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Electric vehicles' consumer behaviours: Mapping the field and providing a research agenda

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ABSTRACT

Research on consumers of electric vehicles appears to offer significant contributions relative to the behaviour factors that stimulate purchase. Although it is one of the topics most endorsed by international organisations, a holistic compendium of the literature is not provided. Therefore, different research directions necessitate a clear systematisation. This study moves in this direction by conducting a bibliometric and thematic analysis of 254 studies related to consumer behaviour in the electric car market. The research reveals the primary co-citation network between international journals and authors, a map of the leading research centres on the topic, and the dimensions covered by scholars. Additionally, the analysis extends the theory of planned behaviour, offering a valuable consumer identikit for practitioners. Based on the results, the study provides multiple research questions helpful to feed the academic debate.

1. Introduction

The transport sector is now being challenged by the increasing focus on environmental and climate change parameters (Secinaro et al., 2020; Umar et al., 2021). According to the European Parliament (2019), this sector is responsible for at least 30% of CO_2 emissions across the European Union (EU). Even overseas, the percentage is close to 37.5% (US EPA, 2021). Of these, around 60% of CO_2 emissions are caused by vehicle traffic in the world's major cities, individuated as a critical places to implement new smart solutions (Ferraris et al., 2018).

Given the cogent subject matter, interest in the transition from diesel/gasoline-powered vehicles to electric vehicles (EVs) involves researchers from countless disciplines. Hence, academics and practitioners are increasingly interested in multiple approaches and experiences with EVs to investigate the optimal strategies to improve energy efficiency, satisfy consumer needs with a wide variety of green vehicles, and meet environmental challenges. For example, Rubio et al. (2020) presented an algorithm to optimise travel time and reduce greenhouse gas emissions, increasing the share of renewable energy and improving energy efficiency. Authors such as Majid & Russell (2015) focused on expanding the range of green products and increasing the supply in transport. Bigerna et al. (2016) explored the issue from an environmental perspective, analysing the purchase intentions of young Italians on the adoption of alternative combustion vehicles. They show that young Italians are the most sensitive to such vehicles' purchases among the broad potential customer base. Furthermore, some scholars have focused on adopting EVs' socio-technical barriers, recognising the price value, the environmental performance of recharge stations (Degirmenci & Breitner, 2017), and alien or untested technologies (Egbue & Long, 2012).

1.1. Theoretical background

The literature has two main strands. The first stream aimed to recognise and positively affect the debate on EVs, stressing themes and issues supporting consumers' behaviour towards electric cars. The second stream focused on exploring the barriers the consumers perceived in manifesting the idea of purchasing an EV.

According to Egbue & Long (2012), EVs have to overcome technology-related problems and issues related to consumer behaviour. Ajzen's (1991) theory of planned behaviour (TPB) explains the factors influencing behavioural intentions driven by knowledge and experience. Hence, the main challenges in consumers' behaviours toward EVs may persist even after fixing technical problems. The theory appears

Abbreviations: EV, Electric vehicle; TPB, Theory of planned behaviour; RQ, Research question; TAM, Technology acceptance model.

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appropriate for explaining ecologically-based purchasing decisions (Hale et al., 2002). However, it seems less effective in understanding behaviour with a strong irrational component (Koenig-Lewis et al., 2014; Mohammed et al., 2021). According to Berveling & van de Riet (2012), car buying can result from an irrational choice. Although it may appear rational because the car must fulfil physical and economic requirements, the purchase may arise from status reasons. That makes the topic internationally relevant, and therefore different authors present literature reviews on EVs to systematise its knowledge.

For example, Globisch et al. (2019) focused on consumers' economic and psychological approaches to considering public charging infrastructure, showing that a significant obstacle to EV deployment is the lack of diffusion of public charging stations. The authors discovered that many potential users are not disposed to pay a fee for the infrastructure deployment, whose high costs do not allow them to obtain the benefits of such deployment. Furthermore, Liao et al. (2017) analysed private consumer intentions and found that EVs' purchase is primarily linked to demographic and psychological factors. They focused on mobility conditions and public policies about EVs. Gil & Taiber (2014) aimed to provide insight into future scenarios for vehicle charging by gathering data related to dynamic wireless charging systems to move beyond stationary charging stations, which appear to be a significant barrier for the consumer.

Considering the multitude of perspectives in which the topic is covered by academics and the fragmentation of the existing knowledge, a literature review appears relevant as a *trait d'union* among identified strands by systematising the flow of knowledge. Degirmenci and Breitner (2017) suggested that new studies focus on geographical differences in renewable energy produced and EV's final price. It is essential to map the key factors influencing purchasing attitudes towards EVs and their public perception (Shetty et al., 2020). This study serves as a bridge to link the gap shown above. In particular, it offers a holistic view of the topic compared to prior literature reviews by enlarging the sample (Axsen & Sovacool, 2019). Moreover, it focuses on the explicit role of the consumer and does not set geographical market limitations (Adnan et al., 2017). Finally, it provides an advanced study by collecting recent information that previous authors have not provided.

1.2. Research gap, aims, and questions

Based on the previous premises, our study aims to provide a bibliometric and thematic analysis of the literature to overcome the existing fragmentation and feed the academic debate, providing theoretical and practical implications (Vrontis & Christofi, 2021). The bibliometric analysis acknowledges offering information about leading international research groups, a global geo-mapping of the most engaged countries and outlining the hot topics of electric car scholars (Biancone et al., 2022; de Bem Machado et al., 2021). Based on these assumptions, this literature review aims to summarise and collect fragmented knowledge on consumers in the electric car sector according to the Theories, Contexts, Characteristics and Methodology (TCCM) framework (Chakma et al., 2021). Furthermore, the analysis uncovers flourishing research fields by identifying precise research questions (RQs) that need to be investigated to expand the ongoing debate on consumer behaviour toward electric cars (Gupta et al., 2020).

For this purpose, this study presents a bibliometric analysis of co-citation variables, which helps understand the benchmark journals and authors for the topic. Moreover, based on the stimulus of several authors (e.g., Degirmenci & Breitner, 2017; Jiang et al., 2020), the research identifies, at the geographical level, the countries involved mainly in the academic debate, while the thematic analysis allows us to identify the main characteristics of the EV consumers and their behaviour, including offering an identikit useful for managers to define future strategies in the industry. Finally, new methodological scenarios are presented (Paul & Dhiman, 2021). Although the interdisciplinary nature of the topic may suggest numerous adopted methodologies, the study focuses on future approaches related to the field of business and management (Goyal & Kumar, 2021).

That is done by strictly applying the research protocol of Massaro et al. (2016) and benefiting from the research indications of Paul and Criado (2020) and Arun et al. (2021). Their methodological contribution allows us to offer a state-of-the-art knowledge of the literature and new research trends, stimulating future lines of research (Chakma et al., 2021). In this context, RQs identification is a vital preliminary step to conduct a bibliometric and thematic analysis (Jebarajakirthy et al., 2021; Secinaro, Dal Mas, et al., 2021). Therefore, this study identified two RQs inspired by the analysis of Zupic and Čater (2015):

RQ1: What are the main bibliometric variables, co-citation's structure, and geographical analysis in the field of 'consumer behaviours on EVs'?

RQ2: What factors affect the purchase of EVs?

