
電子商務策略藍圖(1990-2017): 文獻回顧

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在這幾十年當中，電子商務 (EC) 已成為最秀的研究領域。為了釐清 EC 的知識藍圖，並指出 EC 的研究熱點和未來的發展趨勢，本文以 Scopus 學術資料庫針對 1990 年至 2017 年的 EC 研究進行全面的文獻回顧。根據選取的 11669 篇 EC 文章，我們發現這些文章分別分散在 1717 種不同期刊，而其最初的研究始於 1992 年，在 1997 年起才有顯著地增加，並在 2000 年達到出版的高峰。美國是 EC 出版與被引用最多的國家。此外，美國，英國和加拿大是 EC 學術合作聯盟中排名前三的國家。根據 11669 篇文章所獲得的 18315 個關鍵字，我們歸納 7 個 EC 不同研究主題。本研究的貢獻在提供一種方法能將 EC 的研究範圍予以概念化與操作化，並發展一個概念性架構來組織 EC 的大量研究。最後本研究有一些討論和結論。

關鍵字：電子商務、策略藍圖、文獻回顧、研究熱點、趨勢

Strategic Mapping of e-Commerce from 1990 to 2017: A Literature Review

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During these decades, e-commerce (EC) becomes an exciting and hot research area. To figure out the knowledge mapping of EC and to indicate its research hot spots and trends for future research, this paper made a comprehensive literature review on EC from 1990 to 2017 based on Scopus academic database. Based on the scope of 11669 EC articles, we found that these articles scattered across 1717 different journals while the research output began in 1992, significantly increased since 1997 and was at the peak of publications in 2000. The United States is the country with the most publication and the most citations. Besides, United States, United Kingdom and Canada are the top 3 collaboration cores in EC alliance. According to 18315 keywords from 11669 articles, we explored 7 clusters which represented different research subjects in EC. The contribution of our study is to provide a means to conceptualize and operationalize the coverage of EC. It provides a conceptual framework to organize this vast body of research. This study ends with some discussions and conclusions.

Keywords : E-Commerce, Strategic Mapping, Literature Review, Research Hot Spots, Trend

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Introduction

No matter your business model is B2B or B2C, traditional business in the past mostly relied on physical channels. With the development of the Internet and commercialization since 1994 (Peterson et al., 1997; Poon and Jevons, 1997), there are many changes in the modern global economy (Vaithianathan, 2010). Electronic commerce/or e-commerce (thereafter EC) is one of the most notable changes at that time. EC, in a broad sense, is the use of computer networks to improve organizational performance (Watson et al., 2008). EC can be defined as a channel (Abukhader and Jönson, 2003) and platform (Shafiyah et al., 2013), which use Internet and other networking technologies to achieve business transactions (Ngai and Wat, 2002; Turban et al., 2004). Due to its convenience on shopping on the Internet, EC is extremely useful for customers and sellers (Shafiyah et al., 2013). With the help of development of Internet, EC presented an exponential rate (Gefen, 2000). Because of its relative novelty and exploding growth, EC becomes an exciting and hot research area (Ngai and Wat, 2002). Therefore, this paper will take the EC into account and make a comprehensive analysis on it.

As the development of EC, its topics have been widely discussed, such as familiarity and trust (e.g., Gefen, 2000), trust measures (e.g., McKnight et al., 2002), environment and policy (e.g., Gibbs et al., 2003), mobility and accessibility (e.g., Visser and Lanzendorf, 2004), recommendation applications (e.g., Chen and Wang, 2013; Li and Karahanna, 2015), success of system (e.g., Wang, 2008), quality (e.g., Gotzamani and Tzavlopoulos, 2009), mobile commerce (e.g., Lun et al., 2014), and big data (e.g., Akter and Wamba, 2016). Therefore, it is evident that EC involves many aspects and topics (Lisovskaya and Marchenko, 2013). Basically, the research scope of extant literature review related to EC is diverse. Some for specific issues- classification (e.g., Ngai and Wat, 2002; Wang et al., 2007); retail process (e.g., Burt and Sparks, 2003), b2b (e.g., Visser and Lanzendorf, 2004), personalization research (e.g., Adolphs and Winkelmann, 2010), mobile EC (Lun et al., 2014), value co-creation (e.g., Paredes et al., 2014), application at agri-food (e.g.,

Zeng et al., 2017) and big data (e.g., Akter and Wamba, 2016); some for specific perspective-logistics (e.g., Mangiaracina et al., 2015), cross-border (e.g., Giuffrida et al., 2017) and cross-culture (e.g., Liao et al., 2008); some for the country developing EC- China (e.g., Li et al., 2010), India (e.g., Vaithianathan, 2010) and Malaysia (e.g., Izzah et al., 2016).

The use of literature reviews is necessary for those seeking to better understand the issues associated with a topic of research (Burgess et al., 2006) and to provide direction for future studies that can address existing knowledge gaps. Though there already have existed literature reviews on EC, there still have some rooms to improve. First, the lack of hot spots of EC research makes researchers more confused about the point. Second, it is not clear about the evolution of EC which is experiencing a long period near 30 years. Third, it is necessary to figure out the new trends of EC and its applications, including Big data (e.g., Chen et al., 2012; McAfee et al., 2012), social media (e.g., Hariguna and Berlilana, 2017; Yan et al., 2016) and artificial intelligence (e.g., Lei, 2017).

Bibliometrics is a statistical method that is commonly used in academic literature review for quantifying the assessment of scientific outputs (Bellis, 2009). Among past literature, some scholars used bibliometric methods to explore EC related studies, for example, global trends of EC (e.g., Hou and Lin, 2014; Lin et al., 2016), key factors in the adoption of EC (e.g., Villa et al., 2018) and business models, service relationships, and technology (e.g., Yoo and Jang, 2019). To make the concept of EC more accessible, here we present a comprehensive survey of published research on EC from 1990 to 2017 and explore its research hot spots, evolution and trends as well as comparisons between this study and those using bibliometric methods. Based on these analyses, we then present a conceptual model capturing the relationships between the domains of EC research. This is followed by a discussion of some of the limitations of our research as well as directions for further research and some brief conclusions.

Data and research tool

Data collection

To get a list of articles for our survey, we selected the Scopus created by Elsevier to collect the literatures. Why we choose Scopus? There are 3 major considerations: (1) it is the largest database (Chadegani et al., 2013; de Moya-Anegón et al., 2007; Falagas et al., 2008) compared with Pubmed and Web of Science; (2) this database not only covers a superior number of journals (Chadegani et al., 2013) and all areas of knowledge (de Moya-Anegón et al., 2007), but also records all the references cited since 1966; (3) over 4.5 million articles have been reprocessed to index more cited references here with over 1.4 billion cited references in 2017. The Scopus database was searched with the keyword phrase “e-commerce” and “electronic commerce” from 1990 to 2017 on Nov. 20, 2017 to provide a complete academic trajectory of EC. We started with approximately 15 thousands papers based on the descriptor mentioned previously. As the amount of these articles is enormous, therefore, we decided to eliminate some papers, such as conference papers, textbooks and unpublished working papers and so on. The selection criteria here are similar to Liao et al. (2011) and Chang and Katrichis (2016), suggesting that academics and practitioners alike most often use journals to acquire information and disseminate new findings. In general, journals represent the highest level of research (Nord and Nord, 1995). After filtering these original papers, we finally selected 11699 articles for following analyses.

