

# Mapping E-Commerce Research during the COVID-19 Pandemic: A Bibliometric Analysis

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## Abstract

**Background:** Digital technology and broad Internet access have significantly changed consumer behaviour, primarily through the rise of online shopping and improved information-sharing channels. **Objectives:** The COVID-19 epidemic fuelled the adoption of digital technologies, leading to a significant increase in online shopping. The authors of this paper captured and showed this increasing trend. **Methods/Approach:** The authors use bibliometric and text-mining methods to demonstrate the importance of COVID-19 in the e-commerce development literature. **Results:** A search of the Scopus database identified 845 relevant papers from 2020 to 2023, which were then refined to 417 within the fields of Business Management, Accounting, and Social Sciences. Most of these publications were scholarly articles (71.9%), reflecting a wide range of interdisciplinary contributions across Computer Science, Economics, and Engineering. The text mining analysis identified common keywords, including COVID-19, online shopping, purchase intention, e-commerce, and consumption behaviour. These keywords were grouped into six main clusters: consumer behaviour, online shopping intentions, impulsive buying, consumer satisfaction, sustainability considerations, and smartphone shopping behaviours during the pandemic. By implementing such an approach, it became evident which research topics and groups are the primary focus, which authors are the most productive, and which countries collaborate most on this topic. **Conclusions:** The analysis reveals that the COVID-19 pandemic significantly shaped research directions in e-commerce, with a strong emphasis on consumer behaviour, trust, satisfaction, and impulsive purchasing. The identification of six distinct thematic clusters provides a structured overview of the most prominent topics explored during this period. Additionally, the study highlights which institutions and countries led the research efforts, showing robust collaboration networks in Asia and Europe, where international co-authorship has notably intensified.

**Keywords:** e-commerce; consumer electronics; COVID-19; consumer behaviour

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## Introduction

The development of digital technology significantly accelerated the use of the Internet for various purposes, and today's life is unimaginable without it. Continuous digital innovation has made mobile devices and laptops indispensable tools in everyday life (Dakduk et al., 2017). In addition, this has opened new sales channels through the Internet, specifically for online shopping and easier information exchange (Chen et al., 2021).

Consumers began to change their traditional shopping habits and adopt new ones, supported by technological innovations. At the global level, 53% of the population has access to the Internet, and 92% use their smartphone to access it. Due to technological developments such as smartphones, sales channels are shifting from conventional to those aimed at users of portable devices. E-commerce platforms that provide adequate customer support tend to achieve higher sales levels, indicating that service quality influences purchasing decisions (NASDAQ OMX News, 2021). Global connectivity has significantly reduced the importance of geographical boundaries in commercial exchange (Kovač, 2020).

Online shopping is the process by which customers purchase products or services directly from sellers in real time and it is a form of e-commerce that can involve participants such as businesses, individuals and governments. An e-commerce platform is a software solution that enables businesses to sell products or services online (Jain et al., 2021). It offers a digital platform where vendors can display their products, manage stock, process transactions, and manage orders. E-commerce platforms commonly provide functionalities such as product listings, shopping carts, secure payment gateways, and order management systems. These platforms support the complete online buying process for both organisations and customers, enabling electronic transactions over the Internet (Gupta et al., 2023).

To enable consumers to access the e-commerce platform, specific marketing strategies are required. Buyers most often type a keyword into a search engine to get results. Thus, they turn to the e-commerce platforms of individual companies that offer the products or services they are seeking (Knežević, 2011). Furthermore, entering the brand name enables a faster search for the specifically requested product (Jansen & Molina, 2006). In cases where the customer wants a broader selection of individual products, for example, from several manufacturers, e-commerce platforms such as Amazon, eBay, AliExpress, and Etsy can help compare prices and quality (Asfuroglu et al., 2020). In addition to e-commerce platforms, some companies create applications that make product selection easier and inform consumers about specific promotions, discounts, and news. In addition to the above, customer satisfaction is among the key factors influencing online purchase decisions. The risk of negative comments is much higher in online shopping because information spreads more easily than in traditional retail. Thus, customer support before and after purchase becomes more important (Boruah & Goswami, 2021).

Online purchasing alters both the range of available products and the associated service experience (Vuksanović Herceg et al., 2020; Gligorijević, 2011). Therefore, with online shopping, characteristics that do not accompany traditional shopping emerge, such as product availability and delivery options, which become valuable in themselves, and consumers include these characteristics in their utility functions. Therefore, the customer sometimes agrees to a product that meets his needs, but the accompanying service compensates him for this deficiency (Herceg et al., 2008).

Changes in the working and living environment, such as those brought about by the COVID-19 pandemic, significantly influenced the way of doing business (Bonazzi et al., 2020), e-learning (Pejić Bach et al., 2023a), and the development of e-

commerce platforms (Grashuis et al., 2020). Following the declaration of the COVID-19 pandemic in March 2020, most European Union countries introduced restrictions on citizens' social lives (Tatalović & Malnar, 2021). Under various work ban measures, retail stores that did not sell food products were also closed, and their owners, if they wanted to stay in business, had to take concrete steps towards digitalisation. Companies that did not have an e-commerce platform implemented soon implemented one and began offering their products online to customers. Those who had it further modernised it and expanded options, such as fast home delivery and in-store or third-party pickup, thereby trying to increase their competitiveness (Sheth, 2020).

There are many research articles on the impact of COVID-19 on e-commerce development, underscoring its importance. Paraschiv et al.'s (2022) research uses a combination of qualitative and quantitative methodologies, including cluster analysis, to investigate the pandemic's influence on European e-commerce through mobile buying. The findings show that, while e-commerce increased across the EU, the effect was more evident in less digitally advanced countries. The COVID-19 pandemic brought challenges in other areas and boosted the acceptance of e-commerce. The pandemic effects on e-commerce in four Middle Eastern nations are examined in Alwan et al.'s (2023) research paper, which also notes supply chain interruptions as the primary concern. The paper's authors advise expanding supplier bases and implementing digital supply chain initiatives to accelerate e-commerce expansion. Furthermore, the research papers of Şimandan (2023) and Ambrosio-Pérez et al. (2023) presented bibliometric findings in the e-commerce and e-business spheres. In the research paper by Şimandan (2023), a bibliometric analysis of the COVID-19 influence on e-commerce is presented without further analysis, such as text mining. On the other hand, Ambrosio-Pérez et al. (2023) used both bibliometric and text-mining analyses to demonstrate COVID-19's impact on e-business more broadly. None of the research papers mentioned focused on bibliometric and text-mining analyses of the COVID-19 pandemic's influence on e-commerce development.