This study suggests and defines several research fields that could be of interest to scholars, such as how a charging system powered by entirely sustainable energy can be implemented or the prospects for an all-electric transportation system.

1.3. Originality and map of the paper

This analysis is different from previous studies for several reasons. First, the study aims to feed the academic debate on EVs and offer several theoretical and managerial contributions (Austmann, 2021; Sabbaghtorkan et al., 2020). Second, the research goes beyond the mere bibliometric description of variables such as authors, countries, and keywords. The study offers broad perspectives on past research, such as on Guo et al. (2019) and Secinaro et al. (2021) studies, providing insight into the citation network, valuable consumer, and customer identification elements in the electric car market, and addresses geographical needs (Arun et al., 2021; Baima et al., 2020; Paul & Criado, 2020). The author's work addresses future research challenges by analysing thematic and co-occurrence keywords.

Finally, the study is structured as follows. Section 2 describes the methods (bibliometric and thematic analysis) employed. Section 3 provides an in-depth data interpretation, comments, and critique on the main findings. Section 4 concludes the article with a summary of the current state-of-the-art and recommendations for possible future research directions.

2. Methodology

The literature review method allows researchers to implement rigorous and reliable analysis of scientific sources (Hulland & Houston, 2020; Paul, Merchant, et al., 2021). Several scientific review methods exist as theme-based reviews (Paul & Feliciano-Cestero, 2021), using a framework as a methodology (Xie et al., 2017), theory-based (Xie et al., 2017), reviews aiming for theory development (Paul & Mas, 2020), hybrid type (Dabić et al., 2020), and bibliometric analysis (Ruggeri et al., 2019). Considering the research gap, the authors deem that bibliometric analysis could be joined with an in-depth thematic analysis concurrently applying a rigid and systematic research protocol (Furrer et al., 2020). This combination of approaches will allow us to validate bibliometric variables such as authors, citations, keywords, and countries of publication to obtain thematic analyses based on the selected literature (Paul, Lim, et al., 2021; Secinaro, Dal Mas, et al., 2021; Zupic & Čater, 2015). Furthermore, to increase the reliability and replicability of the research results, the authors considered the TCCM framework. Thus, the final section explores the effects holistically to develop future research questions consistent with the above framework (Chakma et al., 2021).

Additionally, the study benefited from the research inputs provided by Paul and Criado (2020) and Paul et al. (2021), which allow researchers to adopt a hybrid research methodology focused on future aspects.

As reported by Massaro et al. (2016) and applied by Secundo et al. (2020), to investigate the literature flow on consumer and customer behaviour in the context of EVs, the researchers adopted five rigorous steps:

1. Defining RQs
2. Writing of the research protocol
3. Definition of the research sample for analyses
4. Development of codes for analysis
5. Critical analysis, discussion, and identification of a future research agenda

The authors legitimate the analysis regarding the research protocol considering the current and expansion research flow of Massaro et al. (2016). This study adopted a bibliometric and thematic analysis to limit the results' subjectivity (Dumay, 2014; Paul, Lim, et al., 2021; Zupic & Čater, 2015).

This study used Scopus, the largest citation database for peer-reviewed literature, to determine the study's selection for literary analysis on the topic. According to Okoli (2015) and Mongeon and Paul-Hus (2016), it is a multi-disciplinary database suitable for management researchers, including a higher number of indexed Journals than the Web of Science. Two researchers independently compared the two databases to ensure no significant and relevant sources were missed despite these results (de Bem Machado et al., 2021). Finally, our comparison between Scopus and Web of Science is in line with Bramer et al. (2017), who found that in 52% of the results Scopus retrieved 100% of all included references retrieved from Embase or Web of Science.

The analysis considers '*Consumer* behaviour*' OR '*Customer* behaviour*' OR'Buyer*' AND '*Electric car**' OR '*Electric vehicle**' related by the boolean operator. In addition to the critical terms on which the study is built, the authors used 'buyer*' as synonymous with consumer and customer, as Arora and Chakraborty (2021) suggested.

The analysis involves several inclusion and exclusion criteria. The search key identified articles between 1980 and 2021, and the authors include scientific articles, excluding non-expert-reviewed articles, books, book chapters, and conference proceedings (Arun et al., 2021; Vlačić et al., 2021). Recognising the embryonic stage of the literature, this research considered the results from all peer-reviewed journals with a peer-reviewed editorial process (Massaro et al., 2016).

The study considered results from 267 peer-reviewed articles. Finally, we examined only English papers (Mariani & Borghi, 2019; Secinaro et al., 2020) and applied all previous restrictive search criteria, selecting 258 articles for analysis. Additionally, four articles identified