Research method- VOSviewer

The main research tool used here to analyze the knowledge mapping of EC was VOSviewer (thereafter VOS). It is an effective analytical tool for bibliometric mapping, science mapping and visualization (van Eck and Waltman, 2010, 2017). According to its functions, it can be used to construct a network of publications, journals, researchers, affiliations/organizations/institutes, countries and keywords and so on. Since VOS mapping technique and VOS clustering technique were the two critical technique in analyzing bibliometric mapping (Heersmink et al., 2011). Most importantly, VOS mapping technique could build a two-dimensional map in which any element

located in such a way that the distance between any pair of items reflects their similarity as accurately as possible (Waltman et al., 2010). By contrast, VOS clustering technique was similar to the clustering (Heersmink et al., 2011), which can reflect the similar research spots according to the algorithm based on modularity. Different from the most computer programs (i.e., Citespace) for bibliometric mapping, VOS pays special attention to the graphical representation (van Eck and Waltman, 2010). Therefore, we used VOS in our survey to get network visualization maps, density visualization maps and clusters of each keyword.

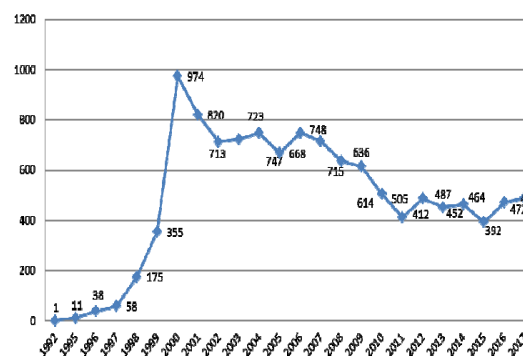


Fig.1 The development of literatures of EC

Data analysis and results

Articles characteristics

The distribution of articles published by year was shown in Fig.1. Research output in EC began in 1992, significantly increased since 1997 and was at the peak of article publications in 2000. Next, we would divide the whole development trajectory into four periods, including initial introduction period (1990-1997), rapid growth period (1998-2000), downward oscillation period (2001-2010) and stable development period (2011-2017), respectively. In the first period (1990-1997) there were 108 articles (0.93% of the total), with the total of the next period (1998-2000) accounting for 1504 articles (12.89% of the total). In the following decade (2001-2010), 59.03% of the total was published while the last period (2011-2017) accounted for 27.14% of the total. Most interestingly, the article production amount of rapid growth period was almost half of that of stable development period. Therefore, the rapid growth period is

the glory of EC can hardly be overemphasized; Even though the overall growth trend is ups and downs since 2001, the article production amount of stable development period has reached approximately 46% of the downward oscillation period. Therefore, the next glory of EC is worth looking forward to.

There were 11669 articles on EC were published in a total of 1717 different journals. The top 20 journals in terms of frequency of article publication were shown in Fig. 2. Of these 20 journals, 8 were (42.4% of the total) dealing with systems, including Decision Support Systems, Expert Systems with Applications, Industrial Management and Data Systems, Journal of Management Information Systems, Journal of Computer Information Systems, Information Systems Research and Computer Integrated Manufacturing Systems. The other 5 were on computer-based and encounter for 507 articles (20.8% of the total), including Lecture Notes in Computer Science, Manufacturing Computer Solutions, Computers in Human Behavior, IEEE Internet Computing and Computers and Security. There were 3 journals related to information management and management science, including Information and Management, International Journal of Information Management and Management Science. Their papers were 14.6% of the total; The 2 journals (15.5% of the total), including Electronic Commerce Research and Applications and Journal of Electronic Commerce in Organizations were clearly consistent with the key word “e-commerce”; The remaining journals were broader in purpose in that they do not align with specific disciplines and collectively accounted for 162 articles (6.7% of the total). To sum up, the paper amount of the top 20 journals (2434 article) only shared 20.86% of the total, meaning that the applications of EC would not be restricted to few of journals.

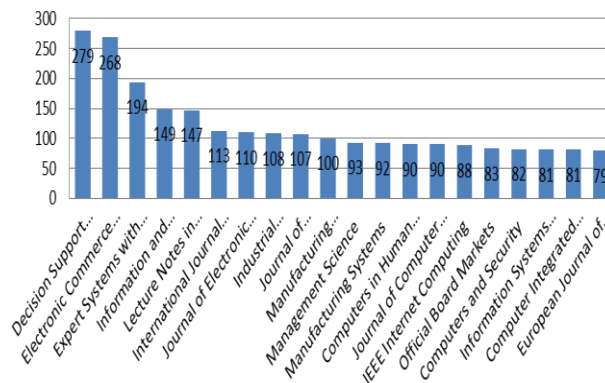


Fig.2 The top 20 journals for EC

Country analysis

In this section, we would make 3 country analyses related to EC. First, we would examine all these 68 countries where authors have published their papers more than 5 times. According to the Fig.3, authors of EC papers majorly came from 6 continents, including United States, China, United Kingdom, Canada, Australia and India. In a word, authors from these 6 countries published more papers than those from other countries.

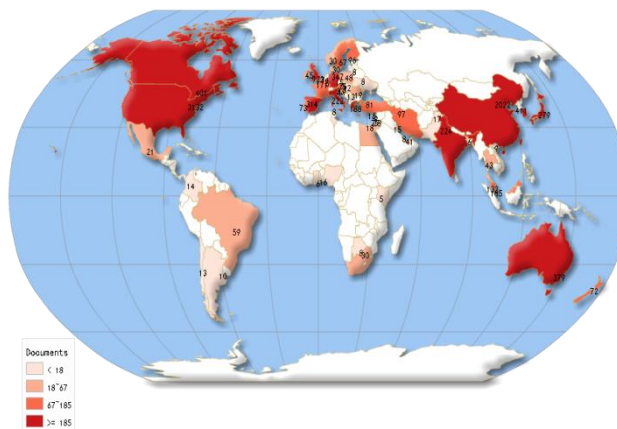


Fig.3 Country distribution of article publications more than five times

Next, we would examine the countries where these articles on EC have been published. A list of countries with a minimum contribution of 300 articles was shown in Table 1. Overall, there were 10 countries having published more than 300 EC papers and these countries have contributed 77.7% of the total. Specifically, the United States not only has the most papers (26.84% of total) among these 10 countries, but also has the most citations. Most interestingly, China has 17.33% of the total papers which is greater than that of Taiwan (7% of the total), but the number of citations is less than Taiwan. From this, it is reasonably to conclude that the reference value of Taiwan’s EC papers is significantly higher than

that of China’s EC papers.