The goal of this paper is to investigate the research topic using emerging articles and to confirm it through further analysis for firm evidence. Despite the significant impact of the COVID-19 pandemic on e-commerce, there is a limited understanding of the underlying patterns, trends, and main drivers of e-commerce development. In this paper, the authors attempt to close this knowledge gap by using bibliometric and text-mining tools to examine the existing literature and identify emerging research fields. The paper's authors therefore searched Elsevier's Scopus database to examine the state of scientific research in e-commerce and its intersection with the COVID-19 pandemic. In detail, the paper's goals are to: (i) detect the publication type, the most prolific research institutions, the most productive authors, the geographical location of authors' institutions, and the funding agencies, and (ii) detect the main topics of the research and research groups using the text mining process.

The article's outline is as follows. After the introduction, the methodology is presented. The third part discloses the article's findings, while the conclusion discusses future implications and limitations lastly.

## Methodology

The process of establishing the parameters for searching and evaluating prior studies is carried out in two stages. The initial stage is the implementation of a bibliometric analysis to provide a comprehensive overview of publications that combine e-commerce and COVID-19 pandemic terms. The second phase entails employing text-mining techniques to investigate and analyse extensive volumes of unstructured

textual data. This involves using tools that extract concepts, patterns, themes, and keywords from unstructured data.

A bibliometric analysis was performed using Elsevier's Scopus database, focusing on peer-reviewed scientific research published in open-access journals between 2020 and 2023. The literature analysis of e-commerce during the COVID-19 pandemic within the specified timeframe is based on publication type, the most prolific research institutions, the most productive authors, the geographical locations of authors' institutions, and the funding agencies associated with the research.

A search was conducted in the Scopus database for English-language scientific publications on the keywords "COVID-19 and e-commerce" (Table 1). The initial search was performed in Scopus using the mentioned keywords. This yielded a substantial number of publications (845) published between 2020 and 2023. Furthermore, the search was narrowed to the Scopus scientific fields of Business Management and Accounting, as well as Social Sciences, for the same time frame, spanning 2020 to 2023. After applying the inclusion criteria, the dataset was reduced to 417 publications.

Table 1  
Scopus search strategy

Search strategy	Scientific publications	Period
"COVID-19 & e-commerce" (Search subject)	845	(2020-2023)
Filtered by: Business Management, Accounting, and Social Sciences (Scientific fields)	417	(2020-2023)

Source: Author's work

Upon searching the Scopus database, information for each article - including bibliometric data, abstract, keywords, and references - is obtained for subsequent analysis. The searched data served as the foundation for conducting text-mining analysis utilising the VOSviewer tool (Megatama et al., 2022). The VOSviewer software uses a distance-based approach to visualise bibliometric relationships, enabling the visualisation of various network types, including those centred on keywords, authors, or countries of origin. The process has two main steps. Firstly, the items were categorised into nodes. Secondly, the distance between these nodes was standardized, as described by Mahadevan and Joshi (2021). Furthermore, the nodes are positioned in a two-dimensional plane under the assumption that highly interconnected nodes are situated near one another, using the VOS mapping technique. Nodes are ultimately assigned to clusters using a sophisticated local movement algorithm, as described by Waltman et al. (2010).

The VOSviewer text mining technique generates networks of co-occurring phrases from English text, such as keywords. This procedure employs the Apache OpenNLP library, a Java-based open-source tool for processing natural language text (Apache OpenNLP Developer Documentation). OpenNLP offers several services, including tokenisation, sentence segmentation, part-of-speech tagging, named entity recognition, chunking, parsing, and coreference resolution (Jehangir et al., 2023; Pejić Bach et al., 2023b).

This methodology enables detailed research into the extensively studied subjects and research clusters on e-commerce usage during the COVID-19 pandemic across the scientific domains of Business Management, Accounting, and Social Sciences. The scientific fields are the primary focus of this research. To perform a reliable

simultaneous analysis, significant emphasis was placed on keywords and the country analysis. This was achieved through the utilisation of a comprehensive counting extraction technique.

## Results

### *Bibliometric analysis*

Publications were refined according to the Business Management, Accounting, and Social Sciences fields. In some cases, scientific publications address multiple scientific fields beyond the primary one, as shown in Table 2.

Many publications are cross-listed in multiple scientific fields, such as Computer Science (10%), Economics, Econometrics, and Finance (9.5%), Decision Sciences (9.2%), Engineering (8.5%), Environmental Sciences (6.2%), Mathematics (1.7%), Biological and Agricultural Sciences (1.3%), alongside other areas (3.4%). Other areas encompass Arts and Humanities, Psychology, Medicine, Earth and Planetary Sciences, Biochemistry, Health Professions, Veterinary Medicine, Chemical Engineering, Immunology and Microbiology, and Materials Science, though with a low number of papers (fewer than 10%). These findings show that the majority of papers on the COVID-19 pandemic's impact on e-commerce development are in the fields of Business Management, Accounting, and Social Sciences, with substantial influence on other research areas.

Table 2

Publication diversification according to the scientific fields

Scientific field	# publications	%
Business Management & Accounting Social Sciences	233	55.8%
Computer Science	42	10.0%
Economics, Econometrics, and Finance	40	9.5%
Decision Sciences	38	9.2%
Engineering	35	8.5%
Ecological sciences	26	6.2%
Mathematics	7	1.7%
Biological and Agricultural Sciences	5	1.3%
Other fields	14	3.4%

Source: Author's work

Table 3 represents the distribution of papers by type of publication. Most publications are scientific articles (300 papers, 71.9%) and conference papers (65 papers, 15.6%), followed by other publication types in much smaller numbers. Furthermore, a higher proportion of scientific papers on the COVID-19 pandemic's impact on e-commerce development reflects the intensity of academic engagement and research output in this area.