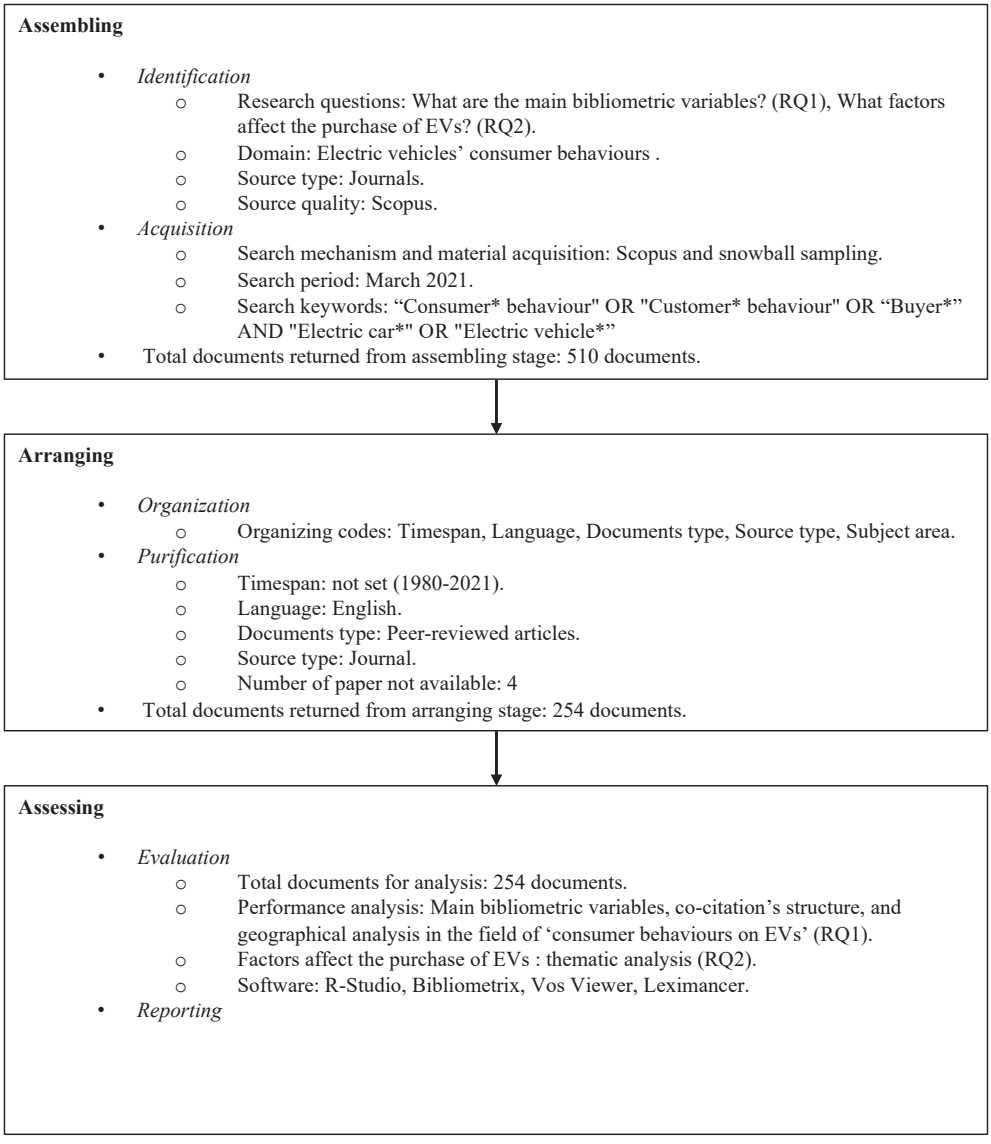

Fig. 1. SPAR-4-SLR protocol. **Source:** Author's elaboration on Paul, Lim, et al. (2021).

by the draw could not be available. Therefore, the final number of articles under analysis is 254. Furthermore, the methodology is consistent with the SPAR-4-SLR guidelines of Paul, Lim, et al. (2021), which satisfies data curation as required in Radu-Lefebvre et al. (2021). Fig. 1 details the information to enable the reliability and replicability of our study. Then, considering the selected articles that impact the field of analysis, we begin by identifying the most frequently cited related articles to rule out the possibility of not having included studies found in other databases. For this research, bibliometric analysis can avoid bias in data selection because it focuses on quantitative analysis, which could help researchers focus on essential and relevant articles (Centobelli et al., 2020). Finally, this research utilizes the snowball sampling validation technique in addition to the citation technique. This approach allowed the scholars to verify the presence of the most relevant research sources not included in the Scopus dataset in the analysed sample. Next, code analysis allowed the researchers to validate the results obtained by Scopus.

Additionally, the RQs allowed us to define the structured path of investigation. In particular, the analysis focused on three primary areas: co-citation analysis to investigate author structure, geographical analysis, and thematic analysis. In the following paragraphs, there are evidence of the analysis steps followed.

2.1. Co-citation analysis

Co-citation analysis (Small, 1973) is a bibliometric technique proposed to map a topic's structure by studying papers cited together (Cobo et al., 2011). Although it allows for identifying meaningful connections between authors, this approach investigates the past research topic, probing more past contributions than new ones (Van Eck & Waltman, 2009). However, the technique effectively provides a holistic view of the specific field of study (Ruggieri et al., 2018).

All articles in the cluster were used to produce a map related to the research topic. The set was then processed through VosViewer software; the output provided the weighted sum of the squared distances among all pairs of publications by their similarity (Van Eck & Waltman, 2009). This procedure made it possible to identify the representation of the various research subfields' intellectual bases.

2.2. Keywords analysis

Keywords analysis is a bibliometric technique that allows analysing the primary content of selected publications (Guo et al. 2019) which enables viewing essential words in a search field along with co-occurrences. In addition the analysis per year allows the search for the most commonly used keywords by researchers over a given period (Aria & Cuccurullo 2017; Guo et al. 2019).

2.3. Geographical analysis

To obtain geographic information on the relationship flows between countries and the most contributing nations on the topic, the authors used Bibliometrix, a statistical package available on R-Studio (Aria & Cuccurullo, 2017). The software collects bibliometric information, including authors, citations, countries of production, and keywords. Then, the Biblioshiny web interface was used to create a concept map and citation network.

Donthu et al.'s (2020) data on country relationships are valid to obtain information about where the topic is the most covered and examine if correlations between authors' contributions and interest in it occur.

2.4. Thematic analysis

Thematic analysis of documents identified from text mining is a form of unstructured ontological research provided to investigate detailed concepts by shifting the study level to the words used by authors to provide a systematic, impartial, and driven review of the literature content (Biesenthal & Wilden, 2014). Qualitative content analysis of the identified sample allows for the study of multiple sources, such as written texts (Elo & Kyngäs, 2008). Researchers benefit from more detailed investigations using technology software to analyse research streams (Krippendorff, 2018).

The identified cluster of documents identified through the keywords already included in the general section of the methodology was processed through Leximancer 4.0 software to pursue these goals and perform a research area's narrative inquiry (Sowa, 2000; Stubbs, 1996). The research aims to return a mapping of concepts to illustrate a close alignment with expert opinion (Campbell et al., 2011; Rooney, 2005). According to Randhawa et al. (2016), the software is appropriate for exploratory research because it demonstrates high reliability and reproducibility of concept extractions and thematic clustering, extricating expectation bias problems intrinsic to manually coded text analysis expert-based systematic reviews.

In summary, Leximancer enables decoding and visualising the structure of complex textual data, such as those typically used in the dynamic search (Forliano et al., 2021). By identifying the relationships between words and the occurrences of structurally related terms, the analysis enables the conceptualisation of the main topics within the provided sample (Massaro et al., 2021). Therefore, it is an appropriate tool for analysing consumer behaviour's underlying themes in the field of electric cars.

3. Results and findings

This section discusses the findings on consumer and customer behaviour on the EV, answering RQ1: What are the main bibliometric variables, co-citation's structure, and geographical analysis in the field of 'consumer behaviours on EV'?

Specifically, the first sub-section intends to show the results of the co-citation analysis performed using VosViewer. The second investigates the topic geographically using Bibliometrix. The third describes the thematic analysis performed using Leximancer software.

The following part provides a general overview of the research field under investigation and answers the RQs. Table 1 shows 254 papers published between 1983 and 2021 (30 March 2021). However, it is possible to see (Fig. 2) the significant increase in the debate on the topic since 2017, when the EU declared among its goals the desire to become a world leader in decarbonisation (European Commission, 2017). The first publication of 1983 is interesting because, despite the absence of EVs in the market, the literature began to question the issue from that year onwards, prompted by the applied research conducted by NASA in the

Table 1
Main information about data.

Description	Results
Timespan	1983:2021
N° of journals	116
Peer-reviewed articles	254
Average citations per document	30,24
Average citations per year per doc	4,738
References	12.107
Keywords plus (id)	1.682
Author's keywords (de)	796
Authors	679
Author appearances	827
Authors of single-authored documents	25
Authors of multi-authored documents	654
Documents per author	0,38
Authors per document	2,63
Co-authors per documents	3,21
Collaboration index (CI)	2,81

Source: Author's elaboration using Bibliometrix.