As most of EC papers here were finished through international collaboration, therefore, we further examined the inter-country collaboration among various countries (see Fig.4). The thickness of the connecting lines in Fig.4 represented the extent of collaboration between two countries (Sweileh, 2017; Sweileh et al., 2017). Obviously, United States is standing at the core of collaboration networks while its major academic partners are China, Hong Kong, Taiwan and United Kingdom, respectively. By contrast, the United Kingdom and China were the next two collaboration cores.

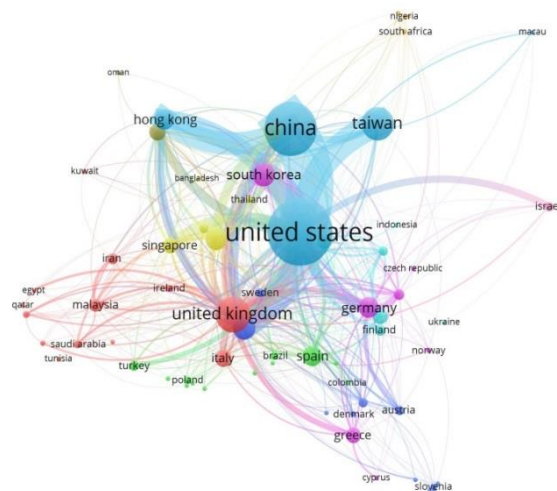


Fig.4 Inter-country collaborations among countries with minimum of 5 publications

Table 1 List of countries with a minimum contribution of 300 papers

Country/Region	Documents	Percentage of the total	Citations
United states	3132	26.84%	141960
China	2022	17.33%	11963
United Kingdom	923	7.91%	19250
Taiwan	817	7.00%	21966
South Korea	411	3.52%	11337
Canada	401	3.44%	19473
Australia	379	3.25%	11842
Germany	347	2.97%	6636
Hong Kong	321	2.75%	11431
Spain	314	2.69%	5772
Total	9067	77.7%	261630

Table 2 Top 10 highly cited authors in EC field

Author/Country	Citations	Documents	Average citations per paper	Affiliations
Benbasat, I. (Canada)	5559	31	179.32	The University of British Columbia
Gefen, D. (US)	4659	9	517.67	Drexel University
Straub, D.W. (US)	4322	7	617.43	Georgia State University
Pavlou. P.A. (US)	2863	10	286.3	Temple University
Gunasekaran,A. (UK)	2017	14	144.07	Brunel University
Ngai, E.W.T. (HK)	1877	19	98.79	The Hong Kong Polytechnic University
Zhu, K. (UK)	1772	6	295.33	University of California
Kauffman R.J. (US)	1706	30	56.87	University of Minnesota
Liu L. (US)	1552	25	62.08	University of Akron
Kim D.J. (US)	1531	11	139.18	University of North Texas

Highly cited authors and co-authorship

In our survey, there were 17558 authors having devoted themselves to the research of EC during 1990 to 2017. Based on the rule for one author with minimum 25 articles in that period, the Top 10 of the 32 qualified authors with high citations were categorized in Table.2. Among them, there were 6 authors from the United State, 2 from the Unite Kingdom, one from Hong Kong and one from Canada. Especially, the author Benbasat, I., working at the University of British Columbia, Canada, had become the most cited author with 5539 citations and 179.32 average citations per paper. On the other hand, the author Straub, D.W. from Georgia State University had the highest average citations per paper (617.43) among the top 10 highly cited authors and followed by Gefen, D. from Drexel University with 517.67 average citations per paper. Most importantly, this paper also analyzed the co-occurrence of authors in EC. Picking those papers with a minimum 10 documents and total 150 citations of an author at least, then the co-occurrence network was visualized using VOS technique with weight of citations

and presented in Fig.5.

The strength of collaboration among authors was measured by the thickness of connecting lines which was numerically represented as relative link strength. The larger circle size indicated greater citations (e.g., van Eck and Waltman, 2010). In Fig. 5, there were 97 circles in which each circle represented each author. Closer circles indicate authors with close research collaboration. According to Fig.5, many authors had close relationship with others, such as Benbasat, I., Ratnasingam, P. and Wang W. In addition, the network visualization map also helped us to find the research team of authors in EC fields. Based on Fig.5, each cluster stood for a research group with same color. In view of this, there were 22 clusters (i.e., 22 research groups of authors), for example, the group of Benbasat was composed of the following authors: Benbasat, I., Cheung, C.M., Gupta, A., Lee, M., Pavlou, P.A., Ratnasingam, P., Wang, W. and Whinston, A.B.

Table 3 Hot research subjects in EC from 1990 to 2017

Subject	Keywords
Consumer behavior (15)	<i>B2C, China, Consumer behavior, Customer loyalty, Customer satisfaction, Internet banking, M-commerce, Mobile commerce, Online shopping, Perceived risk, Satisfaction, Service quality, Technology acceptance model, Technology adoption and Trust.</i>
Technology (14)	<i>Agent, E-business, E-government, Electronic business, Information systems, Information technology, Knowledge management, Multi-agent systems, Negotiation, Ontology, Supply chain, Supply chain management, Web service, XML.</i>
Security (8)	<i>Anonymity, Authentication, Cryptography, Digital signature, Information Security, Mobile agent, Privacy, Security</i>
Process management (7)	<i>Clustering, Collaborative filtering, Data mining, Personalization, Recommendation system, Recommender system, Reputation</i>
Online game strategy (7)	<i>Auctions, E-commerce, Electronic markets, Game theory, Marketing, Online auctions, Pricing</i>
Sales channels (5)	<i>Internet, Internet marketing, Internet shopping, Retailing, Small to medium-sized enterprise</i>
New application and development (4)	<i>Adoption, Case study, Innovation and Smart city</i>