Table 3

Distribution based on the publication type

Type of publication	Number of publications	Percentage
Scientific Articles	300	71.9%
Conference Papers	65	15.6%
Book Chapters	25	6.1%
Review Paper from the Conference	10	2.4%
Review Paper	10	2.4%
Book	2	0.6%
Other publications (Introductory articles, critical reviews)	4	1%

Source: Author's work

Table 4 contains the most productive institutions for the specified research subject. The most productive Institutions are measured by the total number of published papers in the specified research area. Bina Nusantara University has 14 publications and is by far the most productive Institution in this sample. The other Institutions have fewer than three publications. This may reflect institutional research priorities, available resources, or active collaborations.

Table 4

Distribution based on the most fruitful institutions (3+ papers)

Institution	Number of publications
Bina Nusantara University	14
Bucharest University of Economic Studies	5
University of Economics Bratislava	4
Portland State University	4
Institute of Technology and Business in Češke Budejovice	3
Julius Maximilians Universität Würzburg	3
Michigan State University	3
Institut Teknologi Spuluh Nopember	3
Amrita Vishwa Vidyapeetham Amrita School of Business	3

Source: Author's work

Table 5 presents the distribution of publications by authors' institutions and the funding agencies that supported research on e-commerce and COVID-19 topics. The United States of America had the most publications (52), followed by the People's Republic of China (48), Indonesia (42), India (31), and the United Kingdom (30). In contrast, the remaining countries had fewer than 20 publications each.

The primary funding agencies in the field of e-commerce research include the National Natural Science Foundation of China (with 10 publications), the National Office for Philosophy and Social Sciences (with eight publications), the European Regional Development Fund (with six publications), the Fundacao para a Ciencia e a Tecnologia (with six publications), and the Vedecka Grantova Agentura MSVVaS SR

a SAV (with five publications), while all other have three publications or less. The prevalence of the mentioned countries and funding agencies underscores the potential discrepancies in research endeavours across geographical locations and institutions. The consolidation of resources may lead to better collaboration and knowledge exchange, but it also raises concerns about potential research gaps in other regions and fields.

Table 5

Origin of the author's Institution

Origin of the author's Institution (top 10)	# publications
United States of America	52
People's Republic of China	48
Indonesia	42
India	31
United Kingdom	30
Poland	19
Italy	17
Malaysia	16
Spain	14
South Korea	13

Source: Author's work

The following section presents connections among publications, authors, origins, and keywords using text mining methods. An additional component of this research involves a graphical representation of the topics, which enhances readers' accessibility to this subject matter.

### Text mining results

The research uses the VOSviewer tool, utilising text mining, to examine 417 publications and identify the predominant keywords in online shopping research during the COVID-19 pandemic, as shown in Figure 1. The prevailing keywords are COVID-19, online shopping, buying intention, e-commerce, and consumption behaviour. Figure 1 displays all terms with at least five instances. The node's size corresponds to the frequency of the keywords: larger nodes represent more common keywords. The thickness of the connecting lines represents the strength of co-occurrence between two terms. Furthermore, to prevent the occurrence of synonymous terms, a Thesaurus document was generated to address this issue (Yu et al., 2020). The investigation identified 640 connections across 63 items, yielding an average link intensity of 27.5 (across all keywords).

As seen in Figure 1, most keywords are related to both main paper topics: COVID-19 and e-commerce. This means that these main keywords cover various aspects of business and personal life, indicating their central role in the academic discourse on e-commerce during the pandemic.

Figure 2 shows a heat map of keyword frequency, with colour intensity indicating frequency. The gradient extends from green (low frequency) to yellow (high frequency). The phrases 'e-commerce' and 'COVID-19' dominate the map, forming a cluster of high-frequency terms related to online purchasing and consumer behaviour. There is a clear shift towards pandemic-related keywords, consistent with the research articles.



## Cluster Extraction

Clusters were created to represent the keyword analysis better. Furthermore, each cluster was assigned to a specific topic based on the keywords it included. The results of the text mining process using the VOSviewer tool are shown in Table 6. The first column represents the clusters, while the second lists all included keywords that have been repeated at least five times. The third column shows the publications on the topic of the clusters from the first column.

Table 6

Keywords cluster and themes with a minimum of five recurrences

Cluster	Cluster main keywords	Cluster topics/ Publication examples
<b>Cluster 1</b> Consumer behaviour; buying activity	Attitude, consumption behaviour, COVID-19, disease spread, epidemic, food consumption, food safety, Internet, pandemic, panic buying, perception, psychology, public attitude, public health, shopping activity, theory of planned behaviour	Seah et al., 2022; Tri Cuong, 2021; Belmonte et al., 2021; Bajdor 2021
<b>Cluster 2</b> The online shopping intention: trust	e-commerce, online grocery shopping, online purchase intention, perceived risk, perceived usefulness, purchase intention, purchasing, retail, sales, social distancing, trust	Chmielarz et al., 2022; Morales 2021; He et al., 2021; Koch et al., 2020; Lv et al., 2020
<b>Cluster 3</b> Impulsive shopping	Consumer behaviour, factor analysis, impulsive buying, online purchase	Victoria et al., 2021; Li & Shu, 2021
<b>Cluster 4</b> Consumer satisfaction	Consumer satisfaction, data mining, social media, social networking (online), sustainable development	García-Salirrosas et al., 2022; Galhotra & Dewan, 2020
<b>Cluster 5</b> The consumer behaviour	Behaviour, consumption marketing, sustainability	Degli Espostiet al., 2021; Borsellino et al., 2020
<b>Cluster 6</b> The buying behaviour	Buying behaviour, consumer behaviour, impulse buying	Wiścicka-Fernando 2021

Source: Author's illustration, using VosViewer

## Cluster Description

The research will focus on six clusters, as indicated in Table 6. All clusters are described in detail, and a summary of every cluster is provided below each paragraph.