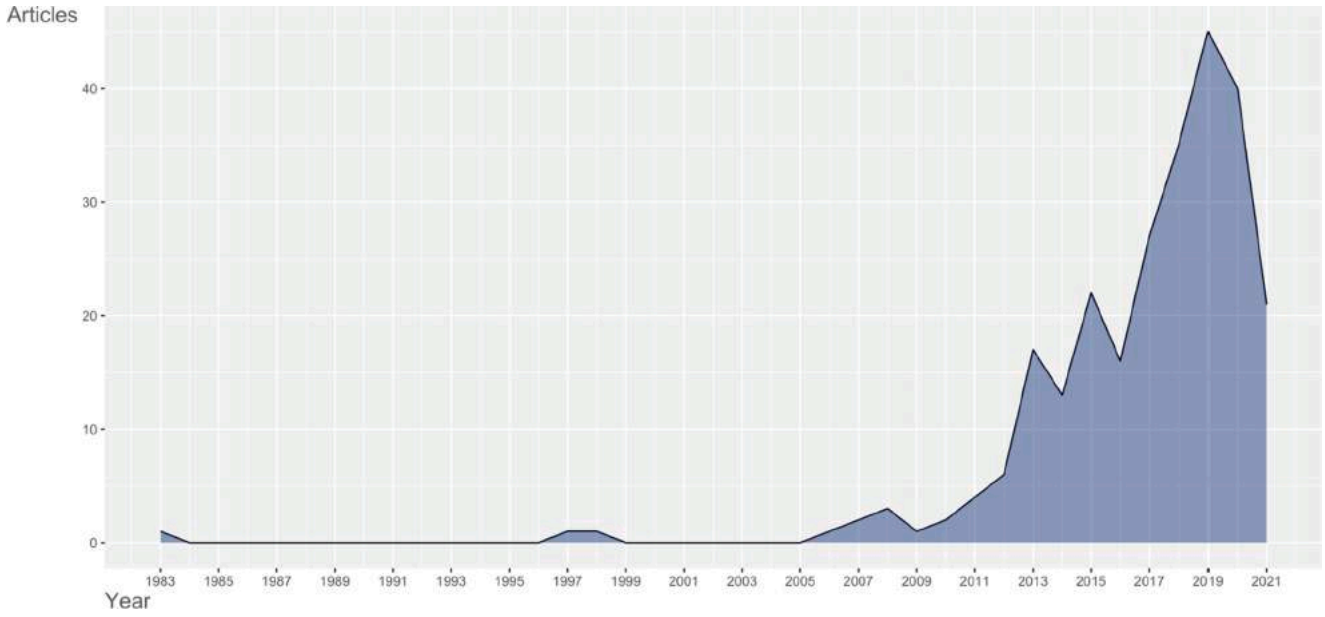

Fig. 2. Annual scientific production **Source:** Author's elaboration using Bibliometrix.

USA on electric batteries. Therefore, the embryonic discussion pushed the debate towards resolving low battery performance by identifying three determining factors in the purchasing decisions of future consumers: range, performance, and cost (Schwartz, 1983). After the first publication stage, researchers showed a renewed interest in the subject only in 2007.

The number of keywords used is 796, meaning that the theme was examined from various perspectives. Moreover, the keywords plus,

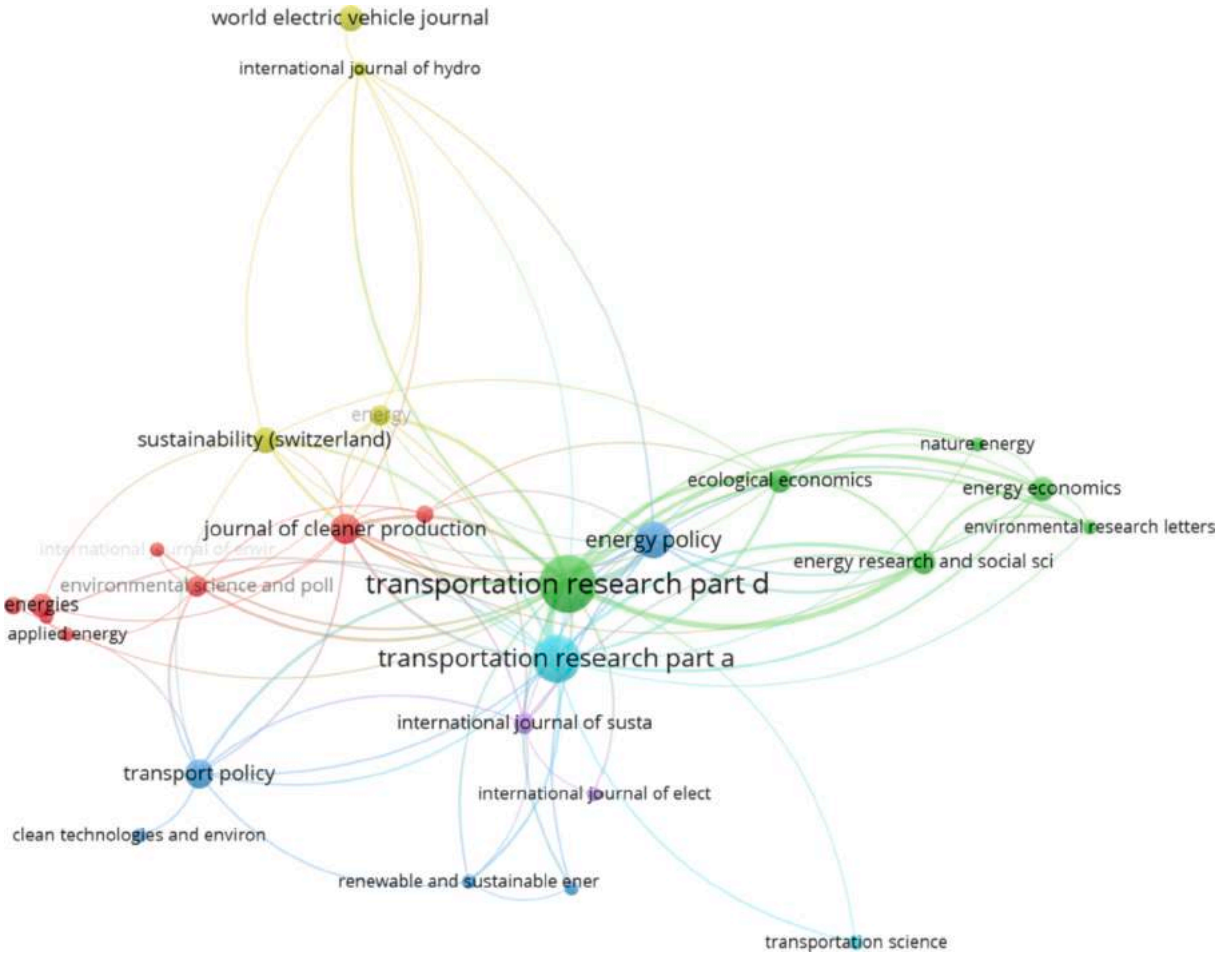

Fig. 3. Co-citation of journal **Source:** Author's elaboration using VosViewer.

which means that the number of keywords frequently appearing in the title of an article, is almost 10 times the total number of articles. Under the authors' index per paper, each article was written on average by more than two authors (2,81). Finally, the search covers 679 authors, and the average number of citations per paper is 30,24. Specifically, the average number of citations appears low, indicating a limited interest in the topic considering the temporal period.

3.1. Co-citation analysis

Co-citation analysis allows researchers to investigate when other journals and authors co-credit the same scientific contribution (Small, 1973). Fig. 3 considers the co-citations of papers among different journals. It is interesting to note at least three main clusters of interest in the research topic. For example, the green and blue areas have the international Energy Policy Journal in the centre addressing energy supply and use policy implications. The journal is central to researchers among 'Transportation research part a: transport and environment' and 'Transportation part d: policy and practice'.