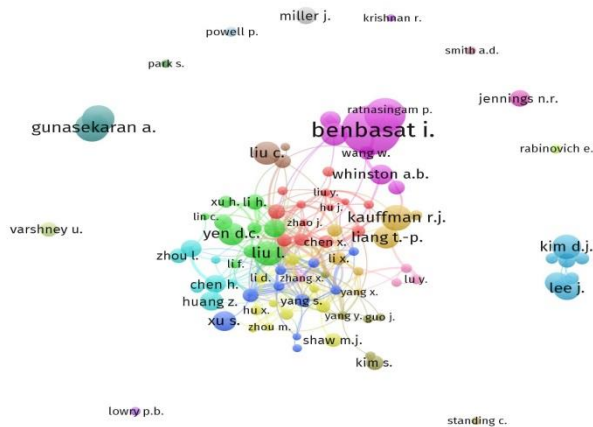


Fig.5 Network visualization map of active authors in EC

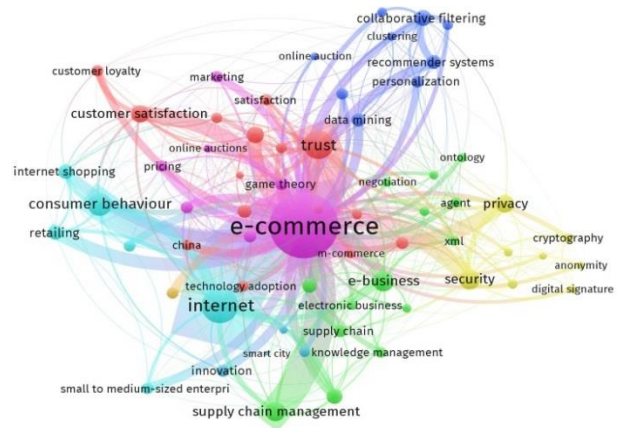


Fig.6 The co-occurrence of keywords in EC

Popular topics and trends

A literature review is a description of the literature relevant to a particular field or topic (Chang and Katrichis, 2016, p. 793). Keywords studies is not only an approach for literature review (Huimin, 2016). Therefore, we can use keyword co-occurrence network analysis to get spotlights from keywords (Hu et al., 2016; Su and Lee, 2010; Xiao et al., 2017) and get the research direction (Ruan et al., 2016). Therefore, this paper used keyword co-occurrence network analysis to reveal research hot spots and its evolution of research topics in EC. Based on 18315 keywords from 11669 articles, this paper using VOS and picked qualified papers we needed with a minimum 40 co-occurrence of a keyword. As a result, we found 60 keywords suitable for the criteria in Fig. 6. The top 10 keywords here were e-commerce, internet, trust, e-business, supply chain management, security, online shopping, consumer behavior, customer satisfaction, privacy. Next, this paper further classified these 60 keywords into 7 clusters which represented different research subjects in EC, including consumer behavior, technology, security, process management, on-line game strategy, sales channels and new application and development. These 7 clusters were shown in Table 3.

EC literature with keywords "consumer behavior"

Using a sample of 125 Spanish firms, Martin et al. (2012) suggested that the perception of performance by firms engaging in m-commerce depends on the extent to which firms' activity fits mobile business, technological competence and customer value for the firm. Based on the jewelry market of Africa and China, Zhou et al. (2013) argued that there was a significant implication of an innovative B2C business model in the jewelry industry by creating superior customer experiences. Besides, e-banking service quality would affect customer satisfaction (Hussien and El Aziz, 2013). Hong and Cha (2013) conclude that the reduction of risks will first improve consumer trust, and then increase consumer's intention to buy online. Finally, China is the most used Eastern country in ecommerce (e.g., Martinsons, 2002; Tong, 2010; Zhou et al., 2013), meaning the applications of EC are popularized through this big country. EC literature with keywords "consumer behavior" is categorized in Table 4.

EC literature with keywords "technology"

Undoubtedly, there were many technologies used in EC (Rosaci and Sarnè, 2014). With continuous development of EC, business supply chain has undergone enormous changes, which increasingly reflected in the supply chain management based on the EC (Yang, 2012). Vahidov and Fazlollahi (2003) argued that a combination of decision support system (DSS) and agent technologies would prove a powerful tool for rendering decision support in EC application. Today, many industries have adopted information system/technologies in EC, for example, manufacturing (e.g., Cao and Dowlatshahi,

2005); tourism (e.g., Chang and Chou, 2007), airline (e.g., Granados et al., 2008), banking (e.g., Farzaneh et al., 2015), retailing (e.g., Bakos et al., 2005) and wood (e.g., Trang et al., 2016). Many firms begin to establish knowledge management systems (KMS) to gain competitive advantage (Huosong et al., 2003) in the emerging economy in which EC knowledge is an important part of organizational puzzle (Kumar, 2017). While existing agent-based systems had addressed the crucial/difficult issues of automated negotiation and auction (Sim and Wong, 2001), the importance/benefits of Web services for process management in e-business is requisite (Zhang, 2004). EC literature with keywords "technology" is categorized in Table 5.

EC literature with keywords "security"

Due to the openness of EC, there were many security issues in EC, such as system security (e.g., Lam et al., 2003), information security (e.g., Liao and Shi, 2017), customer privacy (e.g., Kelly, 2000; Liu et al., 2005; Wang et al., 1998) and network/Internet security (e.g., Turban and Gehrke, 2000; Shoniregun, 2003). Basically, there are some security mechanisms in EC, including anonymity, authentication, cryptography and digital signature to guarantee customer's privacy and security thorough the transaction process. Privacy protection is a very complex issue. It is not simply a technical, but mostly an economical, social, and legal issue, that involves multiple parties often with conflicting interests (Head and Yuan, 2001). In context of tourism, web functionality, web content, and information security positively influence consumers' perceived value of online tourism services (Liao and Shi, 2017). On the other hand, traditional approaches for authorization and access control in computer systems are not appropriate to address the requirements of networked systems and that proper authorization and access control requires infrastructural support in one way or another (Lopez et al., 2004). An e-business participant can generate a mobile, intelligent agent via some mobile devices (such as a personal digital assistant or mobile phone) and dispatch the agent to the Internet to do business on his/her behalf (Weng and Tran, 2007). Since known intelligent trade agents (ITA) systems do not provide anonymity in transactions, therefore, it requires an on-line trusted third party and implicitly assumes that the user trusts the ITA (e.g., Domingo-Ferrer and Herrera-Joancomartí, 1998). EC literature with keywords "security" is categorized in Table 6.

EC literature with keywords "process management"

Compared with Single-pass clustering algorithm, the K-means clustering algorithm has a high intra-class dissimilarity and inter-class similarity when analyzing ecommerce transaction. Besides, the K-means clustering algorithm has very high efficiency and strong elasticity when dealing with a large number of data items (Huang and Song, 2014). Data mining is a set of automated techniques used to extract buried or previously unknown pieces of information from large databases, using different criteria, which makes it possible to discover patterns and relationships (Rastegari and Md. Sap, 2008). Data mining as a whole is believed to be a good promoter of EC (Ismail et al., 2015). Personalized recommendation by predicting user-browsing behavior using association-mining technology has gained much attention in web personalization research area (Wang and Shao, 2004). EC literature with keywords "process management" is categorized in Table 7.

EC literature with keywords "online game strategy"

Dominici (2011) suggested that game theory seems to be an ideal candidate for firms to face complex business environment and let them equipped with more effective tools to consider the effect of the strategic choices of the actors of the market and to supply information useful for managerial decision process. EC market is traditionally thought as winner-takes-all market, and the winner is usually decided upon the factor of how much discounts they can offer (Agrawal, 2016). Byde (2004) demonstrated that simulated evolutionary game theory can be used to explore a space of auction mechanisms and have established the superiority of nonstandard auction types in a variety of common environments. EC literature with keywords "online game strategy" is categorized in Table 8.