### Cluster 1: Consumer behaviour; buying activity

Cluster 1 includes key terms such as attitude, consumption behaviour, COVID-19, disease spread, epidemic, food consumption, food safety, Internet, pandemic, panic buying, perception, psychology, public attitude, public health, shopping activity, and theory of planned behaviour. Cluster 1 is centred on consumer behaviour and shopping activity. Seah et al. (2022) identified the factors driving e-commerce

demand during the COVID-19 pandemic, explicitly focusing on the platforms Shopee and Lazada, which are popular among Malaysian consumers. They investigated the relationships between administrative and psychological factors and product, pricing, time savings, payment, and security with demand for e-commerce. The Malaysian Government's implementation of the Movement Control Order (MCO) led to restrictions on the typical working environment and store closures. As a result, customers shifted to online shopping to obtain essential items. The survey-based research gathered data from 200 individuals. The research results showcased that elements such as product, price, time savings, payment, security, and administrative aspects are significantly correlated with the desire for e-commerce. Tri Cuong's (2021) research examined how customer convenience and trust influence satisfaction and online shopping intention. The research model was derived from prior studies, and a sample of 306 clients in Ho Chi Minh City, Vietnam, was gathered for this study. The research findings indicated a strong, significant relationship among customer convenience, contentment, and the intention to shop online. The results also showed that trust significantly influences satisfaction and the propensity to shop online, and that satisfaction is positively correlated with online shopping. The availability of e-commerce models, such as online grocery shopping and delivery, has expanded dramatically in the Philippines during the COVID-19 pandemic, as emphasised by Belmonte et al. (2021). This research aims to identify the elements that impact Filipinos' satisfaction with online shopping and home delivery. The paper's findings indicated that technology choices, customer choices, product/service choices, and the shopping process directly influence consumer satisfaction with online shopping and the delivery of products to their address. In Bajdor's (2021) research, the authors aimed to analyse e-commerce consumers' time spent on online shopping (interpreted as the e-commerce customer experience) and to evaluate their satisfaction levels. The authors revealed that perceptions and criteria affecting e-commerce platforms evolve as users gain an online buying experience. Nevertheless, consumer happiness does not consistently increase. As consumers gain more experience, their satisfaction level declines; hence, e-commerce systems should adhere to the same rules to maintain satisfaction among experienced users. Furthermore, enhancing innovation is necessary to improve the user experience.

Product attributes, pricing, convenience, trust, and satisfaction are among the factors identified by the research paper authors in cluster 1 as core influences on online purchasing decisions. The COVID-19 pandemic has accelerated e-commerce growth, as consumers have become increasingly dependent on online platforms for essential products and services. Nevertheless, e-commerce enterprises encounter obstacles in sustaining customer satisfaction over time.

#### *Cluster 2: The online shopping intention; trust*

Cluster 2 includes important terms like e-commerce, online grocery shopping, online purchase intention, perceived risk, perceived usefulness, purchase intention, purchasing, retail, sales, social distancing, and trust. The topics of this cluster are online shopping intention and trust, which are one of the main areas of this research. Chmielarz et al. (2022) analysed the progress of e-commerce in Poland, Turkey, and the People's Republic of China before and after the COVID-19 pandemic, specifically comparing the first months of 2020 and 2021. The research sample comprised 650 academic experts from the stated nations. The research findings indicated that differences in e-commerce development during the COVID-19 pandemic were primarily observed in the direction of growth, the type of device utilised for online shopping (mobile/traditional), and the unique characteristics of each country,

including past experiences, cultural context, and consumer behaviour, which impacted the evolution of e-commerce. Morales (2021) intended to statistically study and assess consumer purchasing behaviour across age groups in retail and e-commerce. The article aimed to provide empirical evidence to support advice for entrepreneurs and owners of e-commerce and retail establishments on optimising costs and increasing revenue estimates. The sample included 314 customers aged 22 to 80 years old in the United States of America. Youthful age groups demonstrated a superior grasp of technology and, as a result, higher consumption rates than older age groups. The COVID-19 pandemic intensified this research outcome by limiting consumer mobility, thereby increasing computer use and indoor activity. He et al. (2021) examined the impact of the COVID-19 pandemic on the correlation among production capacity, prices, and online purchasing methods of retail establishments. The paper also introduced an e-commerce model that integrates with retail stores and an online-to-offline (O2O) third-party platform. Online shopping generates revenue comparable to traditional in-store purchasing but incurs significantly higher expenses for creating an e-commerce platform and managing delivery services. Moreover, by engaging in direct sales through e-commerce, retail stores enhance their competitiveness and increase their earnings, thereby mitigating the effects of competition from online-to-offline (O2O) channels. The research authors expanded the empirical model to analyse the impact of the "reopening policy" in conjunction with government subsidies. They argued that subsidies can enhance the profitability of retail dealers but may also reduce consumer surplus under certain circumstances. They suggested that government entities consider retail establishments' capabilities and operational methods when developing subsidy policies. Koch et al. (2020) researched the reasons for online buying among Generations Y and Z during the COVID-19 lockdown in April 2020. The survey questionnaire collected data from 451 German consumers, who were analysed using structural equation modelling to examine the connections between normative, utilitarian, and hedonistic incentives and the inclination to shop online. The findings indicated that normative factors, including media coverage of economic situations, are linked to consumers' inclination to shop online, whereas the normative impact of social media is not. The paper's authors indicated that hedonic incentives are a more accurate predictor of the desire to shop online than utilitarian motives. Individuals who adhere to social distancing guidelines belong to Generation Z, while women in general exhibited higher levels of hedonistic desire compared to male participants. Lv et al. (2020) developed a proprietary evaluation approach to analyse data from e-commerce platforms. Their focus lies on data regarding the execution of promotional plans via social media, the sharing of discount details with users, and the platform's reputation. The statistics presented are crucial for understanding consumer buying patterns. Findings indicated that price discounts are the primary incentive for buying on e-commerce platforms with low reputations. Enhancing the platform's reputation diminishes consumers' inclination towards high discounts. Hence, discounts should be based on a platform's reputation. In other words, as the e-commerce platform's reputation grows, consumers may be less motivated by discounts alone, and the platform can focus more on providing value through quality products, excellent customer service, and other factors that contribute to its reputation. E-commerce enterprises should work together, set fair rates, and improve quality to establish an environmentally friendly, prosperous purchasing environment that promotes higher revenue and sustainable growth when possible.