Moreover, innovative are numerous contributions to electric cars' purchase intentions (Axsen & Kurani, 2013). In particular, the green node primarily includes journal contributions with implications for electric car purchase decisions. Nature Energy Journal appears among the sources, including distributed energy resources for electric car consumers and transmission systems.

The authors find a further node of hybrid co-citation (in red and yellow) among the journals concerning the sustainability of electric cars compared to conventionally powered vehicles and choices in terms of transport subsidies. Among them, the analysis reveals the Journal of Cleaner Production, Sustainability Journal, and World Electric Vehicle Journal with relevant publications in terms of sustainable choices based, for example, on the TPB and factors for purchasing EVs (Adnan et al., 2017; Asadi et al., 2021; Carlucci et al., 2018).

Finally, Fig. 3 demonstrates the absence of co-citations of top journals in the topic and area of marketing (AJG, 2021). This element is further solidified by subsequent findings that demonstrate the scientific interest of researchers currently limited to sustainability and transportation modification approaches.

Fig. 4 provides some evidence of co-citations among authors. All authors are part of a well-structured network-based almost on four areas.

For example, the red area, dealing with the impact of consumers on the purchase of electric cars, includes among the most cited contributions from Axsen and Kurani (2013) with a survey of drivers' preferences among petrol, hybrid, plug-in hybrid, and pure EVs. Axsen and Sovacool (2019) explored users' perceptions of electric cars along the same research lines.

The green area includes studies on vehicle performance and sustainable consumption. Examples include Skippons' (2014) contributions, which pose an interesting question about better EV performance than conventional. Jansson et al. (2017) present an engrossing perspective, examining sustainability drivers, including standards and carmaker leadership.

The blue area of co-citation appears to be the authors' narrowest concerning application models that aim to estimate break-even points concerning fuel and EV systems (Liu & Santos, 2015) and predictive models for consumer purchasing (Wang et al., 2016).

Finally, the yellow/purple area finds a strong group of co-citations behind the contribution of Franke et al. (2017) in terms of customer satisfaction on the maximum mileage range of the electric car.

3.2. Co-keywords analysis

This section investigates the linkages and co-occurrences of the keywords used by the authors of the selected sources (Guo et al., 2019; Secinaro, Calandra, et al., 2021). To illustrate the search clusters around

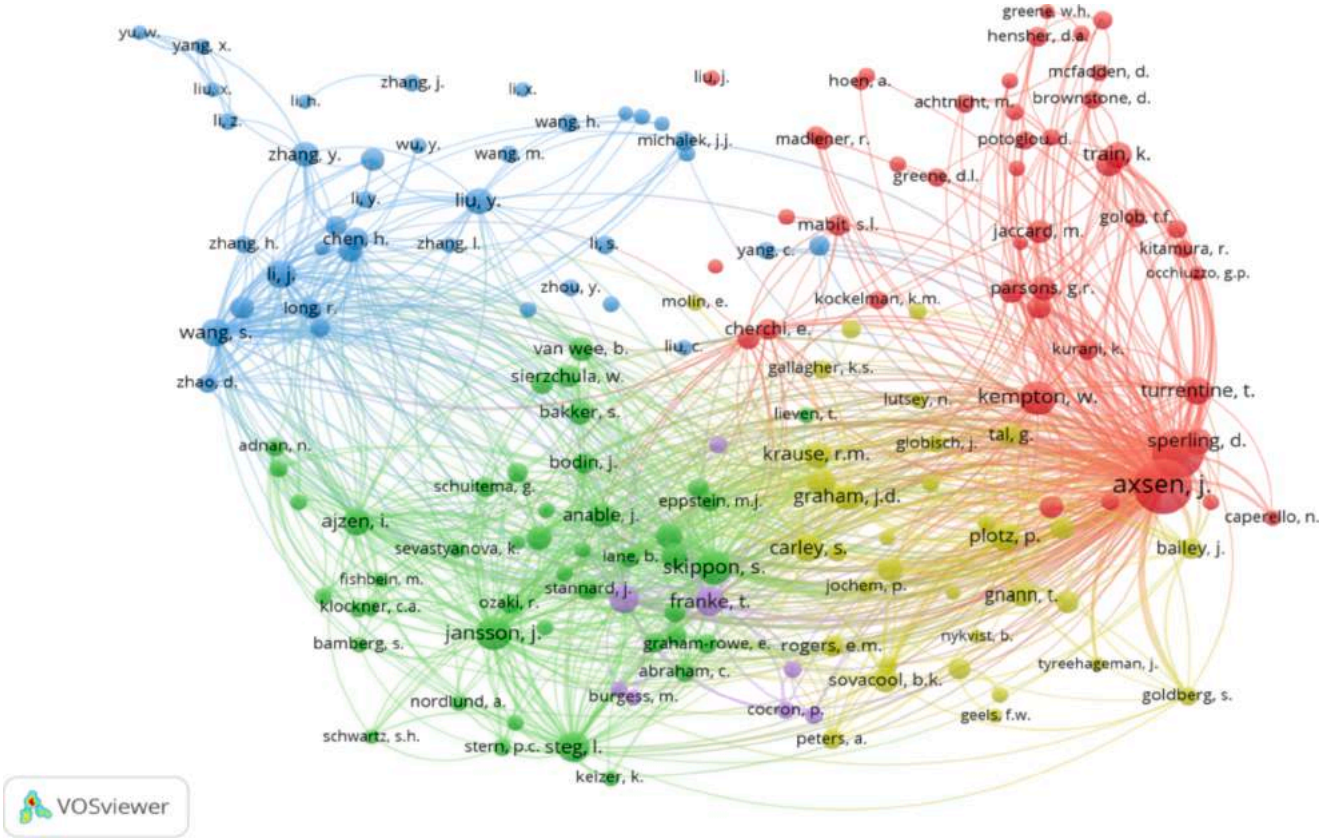

Fig. 4. Co-citation of authors **Source:** Author's elaboration using VosViewer.

EVs, the authors used keyword co-occurrence by setting it to a value of 10 items. That resulted in 4 search clusters, 1121 links, and 58 items in the visualisation. Figs. 5 and 6 display the keyword network on the co-occurrence-based search and the keyword overlap on co-occurrence and average publication scores per year, respectively.

Fig. 5 illustrates a set of co-occurrences represented by circles of keywords in order of size which means that the larger the keywords, the stronger they are within the search thread. Furthermore, the same colour indicates a search cluster, that is, a classification of similar topics. The results suggest four main clusters. In the green cluster at the top left, keywords such as carbon emission, emission control, energy efficiency, sustainability, and innovation related to 'environmental sustainability' emerge. In the yellow cluster at the top and the middle, the results are keywords such as gas emissions, competition, and charging infrastructures, focusing on the research domain of transport infrastructures for EVs. In the blue cluster on the right, the study identifies keywords such as costs, commerce, charging (batteries), and decision-making, with research papers more interested in investigating the relationship among costs, how vehicles are sold, and the role of batteries. Finally, the red cluster on the left includes keywords such as sales, purchasing, perception, preference behaviour, and secondary batteries more concerned with sales, and consumer preferences.

Furthermore, different colours are used to represent the co-occurrences of the keywords over time from 2016 (in dark purple) to 2018 (in yellow) in Fig. 6. In the last years of publication, the most used words are gas emissions, technology adoption, and purchasing.