EC literature with keywords "sales channels"

Channels are organized structures of buyers and sellers that bridge the gap of time and space between the manufacturer and the customer (Jain, 2000, p. 444). Specially, small to medium-sized enterprise often used sales channels such as Internet, Internet marketing, Internet shopping to engage in retailing (e.g., Jung et al., 2014; Rasheed, 2009). From the very beginning, the

potential of the Internet as a radically different and a highly effective communications channel appeared obvious: global reach; ease of access; enhanced interactivity, flexibility and speed; ability to communicate large amounts of information, cost efficiency and ease of maintenance (Pyle, 1996; Jones and Visayasarthi, 1998). EC literature with keywords "sales channels" is categorized in Table 9.

EC literature with keywords "new applications and development"

Social commerce is the use of social media, in the context of e-commerce, to assist with buying and selling products and services online, while Web 2.0 enterprises are best off building their own networking platform in terms of increasing sales (Lai, 2010). Dewan et al. (2003) argued that these Internet commerce technologies would offer significant advantages to an early adopter who gains market share and profits at the expense of the conventional seller. On the other hand, the technology, big data has the potential to be the foundation of making a smart city (CIORReview, 2018). Smart cities and smart enterprises deal with the integration of artificial

intelligence (AI), web technologies, smart mobile platforms, telecommunications, e-commerce, e-business, and other technologies (Impedovo and Pirlo, 2020). Therefore, smart cities can refer to the combination of AI and big data to EC.

Among extant literature in EC, most of them were using case study methodology, such as small to medium-sized enterprise (e.g., Ramelet and Bauer, 1999), smart city (e.g., Difallah et al., 2013; Lee et al., 2014); supply chain (e.g., Kurnia and Johnston, 2000), health information networks (e.g., Payton, 2000) and so on. Besides, the new adoption and development in EC was also a research hot spot. For example, more and more researchers focused on the innovation related issues in EC (e.g., Koellinger, 2008; Power, 2009; Tsao, 2014), including value innovation (e.g., El Sawy et al., 1999), innovation adoption (e.g., Hung et al., 2011) and innovation diffusion (e.g., Lee, 1998; Dos Santos and Peffers, 1998; Kocas, 2002) and so on. EC literature with keywords "new applications and development" is categorized in Table 10.

Table 4 Keywords involving consumer behavior in EC

Keyword index	Researchers
B2C	Kim et al. (2009); Zhou et al. (2013)
China	Martinsons (2002); Tong (2010); Zhou et al. (2013)
Consumer behavior	Strader & Shaw (1997); Chiang et al., (2006); Lin (2008)
Customer loyalty/customer satisfaction	Caruana & Ewing (2006); Hussien & El Aziz (2013); Park & Kim (2014)
Internet banking	Hussien & El Aziz (2013)
Customer Relationship Management (CRM)	Kampani & Jhamb (2020)
Mobile commerce/M-commerce	Martin et al. (2012)
Online shopping	Caruana & Ewing (2006); Hasan (2010); Li (2010)
Perceived risks	Hong & Cha (2013)
Service quality	Hussien & El Aziz (2013)
Technology acceptance model	Lee & Lee (2003); Sheridan et al. (2009)
Technology adoption	Basu & Muylle (2003); Fabrizi (2011)
Trust	Pavlou & Fygenson (2006); Hong & Cha (2013)

Table 5 Keywords involving technology in EC

Keyword index	Researchers
Information systems/technology	Khalifa & Davison (2006); Bakos et al. (2005); Trang et al. (2016); Cao & Dowlatshahi (2005); Granados et al. (2008); Chang & Chou (2007); Farzaneh et al. (2015)
Knowledge management	Filos & Banahan (2001); Maruyama (2002); Mclean & Blackie (2004); Huosong et al. (2003); Gao (2006)
Multi-agent systems	Vahidov & Fazlollahi (2003);
Negotiation	Sim & Wong (2001); Brazier et al. (2002);
Ontology	Howard & Kerschberg (2004); García et al. (2016)
Supply chain management	El Sawy et al. (1999); Tarn et al. (2002); Sila (2015);
Web service	Maruyama (2002); Howard & Kerschberg (2004);
XML	Maruyama (2002);

Table 6 Keywords involving security in EC

Keyword index	Researchers
Anonymity	Domingo-Ferrer & Herrera-Joancomartí (1998); Head & Yuan (2001)
Authentication	Al-Helali Adnan & Zhang (2003); Frikken et al. (2006); Lopez et al. (2004)
Cryptography	Hwanget al. (2002); Chow et al. (2006)
Digital signature	Eigeles (2005); Hernandez-Ardieta et al. (2008); Song & Chen (2009);
Information Security	Grazioli & Jarvenpaa (2003); Liaw et al. (2006); Liao & Shi (2017);
Mobile agent	Hamza et al. (2005); Benachenhou & Pierre (2006); Weng & Tran (2007);
Privacy	Head & Yuan (2001); Smith & Manna (2004); Frikken et al. (2006);

Table 7 Keywords involving process management in EC

Keyword index	Researchers
Clustering	Kim (2007); Tang et al. (2013);
Collaborative filtering	Wang & Shao (2004);
Data mining	Mansingh et al. (2013); Ismail et al. (2015);
Personalization	Iwata et al. (2008); López-Nores et al. (2009)
Recommendation system	Iwata et al. (2008)

Table 8 Keywords involving online game strategy in EC

Keyword index	Researchers
Auctions	Byde (2004); Kim et al. (2009); Zhou et al. (2013)
e-market	Tong (2010); Zhou et al. (2013)
Game theory	Strader & Shaw (1997); Chiang et al., (2006); Lin (2008);
Marketing	Hussien & El Aziz (2013)
Pricing	Pavlou & Fygenson (2006); Hong & Cha (2013)

Table 9 Keywords involving sales channels in EC

Keyword index	Researchers
Internet marketing	Novak et al. (2000); Smith & Manna (2004)
Internet shopping	Moon et al. (2000);
Retailing	Burt & Sparks (2003); Abdoli et al. (2012);
Small to medium-sized enterprise	Gilmore et al. (2007); Jones et al. (2011)

Table 10 Keywords involving new applications and development in EC

Keyword index	Researchers
Adoption	Luo et al. (2000); Dewan et al. (2003); Campbell et al. (2013); Senarathna et al. (2014)
Case study	Ramelet & Bauer (1999); Payton (2000); Kurnia & Johnston (2000); Lee et al. (2014);
Innovation	Dos Santos & Peffers, 1998; El Sawyet al. (1999); Tsao (2014); Lee (1998); Kocas (2002); Koellinger (2008); Power (2009);
Social media	Lai (2010); Hariguna & Berlilana (2017); Singh & Singh (2018);
Smart city	Difallah et al. (2013); Lee et al. (2014);

The evolution of research hot topics

This section, we would further examine the evolution of keywords in EC during the 4 periods mentioned previously. The information of Table 11 represented the

total keywords, clusters, items, links and total link strength among 4 different periods, respectively. On the other hand, the 4 visualized maps (see fig. 7) drawn from the VOS technique released the trajectory of keyword clusters in EC. The meanings of these changes from their individual periods were described as follow:

Table 11 The overall change of keywords

Period	Total keywords	Clusters	Items	Links	Total link strength
initial introduction period(1992-1997)	167	24	128	466	498
rapid growth period (1998-2000)	770	23	103	270	424
downward oscillation period (2001-2010)	11509	8	97	998	4077
stable development period (2011-2017)	8525	10	116	861	2183

From Table 11, we found that the number of total keywords from the first 2 periods were much smaller than that from the last 2 periods. It possibly showed that the mass articles of EC came from 2001. On the contrary, the clusters from the first 2 periods were greater than that from the last 2 periods, meaning there was a scattered feature of research in EC before 2000. As to the total link strength, the keywords from the last 2 periods showed much stronger connections with others rather than that from the first 2 periods. It appeared that the trend of recent research in EC had reached more diverse and distinguished. Therefore, we would use VOS to examine the trade-off among keywords within individual period

and trace the differences among these 4 periods. According to 4 VOS maps (i.e., Fig 7a- Fig 7d), a color bar shown in the bottom right corner with different colors meant the keywords of different years. Therefore, this paper showed the research hot spots of different periods year by year.