Factors such as age, technology adoption, and government policies have influenced consumer behaviour, leading to a shift towards online purchasing.

Although e-commerce has opened new opportunities for businesses, obstacles remain, including the evolving digital landscape, consumer satisfaction, and competition. To develop effective e-commerce strategies, it is essential to have a thorough comprehension of these dynamics, as stated in the cluster 2 research papers.

#### *Cluster 3: Impulsive shopping*

Cluster 3 includes consumer behaviour, factor analysis, impulsive buying, and keywords for online purchases. Impulsive shopping is the main topic of this cluster. Victoria et al. (2021) identified modernisation and innovation as key drivers of demand for e-commerce and online buying. Various techniques were implemented to attract clients and boost revenue, a trend particularly evident during the COVID-19 pandemic. This research aimed to investigate the effects of sales promotion, self-control, and hedonism on impulsive buying behaviour among users of e-commerce platforms, particularly during the COVID-19 pandemic. The research sample included 205 e-commerce consumers who shopped during the COVID-19 pandemic and provided the necessary data via a survey. The paper's authors utilised random sampling. The study's results confirmed the authors' implications. The primary finding of the study is the impulse buying that occurs when a buyer's self-control is low. Due to the COVID-19 pandemic, most consumers became familiar with online shopping and various e-commerce platforms. E-commerce platforms are now a crucial component of digital marketing strategies and have gained popularity among clients, as noted by Li and Shu (2021). The paper authors developed a theoretical framework of impulse buying by reviewing the literature on digital engagement, presence, and impulse buying to establish research hypotheses. The study indicated that interpersonal ties are positively correlated with social presence and experience. Presence, directly and indirectly, influences impulsive purchases, with experience mediating these effects.

The impact of elements such as sales advertising, self-control, and hedonism on purchase decisions is discussed. Furthermore, the impact of the COVID-19 pandemic on e-commerce uptake and customer behaviour is highlighted.

#### *Cluster 4: Consumer satisfaction*

Cluster 4 consists of consumer satisfaction, data mining, social media, social networking (online), and sustainable development keywords. Consumer satisfaction is the primary focus of this cluster – García-Salirrosas et al. (2022) aimed to understand customer behaviour in emerging nations in the online environment. Four dimensions of the "Preveincosa" scale were examined: intention to purchase online as the dependent variable, and trust, perceived value, and satisfaction as the independent variables. The survey was distributed among consumers in Mexico, Peru, and Colombia. A total of 330 questionnaires were gathered from e-shop consumers, predominantly those who primarily purchased clothing products. The research findings indicated that trust and satisfaction have a direct and positive impact on the sense of value and the propensity to make online purchases. The sense of value significantly affects consumers' online purchase intentions in the research sample in Mexico, Peru, and Colombia. Galhotra and Dewan (2020) conducted a thorough investigation of various types of goods and movable assets offered across numerous e-commerce platforms during the COVID-19 pandemic. The analysis primarily examined how the COVID-19 pandemic affected companies by studying shifts in consumer purchasing patterns. Additionally, the analysis evaluated consumer feedback on aspects such as usage, performance, security, usefulness, and satisfaction related to e-commerce platforms during the final stage of the purchasing process before payment. The

research findings indicated that people are utilising e-commerce platforms efficiently and are interested in their features.

According to cluster 4 papers, trust, perceived value, and enjoyment all affect online purchase intentions. The COVID-19 pandemic has accelerated e-commerce adoption, offering significant insights into customer behaviour, platform usage, and consumer satisfaction. Understanding these variables is critical for companies seeking to improve customer happiness and loyalty.

#### *Cluster 5: The consumer behaviour*

Cluster 5 comprises important terms such as behaviour, consumption, marketing, and sustainability. The concept of this cluster is customer behaviour in the online shopping process before, during, and after the COVID-19 pandemic. Degli Esposti et al. (2021) conducted a quantitative study to investigate Italians' preferences for sustainable products during the COVID-19 pandemic and how the pandemic affected those preferences. A questionnaire was used to obtain data from 500 respondents between October and December 2020. The second phase of the research aimed to explore shared consumption further and examine how the pandemic is impacting and will alter Italian consumers' willingness to embrace particular shared consumption practices, such as ride-sharing or bike-sharing. Research data indicated that respondents have increased their frequency of purchasing specific products/services, such as books and series, while lowering their frequency of purchasing items such as cosmetics and clothing. Moreover, the research revealed a decline in the use of public and shared transportation due to respondents' preference to minimise contact with unfamiliar individuals in these modes. The research findings highlighted the dedication of young, educated women to adopting more diligent consumer behaviour in terms of sustainability. Borsellino et al. (2020) conducted a study analysing consumers' understanding of the effects of the COVID-19 pandemic on supermarket purchasing habits. The COVID-19 pandemic had different effects on consumer behaviour, depending on personal attitudes, individual and household experiences, and features, following the widespread grocery buying seen in many nations during isolation. The financial, economic, and logistical aspects of the context are important for studying the COVID-19 pandemic and consumer behaviour in supermarket shopping. Amid the COVID-19 pandemic, new global patterns emerged. Home cooking regained popularity, driving demand for essential food items and a preference for shopping at small, local stores and online sellers. Many consumers have shifted to buying healthier, more sustainable food, despite price fluctuations and concerns about future income. Furthermore, the quantity of food waste fell dramatically. Producers and retailers should proactively capitalise on this opportunity to fulfil consumer demand.

Consumers showed increased interest in sustainable products and reduced food waste, despite declines in specific categories such as apparel and cosmetics. Businesses must understand these changing patterns to adapt their approach and meet evolving customer demands.