Although representative, the previous figures could mislead the reader. Thus, Table 2 and Fig. 7 show the trend of keywords from 1983 to 2021.

Initially, the authors only dealt with EV' and 'plug-in' as a theme, with publications moving towards physical, transport, and EV presentation. Since 2014, consumer behaviour has become a key theme (Skippon, 2014). The topic's novelty extended the interest of researchers who initiated survey research topics towards consumers and their interest in new vehicles. Simultaneously, the field of research on renewable energies has grown. According to Secinaro et al. (2020), to be sustainable, electric cars must include energy chains that can cope with the growth in energy demand.

In the following period, consumer behaviour gradually began to emerge from the interest of researchers. Many publications then focused on analysing climate change and the transport sector's role (Brady & O'Mahony, 2011; C. Li et al., 2015). Eventually, in this period, the topic of energy management remained driven by enunciating the EV battery disposal point for the first time (Kampker et al., 2016).

Today, research still focuses on the development of EVs with an eye on the sustainability of the environmental impact (Canals Casals et al., 2016). However, key issues emerge, such as the ability to meet the growing demand for such vehicles with concerns about energy sustainability (Axsen & Kurani, 2013a). Finally, a nascent area is consumer adoption, which draws from early consumer experiences in several countries worldwide (Jaiswal et al., 2021).

3.3. Methodological analysis

This subsection investigates all the methods used by authors in the selected papers to show how the researchers studied the phenomenon (Secinaro, Dal Mas, et al., 2021; Zaheer et al., 2019). Table 3 shows the most used methods. As shown, it is possible to classify 60,82% of

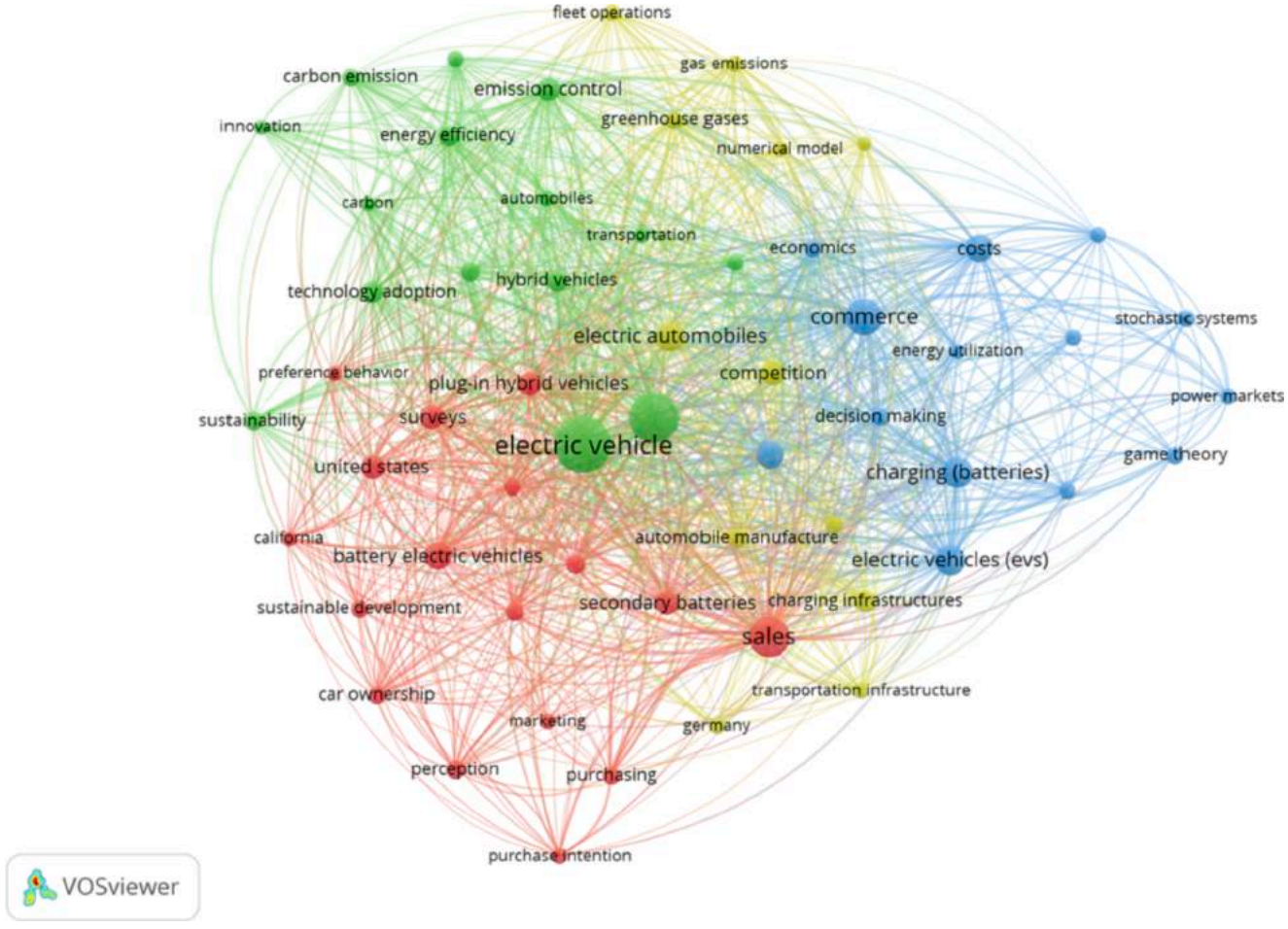

Fig. 5. Co-keywords network. **Source:** Author's elaboration using VosViewer.