In the *initial introduction period* (1990-1997), the scope of research mainly focused on the development of EC and formed 24 clusters, such as adoption barriers of EC (e.g., Auger and Gallagher, 1997) and technology used in EC (e.g., Iacovou et al., 1995). Overall, the research trend on EC in Fig. 7a began to shift to market

research (e.g., Strader and Shaw, 1997). During rapid growth period (1998-2000), there were 23 research hot spots on EC. The rapid development of technology accelerated the exploration of EC. Therefore, many researches focused on the information and technology on EC (e.g., Trappey and Trappey, 1998). However, there was another obvious conversion of research hot spots (see Fig.7b). Early of this period, the market and technology on EC had been focused, whereas the late of this period, the issues related to consumers of e-business, such as quality of service (e.g., Bhatti et al., 2000) and customer service (e.g., Å berg and Shahmehri, 2000) had taken the place to attract researchers' attentions.

In the *downward oscillation period (2001-2010)*, there were 8 clusters had been concerned with, such as e-market and consumer behavior (e.g., Koufaris et al., 2001; Dholakia et al., 2002; Esmahi, 2008; Markopoulos et al., 2010; Mishra and Agarwal, 2010). According to

Fig.7c, we found an obvious transform from the price-competition in e-market (e.g., Kocas, 2002; Dewan et al., 2003; Chun and Kim, 2005) in the early period to the consumer loyalty (e.g., Wang et al., 2006; Tsai and Huang, 2009) and satisfaction (e.g., Casaló et al., 2008; Liao and Cheung, 2008) in the late period. In the stable development period (2011-2017), the research scope focused on 10 clusters such as consumer behavior (e.g., Rana et al., 2015; Raphaeli et al., 2017) and new development of EC (e.g., Phan, 2011; Zhang, 2017). Based on Fig.7 (d), we could find that the trends of EC covering from big data (e.g., Ishfaq et al., 2017; Ji and Sun, 2017), social media (Zhang et al., 2017), data mining (Chongwen and Scholten, 2016), cloud computing (e.g., Ali et al., 2014; Chongwen and Scholten, 2016) and Cross-border EC (e.g., Giuffrida et al., 2017).

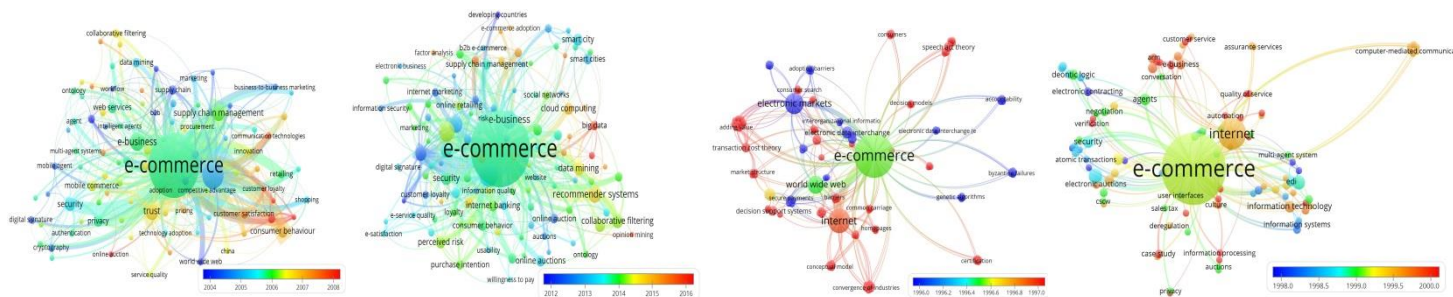


Fig.7 The overlay visualization of research hot spots during different periods

Discussions and Conclusions

Discussions

The distribution of articles in EC began in 1992, significantly increased since 1997 and was at the peak of paper publications in 2000. This finding is similar with that of Fichter (2003) which demonstrates 1993 is the year when the Internet economy was born with the breakthrough of the World Wide Web and 2000 is the year when the Green book initiative was started to establish harmonized environmental requirements for third-generation mobile communication networks. From this literature review, we also can find that these research hot spots (clusters) of EC are diversified due to their authors' backgrounds, expertise, and problem domains. This is why a few authors can appear in the literature of different clusters. For example, consumer behavior/online game strategy (e.g., Hussien and El Aziz, 2013; Hong and Cha, 2013) and sales channels/security (e.g., Smith and Manna, 2004).

According to country analyses mentioned earlier, we found that authors of mass production of EC majorly came from United States, China, United Kingdom, Canada, Australia and India. It apparently showed that these countries were abundant in experts of EC. By contrast, the top countries in which EC papers published were United States, China, United Kingdom, Taiwan, South Korea, Canada, Australia, Germany, Hong Kong and Spain. It meant that these countries were abundant in research power of EC. Finally, the last analysis ended with that the international collaboration groups totally focused on United States, United Kingdom and Canada and China, Hong Kong, Taiwan and United Kingdom were the key partners with United States.

Based on the 7 clusters of research hot spots in Table 3, we would further propose a conceptual framework to describe the outline of the interactions between service providers (i.e., seller) and consumers (i.e., buyer) in today's on-line business environment (see Figure 8). In this fig, seller will firstly put all their transaction records with customers into the procedure of process management

(e.g., clustering, data mining, collaborative filtering and personalization) so as to develop a recommendation system for customers to find their feasible solutions in purchase decisions. For example, data mining offers number of benefits to e-commerce companies and allows them to do merchandise planning, analyze customers' purchasing behaviors and forecast their sales which in turn would place them over other companies and generate more revenue (Ismail et al., 2015, p. 508). Wang and Shao (2004) found that the recommendation model built with user clustering by time-framed navigation sessions would effectively improve the recommendation services.