#### *Cluster 6: The buying behaviour*

Cluster 6 includes keywords for buying behaviour, consumer behaviour, and impulse buying. Consumer behaviour and online smartphone shopping are included in this cluster. Contemporary smartphones have the ultimate potential to transcend their fundamental function as standard voice communication devices. The clever design and technological advancements of mobile applications have made users' lives easier than ever. The World Health Organization declared the COVID-19 pandemic

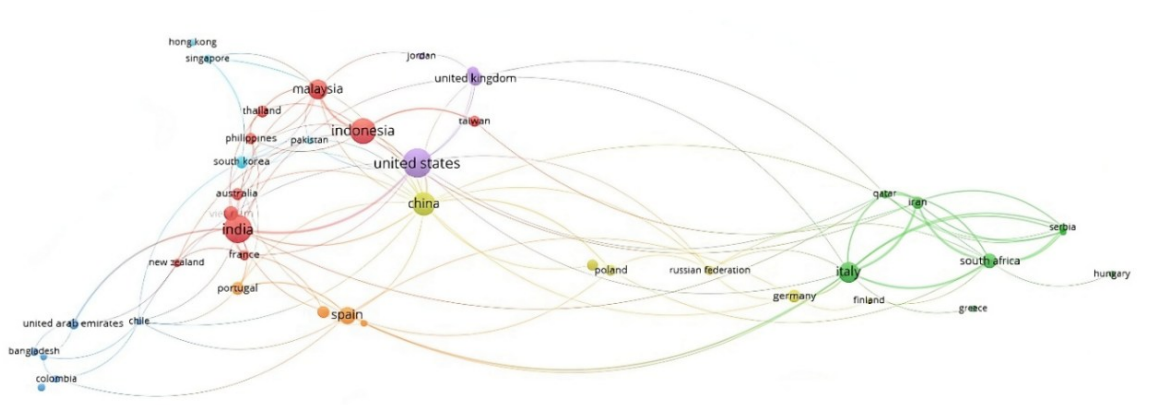
on March 11, 2020, and it has been in effect since December 2019. The global population was experiencing the direct and indirect consequences of the COVID-19 pandemic. However, mobile phone technology provided sophisticated solutions for dealing with a pandemic environment. Therefore, as a pilot study within the Wiścicka-Fernando (2021) research, the author examined the behaviour of Polish consumers using mobile phones, focusing on their online shopping behaviour before and during the COVID-19 pandemic. The survey was conducted in April 2021 to collect primary data from respondents, and a total of 102 respondents were included. To conclude, two types of statistical hypothesis testing were conducted. First, hypothesis testing was conducted to determine whether respondents showed a significant increase in the average number of online shopping transactions per month during the COVID-19 pandemic. Second, hypothesis testing was conducted to determine whether there was a difference in respondents' average monthly online shopping transactions during the pandemic across age groups. The research results confirmed a significant difference in the average monthly number of online shopping transactions before and during the COVID-19 pandemic. However, there is no significant difference in the average number of monthly online shopping transactions during the COVID-19 pandemic between Generation X and Generation Y.

According to the Cluster 6 paper, the COVID-19 pandemic considerably increased the frequency of online buying among consumers. However, the paper authors discovered no substantial variation in internet shopping behaviour between Generations X and Y during the COVID-19 pandemic.

### Country analysis

Figure 3 displays a country co-authorship analysis map that shares at least three articles. There are 80 nations in total, but when imposing restrictions on at least three collaborative publications, the number decreases to 42, with 115 linkages. Seven clusters were found, with the United States of America, India, and Indonesia having the highest number of joint country publications.

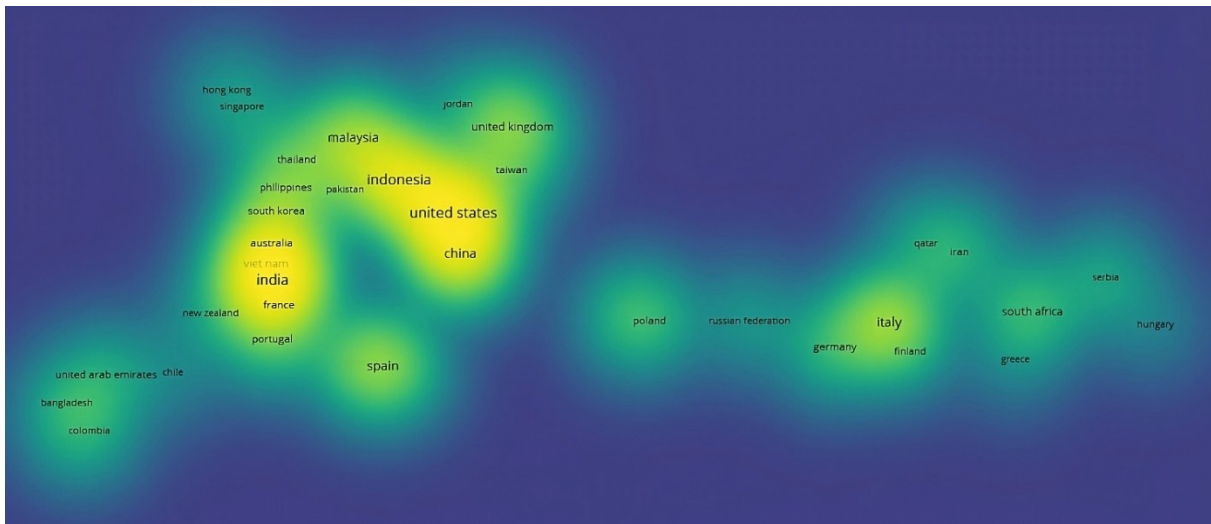
Figure 3  
The country co-authorship map



Source: Authors' illustration, using VosViewer

Figure 4 displays a heat map of country co-authorship analysis, showing the fewest or most collaborative publications. The area on the map with the brightest yellow colour indicates the highest concentration of co-published publications by country. The United States of America, India, Indonesia, China, Australia, Vietnam, and France are the nations with the most joint publications.