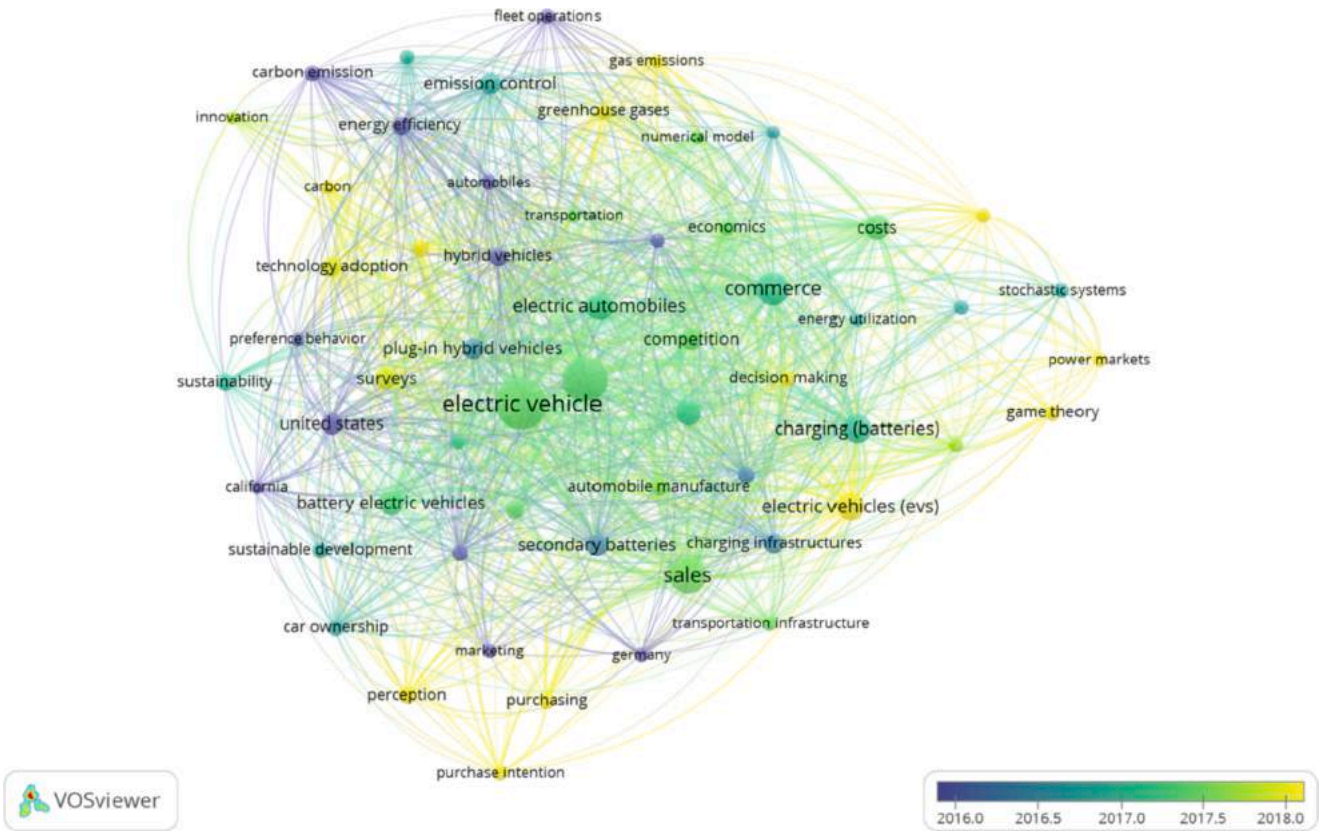

Fig. 6. Co-keywords overlay. **Source:** Author's elaboration using VosViewer.

Table 2
Co-occurrence keywords.

Ranking order	*Keywords*	*Cluster number*	*Links*	*Total Link Strength*	*Occurrences*	*Average publication year*
1	Electric vehicle	2	57	702	130	2017
2	Consumer behaviour	2	57	508	97	2017
3	Sales	1	57	394	66	2017
4	Charging (batteries)	3	51	202	37	2017
5	Plug-in electric vehicles	3	52	199	31	2017
6	Battery electric vehicles	1	48	209	31	2017
7	Carbon emissions	4	48	209	31	2017
8	Costs	3	46	169	31	2017
9	Purchasing	1	34	82	14	2018
10	Decision making	3	37	65	13	2018

Source: Author's elaboration.

quantitative papers, which adopts model creation (Benzidia et al., 2021; Ning et al., 2020) and regressions' analysis (Liu et al., 2019; Wang et al., 2020). Then, mixed methodologies, which join quantitative and qualitative research, are used for 14,69% (Bailey & Axsen, 2015; Bennett, 2015). Additionally, 13,06% adopts qualitative methodologies with case studies. It demonstrates that only a few studies have based their research on consumer behaviour based on non-numerical information (Lopes et al., 2014; Thiel et al., 2020). Then, the results found out that 10,61% of action research, depending on the sample's multi-disciplinary nature, involved experimentation in understanding energy consumption resulting from EV implementation (Akin et al., 2012; Harré & Bossomaier, 2014). Finally, literature reviews are only 2.45% related to EVs, energy savings strategies, and business models, confirming the originality of this scientific study (Axsen & Sovacool, 2019; Rezvani et al., 2015). In the end, the occurrence of conceptual papers and commentaries appears residual.

3.4. Geographical analysis

3.4.1. Country total of articles

This section evaluates which countries most feed the academic debate on the topic and their dynamics: Fig. 8 shows how countries' consumer behaviour on the electric car was considered. The United States is the most prominent prolific nation on the topic (137 published articles). China follows (100), where researchers explore how to understand consumer behaviour and intentions to encourage electric cars to reduce pollution and support sustainability policies.

In addition to the United Kingdom (35), the topic is of interest in Canada (31), in Europe, where Germany (30) and Portugal (14) are the nations most involved in the effort to comprehend the theme, particularly in terms of the changes affecting the market (Plötz et al., 2014) and the use of batteries (Franke et al., 2017). In the middle is South Korea (24). Fig. 5 shows that many areas have not yet engaged in the scientific debate. Significantly, except for Saudi Arabia (4), there has not been a debate on the topic in the major oil-producing countries of the Middle