By contrast to the procedure of process management, the contact management procedure refers to the interaction between human and machine. Today, most of retailers are pursuing Internet-enabled advantages and cost reductions in operations to enhance their competitiveness (Burt and Sparks, 2003). In context of jewelry B2C business, Zhou et al. (2013) argued that an innovative jewelry B2C business model concentrating on combining jewelry with consumer's emotion would create superior customer experiences. Most importantly, protecting privacy rights on the Internet is a critical step towards user acceptance and adoption of an electronic marketplace (Head and Yuan, 2001). Since EC is

internet/data privacy which is at risk in a high security environment (Gharegozi et al., 2011), therefore, it is important to maintain and guarantee consumer's privacy and security among these interactions between sellers and buyers, for example, cryptography (e.g., Hwang et al., 2002; Chow et al., 2006) and digital signature (e.g., Eigeles, 2005; Hernandez-Ardieta et al., 2008; Song and Chen, 2009).

Information systems (IS)/Information technology (IT) has the power to develop the industry and transform how business is run. Internet in business is used for information exchange, media promotion, electronic mail, mailing lists, dialogue, discussions, consulting with consumers online (Yadiait and Bong, 2019). Undoubtedly, EC is kind of virtual community founded in technology which can strongly support the transaction operation smoothly through the processes. Therefore, IS/IT in EC is perquisite, including multi-agent systems (e.g., Vahidov and Fazlollahi, 2003), supply chain management (e.g., Tarn et al., 2002; Sila, 2015), XML (e.g., Maruyama, 2002), knowledge management (e.g., Mclean and Blackie, 2004; Gao, 2006), ontology (e.g., García et al., 2016) and web service (e.g., Howard and Kerschberg, 2004).

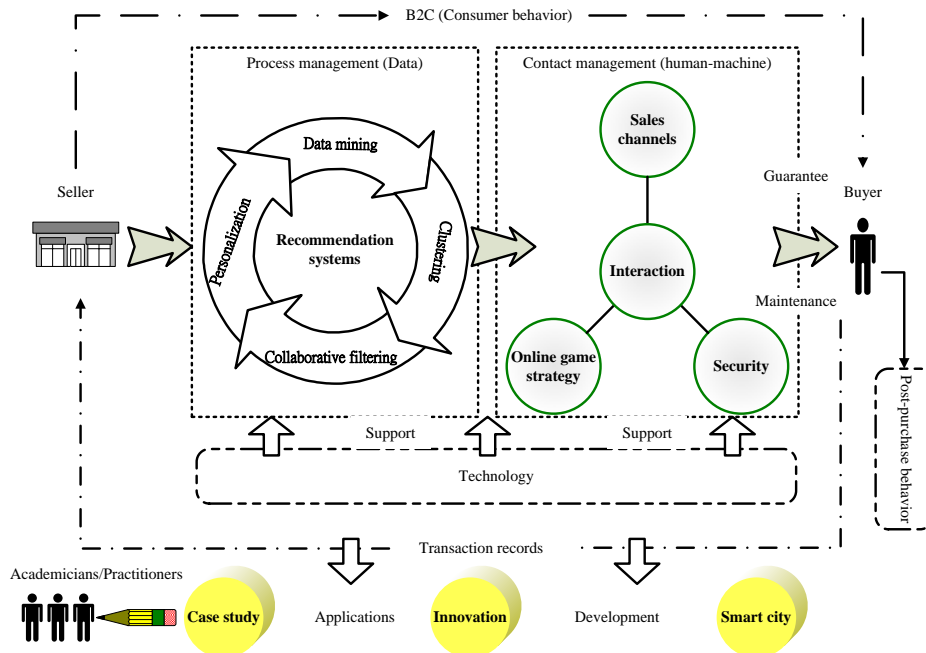


Fig.8 Conceptual framework of EC

Table 12 Comparisons with three EC literatures with this study

	Hou and Li (2014)	Lin et al. (2016)
Period	1996-2012	1990-2016
Selected articles	19831	853
Database	ISI web database	Scopus, Science Direct, ISI Web of Science, Business Source Premier, Emerald, Inspec, ACM Digital Library, IEEE Xplore, and InderScience.
Analysis	<ul style="list-style-type: none"> ● Type of publication ● Characteristics of scientific outputs ● Year of publication ● Subject category 	<ul style="list-style-type: none"> ● Outlets of publication ● Field of journals ● Highly cited and productive authors ● Highly cited references ● Country analysis ● Institution network
Framework	N/A	N/A
Others	<ul style="list-style-type: none"> ● Three popular subjects are “Computer Science Information Systems”, “Business” and “Computer Science Theory Methods” 	<ul style="list-style-type: none"> ● First stage, they focus on 10 leading management/business journals to explore the core of EC. ● Second stage, they use bibliographic survey to examine EC subject categories and follow the ones from Ngai and Wat (2002), including application, technology, support & implementation and others.

Table 12 Comparisons with three EC literatures with this study

	Yoo and Jang (2019)	This article
Period	1986-2017	1990-2017
Selected articles	Over 1000	11669
Database	6 IS journals	Scopus
Analysis	<ul style="list-style-type: none"> ● Year of publication ● Outlets of publication ● Subject category 	<ul style="list-style-type: none"> ● Year of publication ● Outlets of publication ● Country analysis ● Highly cited author ● Author keywords (subject category)
Framework	V	V
Others	<ul style="list-style-type: none"> ● A framework with three perspectives, including business models, service relationships and technology from macro perspective to micro perspective. ● Dividing EC revolution into three phrases: (~2000), (2001-2009) and (2010~presnt) 	<ul style="list-style-type: none"> ● Seven hot research topics were found and further be divided into five subject categories, including process management, contact management, technology, new applications & development and consumer behavior. ● EC development trajectory can be classified into four periods, including initial introduction period (1992-1997), rapid growth period (1998-2000), downward oscillation period (2001-2010) and stable development period (2011-2017).

In this figure, our framework reveals that (1)EC is basically a network-platform for sellers/suppliers to provide their products or services to buyers/consumers; (2)The internal process management (e.g., recommendation system) would analyze and summarize the market needs so as to be an important basis for the contact management (i.e., frontline stations and customers); (3)The human-machine platform is concerned with sales channels, online strategy and security, which are critically determinant to the maintenance of customer relationship as well as the guarantee/assurance of service quality; (4)Undoubtedly, all the EC applications here are relying on technological supports; (5)The new EC applications and development would include case study, corporate innovation and smart city; (6)The buyers' perception of EC environment (i.e., B2B/B2C) and their post-purchase behaviors would completely influence the sellers' subsequent EC strategies.

Next, we would further compare this study with three bibliometrics analyses of EC mentioned above (i.e., Hou and Li, 2014; Lin et al., 2016; Yoo and Jang, 2019) to facilitate a better understanding of EC trends (see Table 12).The comparative results are discussed below:

- Time period— Basically, this study is similar to Lin *et al.* (2016) and shorter than Yoo and Jang (2019). However, the overall time periods of these three studies are over two decades. It seems that the time period of our study is long enough to find the trajectory of EC.

- Selected articles— By contrast, this study and Hou and Li (2014) both embrace large amount of EC literature which could explore lots of information and knowledge of EC trends.

- Databases— Aside from Yoo and Jang (2019), the rest of three studies are getting their samples from the large single database or multi-ones. It means that our study really have a good academic support.