Figure 4  
The country analysis heatmap



Source: Author's illustration, using VosViewer

Table 7 displays the country analysis clusters with at least three collaborative publications. Cluster 1 consists of Australia, France, the Philippines, India, Indonesia, Malaysia, New Zealand, Taiwan, and Vietnam. Cluster 2 consists of Bosnia and Herzegovina, Greece, Iran, Italy, South Africa, Qatar, Hungary, and Serbia. Cluster 3 primarily consists of South American nations, with the exceptions of Bangladesh and the United Arab Emirates. Cluster 4 includes Finland, the People's Republic of China, Germany, Poland, the Russian Federation, and Turkey. Cluster 5 primarily includes Anglo-Saxon nations, excluding Jordan, such as the United Kingdom, the United States of America, and Canada. Cluster 6 comprises nations from Southeast Asia. Most countries have at least three document publications by the country of origin, predominantly from Asia, while findings also show a boost in international collaboration among authors from various countries.

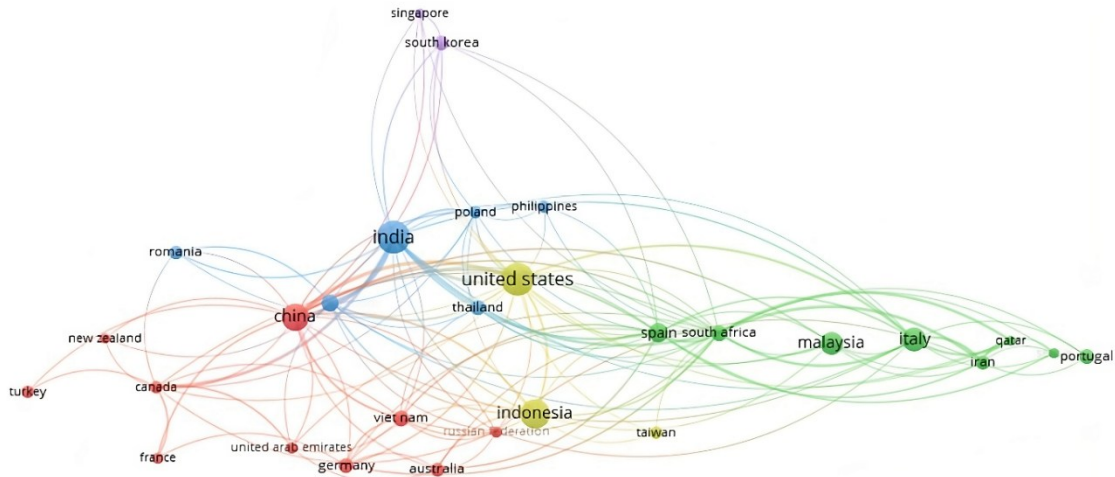
Table 7  
Country analysis clusters (countries with three or more publications)

Cluster	Countries per cluster
Cluster 1	Australia, France, Philippines, India, Indonesia, Malaysia, New Zealand, Taiwan, Vietnam
Cluster 2	Bosnia and Herzegovina, Greece, Iran, Italy, South Africa, Qatar, Hungary, Serbia
Cluster 3	Bangladesh, Chile, Colombia, Mexico, Peru, United Arab Emirates
Cluster 4	Finland, People's Republic of China, Germany, Poland, the Russian Federation, Turkey
Cluster 5	Canada, Jordan, the United States of America, the United Kingdom
Cluster 6	Hong Kong, South Korea, Pakistan, Singapore

Source: Author's work

Figure 5 displays the country's co-citation analysis with at least five shared articles and citations. There are 80 countries in total, but when filtered to include at least five publications and citations per country, the number decreases to 29, totalling 242 linkages. Five clusters were identified, with the United States of America, India, and Indonesia having the highest total number of co-cited works.

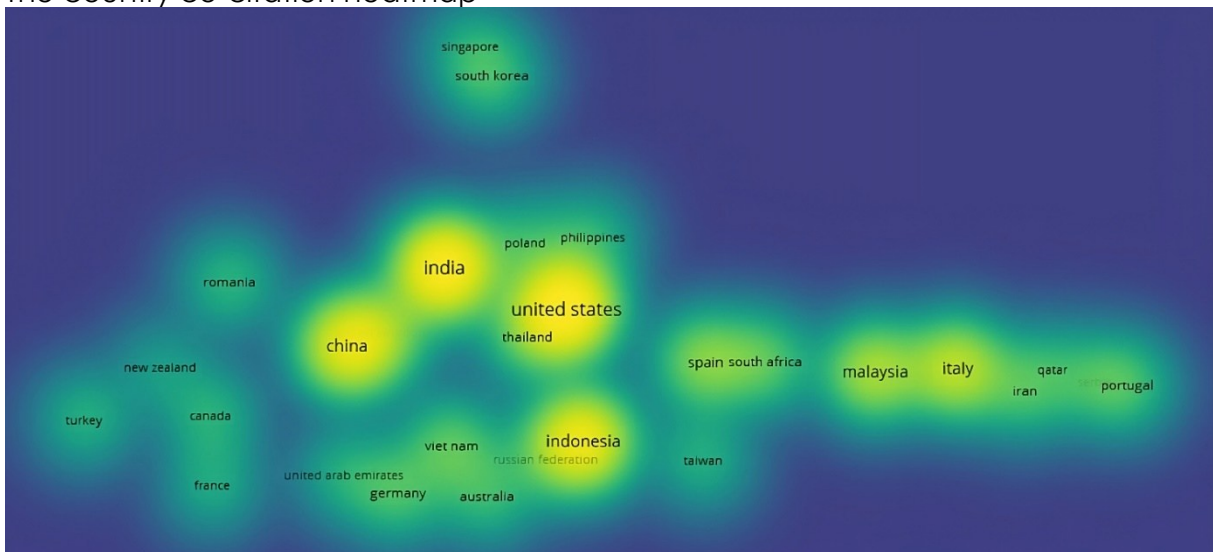
Figure 5  
The country co-citation map



Source: Author's illustration, using VosViewer

Figure 6 displays a heatmap of the country's co-citations with at least five joint publications and citations. The area on the map with the brightest yellow colour indicates the greatest concentration of citations by country. As shown in Figures 5 and 6, the United States of America, India, and Indonesia are the most prevalent countries in this research. China's inclusion in the study further demonstrates its relevance to the research topic.

