference Proceeding Series	9	1.13	88
17	Locking down the e-wallet	T. Caldwell	2012	Computer Fraud and Security	8	1	91
18	Parasitic authentication to protect your e-wallet	T. Ebringer, P. Thorne, Y. Zheng	2000	Computer	8	0.4	125
19	Mobile local macropayments: Security and prototyping	G. Me, M.A. Strangio, A. Schuster	2006	IEEE Pervasive Computing	7	0.5	111
20	Customer perceptions of a thin-client micro-payment system: Issues and experiences	X. Dai, J. Grundy	2003	Journal of End User Computing	7	0.41	120

## **Conclusion**

This paper presents a bibliometric analysis provide a clear trend, history, growth and contribution of researches and reviews on field of e-wallet. Based on the information gathered, the first document published is on 1995, the research shows extreme increase after 2017 and expected to increase more in 2020 since as per April 2019 already 9 documents published. Researches regarding e-wallet is written by multiple authors with number of collaborations maximum of 8 authors for one documents and highest number of 3 authors per documents.

This study also shows that, authors used similar keyword to represent e-wallet and the most used are digital payment and electronic wallet. Based on geographical distribution, the most numbers of documents published is from India followed by United States. The research on e-wallet should be conducted in other developing countries too since it will create more technological impact to the country's economy.

Our study has a few limitations, first the usage on Scopus database. Scopus is largest database in the world for published documents, but there is few incomplete information. For example, 6 documents without Authors name which predicted the documents is not published since unable to find the documents in any other online resources. For citation analysis, the data is extracted from Google Scholar and Scopus, the information presented in this paper is valid as per accessed date and time. The real number of citations may vary from time to time. Besides all these limitations listed, this study is the first bibliometric analysis conducted specifically on e-wallet.

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