- Analysis— Most of these studies have basic analysis options, such as paper publication by year, outlets of journal, subject categories, highly cited authors and country. However, our study solely adds the visualization of co-authorship, co-occurrence of keywords and research hot spots during different periods to in this bibliometrics survey.

- Framework establishment— Only we and Yoo and Jang (2019) have established a framework. However, the latter is a hieratical/static framework based on three

perspectives (i.e., business model, service relationships and technology) and micro and macro perspectives, while our study is visual/dynamic one clear depicting the EC connection from sellers to buyers.

- Others— Compared with the three periods of EC from Yoo and Jang (2019), their first period (~2000) is equals to our initial introduction period (1990-1997) and the rapid growth period (1998-2000); their second period (2001-2009) is similar to our downward oscillation period (2001-2010); their last period (2010~) is like our stable development period (2011-2017).

As a whole, our study and these three all using the publication-based analysis to trace the development of EC during recent decades. Except six items mentioned in Table 12, there still have other differences among them.

As to ease of use and coverage, Scopus is easy to navigate, even for the novice user than Web of Science (<https://en.wikipedia.org/wiki/Scopus>). Among these four in Table 12, the sample collection of Yoo and Jang (2019) is restricted to six IS Journals, which are included in Scopus we used. It means that the analytic source of EC seems to be narrow and insufficient. Besides, their three categories of EC, including business models, service relationships and technology can be referred to the sub-applications of our conceptual framework to some degree. Second, the samples of Lin et al. (2016) are collected from multiple sources than any other studies, but their amount of EC papers is the smallest one. By contrast, our study and Hou and Li (2014) embrace the advantage of publications. Third, the coverage of our study can match up with that of Lin et al. (2016). Therefore, our study can be seen as a literature review with greater breadth and depth perspectives than the other three, which also is a beneficial contribution to EC.

Contributions

Among EC literature review works (e.g., Ngai and Wat, 2002; Hou and Li, 2014; Khoo et al., 2018; Yoo and Jang, 2019), most of them reveal EC development trend/trajectory (publications) and/or its subject categories. This study, by contrast, not only embraces EC trail and its applications (i.e., research hot spots) simultaneously, but also collectively and systematically highlights its evolution of hot research spots and draws a conceptual framework. Most importantly, none of EC studies have proposed any integrated framework. Therefore, the major contribution of this study is integrity and continuity.

Accompanied with rapid development of technology

today, many business opportunities significantly emerge and the people's needs of quality of living are also aroused. However, people/business would live under so-called "data deluge" (Molinari et al., 2014). Therefore, many aspects of information technology applications would be designed to solve these problems, such as smart cities, social media, AI, privacy, security, online-shopping and so on. Moreover, these applications all directly/or indirectly included in our research hot spots. This is our second contribution.

Finally, this study highlights the evolution of keywords on EC across four specific periods. From this, it clearly points out that how the trade-off of EC keywords is going among different periods in last three decades. Therefore, "Catch the trend, hit the point" is the last contribution.

Limitations and suggestions

This paper is a survey of EC literature from 1990 to 2017 to explore its research hot spots, evolution and trends in this period. This study, like any research, has limitations. First, mostly used in our survey is based on the keyword-index that might hinder getting a whole picture of EC. Especially, the terms of "e-commerce" or "electronic commerce" are as common as the term of "business" in business related issues. That is, many papers which were not acquired by the data set in this study are related to electronic commerce in nature. The robustness and coverage of the data set is questionable. Second, only academic journals are included in this literature review would narrow the scope of EC trends. Third, though the Scopus is the popular database equipped with large coverage of academic articles than other databases, there still have some journals related to EC not included in, for example, Tourism and Hospitality Research, Economics of Innovation and New Technology (SAGE publication), Information Systems and e-Business Management (Springer publication) and so on. Forth, some papers published in non-English are excluded from this study, but may provide additional information to explore the development of EC and its applications. Owing to these limitations, there are some suggestions in the future works as follows.

- *Another material for research:* In this paper, conference papers, master and doctoral dissertation, textbooks and unpublished working papers were excluded while journals generally represent the highest level of research (Nord and Nord, 1995). Besides, non-English publications are also not considered here in

this survey. However, it might lead to the narrowing of the research scope. Therefore, it is expected to untie the filtering criteria in the future.

- *The comparative analysis between different databases:* This paper is a survey based on Scopus. Future study can use another database Web of Science or adopt individual database from different publication companies (e.g., ScienceDirect, Emerald, SAGE, Wiley, Springer and Francis & Taylor). Therefore, the comparative analysis between different databases is expected.

- *Focus on specific EC topics:* As EC is a multi-faceted concept involved with service management, knowledge management, Web channel management, cooperative process management, supply chain management, workflow management and database management, taking a segmented field of EC for a comprehensive analysis in the future is necessary.

- *Comparative analysis:* In this study, there are four major periods based on the changing research topics and future works can be expected to make a further comparative analysis to be even more interesting to learn something like- Did article publication characteristics also changed throughout the four periods? Were there other potential reasons for the changing topics (in addition to the changing technology environment, etc.)? For instance, authors from different countries may focus on different topics and/or be active in different periods.

- *Others:* Adopting a literature review method, this paper acts as a guideline for EC to help interested researchers to have access to its essence/core value to upgrade the overall research value. Besides, some of the keywords shown in each table are pretty repetitive and ambiguous. Therefore, the specification of keywords is necessary. Most interestingly, future works to review the literature critically and to identify any possible inconsistencies like theoretical issues, methodological flaws and generalizations for any potential reader (e.g. students or early career researchers) are expected. Of course, our research result might mislead the reader's perceptions and also not reflect the fact that every business activities are related to EC nowadays with our selection criteria, for example, we only choose journal and exclude conference papers, textbooks and comments. Therefore, the future works widely take these omitted materials related EC into account are encouraged.

Conclusions

This paper provides a guide to those interested academicians and practitioners in EC and allows them to understand its development trajectory, research hotspots and applications by adopting VOS technique. Based on Scopus with keyword “e-commerce” and “electronic commerce” from 1990 to 2017, we have 11669 articles scattered across 1717 different journals while the research output in EC began in 1992, significantly increased since 1997 and was at the peak of article publications in 2000. Apparently, authors of EC papers majorly came from 5 continents, including *United States, China, United Kingdom, Canada, Australia and India*. The United States has the most paper publication (26.84% of total) and the most citations. Most interestingly, China has 17.33% of the total articles which is greater than that of Taiwan (7% of the total), but the number of citations is less than Taiwan. Obviously, United States, United Kingdom and China are standing at the top 3 collaboration cores in EC. Using VOS technique to filter 18315 keywords from 11669 articles, there are 60 qualified keywords with a minimum 40 co-occurrence and can be categorized into 7 clusters which represented different research subjects in EC. Finally, we propose a conceptual framework based on 7 clusters serving as a strategic map to lead executives of firms today to facilitate a good understanding of EC.

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