Figure 6  
The country co-citation heatmap



Source: Author's illustration

Table 8 displays countries' co-citation clusters with at least five shared publications and citations. Cluster 1 comprises countries worldwide, including Australia, Canada, China, France, Germany, New Zealand, Russia, Turkey, the United Arab Emirates, and Vietnam. Cluster 2 mainly includes European and Asian countries, with the Republic of South Africa as the only exception. Cluster 3 comprises individual countries from Southeast Asia and Europe. Cluster 4 contains the United States, Indonesia, and Taiwan. Cluster 5 includes two Asian nations, Singapore and South Korea. The data in Table 8 show that country co-citations with at least five publications and citations are widespread globally, with Asia and Europe recording the highest numbers.

Table 8

Country co-citation clusters (more than five shared publications and citations per country)

Cluster	Countries per cluster
Cluster 1	Australia, France, Philippines, India, Indonesia, Malaysia, New Zealand, Taiwan, Vietnam
Cluster 2	Bosnia and Herzegovina, Greece, Iran, Italy, South Africa, Qatar, Hungary, Serbia
Cluster 3	Bangladesh, Chile, Colombia, Mexico, Peru, United Arab Emirates
Cluster 4	Finland, People's Republic of China, Germany, Poland, Russian Federation, Turkey
Cluster 5	Canada, Jordan, United States of America, United Kingdom
Cluster 6	Hong Kong, South Korea, Pakistan, Singapore

Source: Author's illustration, using VosViewer

The results indicate that Asian countries are forerunners in the number of publications on this research topic. Furthermore, their cooperation and mutual citation are seen with European country-based institutions.

## Conclusion

Advancements in digital technologies have reshaped consumer habits and commerce models. The widespread adoption of digital devices has enabled the transition towards online commerce. E-commerce platforms have been established to facilitate customer-to-business interactions and streamline the online shopping process. The COVID-19 pandemic increased overall digital presence and Internet usage across many topics, including e-commerce. The research paper used bibliometric and text-mining analyses to identify relevant literature on e-commerce and COVID-19. The search of the Scopus database yielded 845 publications on "COVID-19 and e-commerce" for the 2020 and 2023 timeframes. After narrowing down the search to Business Management, Accounting, and Social Sciences fields, 417 publications were considered. These scholarly articles underwent peer review and covered a range of scientific fields beyond the primary ones, including Computer Science, Economics, Engineering, and others. The majority of publications were scientific articles (71.9%), followed by conference papers (15.6%) and book chapters (6.1%). Bina Nusantara University emerged as the most productive institution with 14 publications, followed by other institutions with fewer publications. The United States, China, and Indonesia were among the countries with the highest number of publications, with various funding agencies supporting e-commerce research, including the National Natural Science Foundation of China and the European Regional Development Fund.

The text mining analysis of 417 publications identified key terms, including COVID-19, online shopping, purchase intention, e-commerce, and consumption behaviour. To address synonymous terms, a Thesaurus document was created. The analysis uncovered 640 connections among 63 items, with an average link intensity of 27.5 across all keywords. Furthermore, keywords were distributed into clusters for a more detailed approach. Cluster 1 focused on consumer behaviour and shopping trends amid the pandemic, while Cluster 2 focused on online shopping intentions and consumer trust. Research within Cluster 3 examined impulsive buying behaviours and their correlation with self-control deficiencies. Cluster 4 scrutinised consumer satisfaction, highlighting factors such as trust and perceived value. Cluster 5 examined consumer behaviour in online shopping during and post-pandemic, emphasising sustainability considerations; lastly, Cluster 6 explored shifts in smartphone shopping behaviours during the pandemic. Cluster research papers were conducted across a diverse number of countries, including Malaysia, Vietnam, the Philippines, Germany, Italy, and Poland. The findings provide an overview of key thematic areas and geographic trends in e-commerce research during the COVID-19 period. Furthermore, there is a positive trend towards increased cross-country collaboration among authors, particularly in Asia and Europe, indicating a global engagement in understanding and navigating the evolving landscape of consumer behaviour and e-commerce dynamics.

This study has several limitations that should be considered when interpreting the results. The presented research paper's findings are limited in geographic scope, focusing on China, Indonesia, the United States, and European countries, and thus lack other potential cultural, economic, and technological contexts. Furthermore, given that trends and patterns noticed during the pandemic may have changed or evolved, the study's temporal focus on the COVID-19 pandemic may not adequately represent the long-term consequences of digital technology on consumer behaviour and the post-COVID-19 impact on e-commerce. Furthermore, the text mining research may not have fully explored the complexity of consumer behaviour and e-commerce dynamics, despite uncovering important terms and clusters. Richer insights might be obtained by doing a more thorough examination of the connections between keywords and their consequences. Additionally, limiting the study to only Scopus data may miss relevant material in other databases or sources. Research that is more likely to be published in indexed journals may be overrepresented, limiting the range of viewpoints and conclusions. This raises the possibility of publication bias. Although peer review was reported in the study, a more thorough evaluation of the publications' quality and methodological soundness could enhance the reliability of the results. Even if the study shows a link between COVID-19's impact on e-commerce, it might not provide enough evidence to establish a direct causal relationship.

Lastly, although this research paper has limitations, it provides insight into how COVID-19 has affected e-commerce growth. Its reliance on published research and the potential variation in publication quality may be its main limitations, even though it identified important research themes, trends, and contributions. Furthermore, some research efforts may not be fully captured by bibliometric indicators. Future research papers may address these constraints by broadening the analysis to include unpublished or grey literature, adopting qualitative inquiry, accounting for the limitations of bibliometric metrics, investigating the combination of bibliometric analysis with alternative techniques, and addressing ethical issues. Additional research and analysis could improve the meaning and applicability of the results, thereby overcoming these constraints. This can entail broadening the geographic scope to include additional areas, investigating the enduring impacts of digital technologies

beyond the COVID-19 pandemic, conducting a more comprehensive examination of keywords and their consequences, incorporating other databases, and carefully reviewing the quality of the featured papers.

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