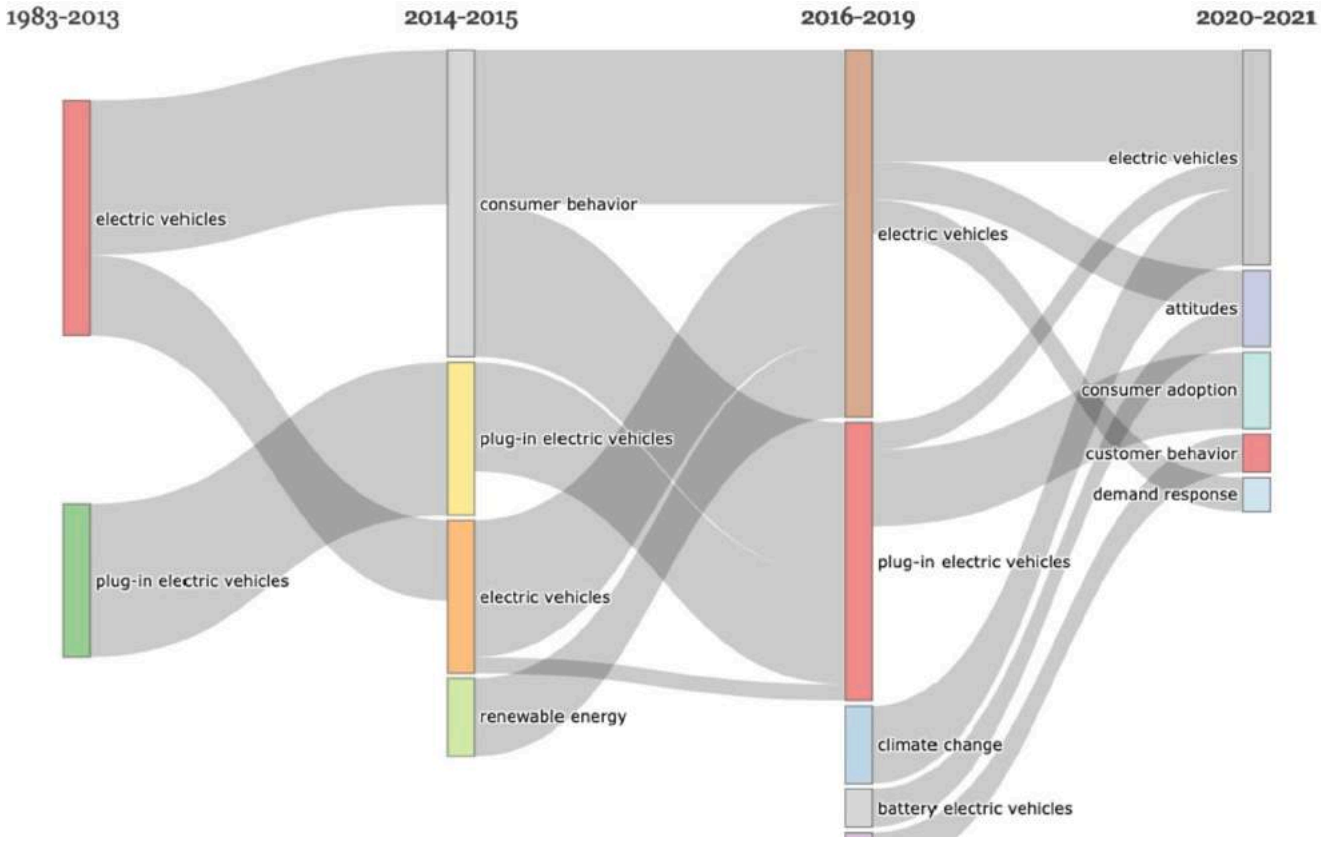

Fig. 7. Keywords and their trends among the years. **Source:** Author's elaboration using VosViewer.

Table 3
Methodology analysis.

Quantitative	60,82%
Mixed Methods	14,69%
Qualitative	13,06%
Action Research	10,61%
Literature review	2,45%
Conceptual	0,41%
Commentary	0,41%

Source: Author's elaboration.

East.

3.4.2. *Country publications and collaboration map*

Here, the results are related to consumer behaviour on EVs in single or multiple publications in each country, illustrating the links across countries. Table 4 shows that Norway, Switzerland, Sweden, and Germany have obtained a higher average number of citations than other countries. Alternatively, the USA, Germany, Canada, and China hold a more significant number of citations. Some countries with the same number of total and average citations are still awaiting more relevance in the future.

Fig. 9 shows the map of global collaborations. The blue colour on the map represents research cooperation among nations. Moreover, the states' pink border indicates the extent of cooperation between authors. The analysis results show that the most robust collaboration occurs between China and the USA and between the USA and European countries such as Germany and Spain. The first couple can be considered a similar interest in the development of new environmental policies related to the sustainability of mobility (Axsen & Kurani, 2013b; Xu & Su, 2016); the second link comes from the proximity of the countries and the political choices made by the nations on the issue (Matthews et al., 2017). Finally, the connection between China and the UK is notable due to the researchers' shared interest in increasing their knowledge about consumer behaviour in the EVs purchase process (Küfeoğlu et al., 2019; S. Wang et al., 2016).

3.5. *Thematic analysis*

This section illustrates the thematic analysis results to explain what critical issues and patterns shape consumer behaviour, answering RQ2: What factors affect EV purchase?

The analysis has identified Fig. 10, which shows several vital themes such as 'Consumer', 'Purchase', 'Market', 'Vehicle', and 'Electric Vehicle'. Additionally, Fig. 11 (at the end of this section) provides positive and negative elements affecting consumer and customer behaviour, establishing a theoretical framework giving a logical representation of the results obtained (Degirmenci & Breitner, 2017; Egbue & Long, 2012; Kumar & Alok, 2020; Liao et al., 2017; Secinaro et al., 2020). The framework considers the focal concepts defined by Leximancer based on the numerosity of occurrence and declines their influence according to the literature review as presented below. In this regard, the research uncovers four main research clusters and several key journals that have handled this promising field of research through the first RQ. To explore the second RQ, the analysis found three main factors influencing purchase intentions: price consciousness, environmental concern, and consumer perception and personality (Asadi et al., 2021; Yang et al., 2019; Yang & Tan, 2019). Moreover, EV consumers are intrinsically attracted to technology and driven by technical attributes and preferences regarding socio-demographic characteristics, usage profiles, and social influence (Liao et al., 2017). A primary reason for buying an electric car is its sensitivity to environmental issues. However, there is apprehension regarding the existing battery technologies and sustainable disposal and charging systems (Goebel, 2013; Robinson et al., 2014).

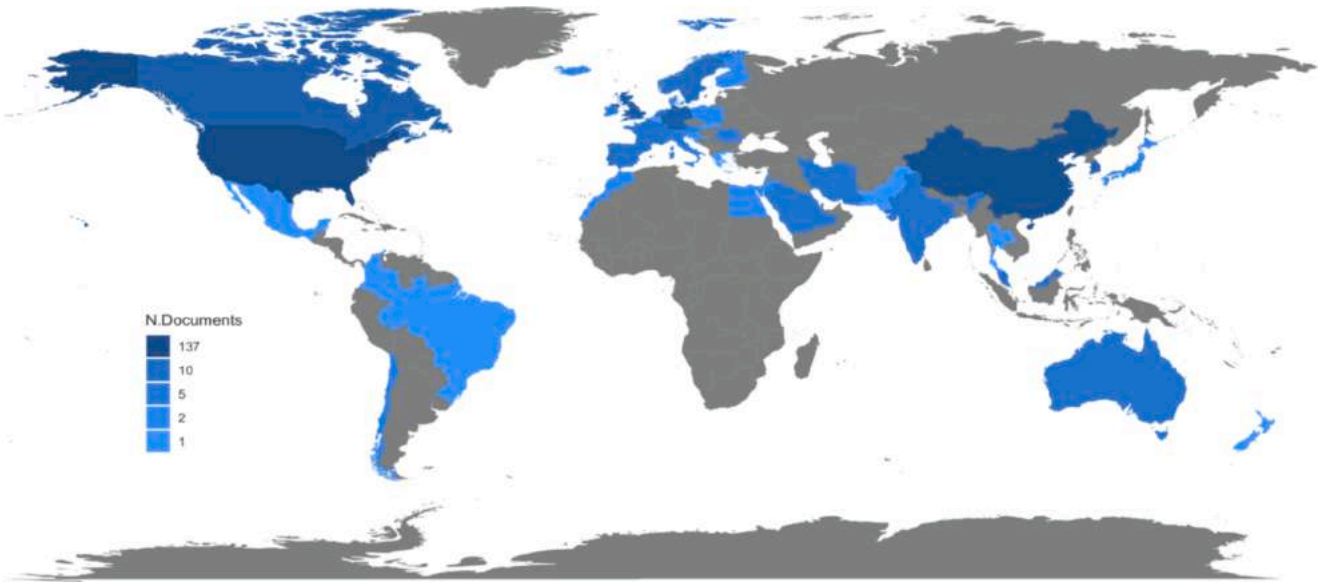

Fig. 8. Country scientific production. **Source:** Author's elaboration using Bibliometrix.

Table 4
Country and their total number of citations.

Country	Total citations	Average article citations
USA	2.034	39,11
Germany	1.062	62,47
Canada	1.001	55,61
China	699	15,20
Norway	360	60,00
Switzerland	284	71,00
Sweden	147	73,50
UK	126	10,50
Ireland	84	42,00
Malaysia	64	21,33
Netherlands	57	28,50
Korea	53	5,89
Romania	45	15,00
Spain	41	10,25
Iran	38	12,67
Portugal	25	8,33
Denmark	23	23,00
Italy	23	11,50
India	22	7,33
Singapore	18	18

Source: Author's elaboration using Bibliometrix.

3.5.1. *Consumers' behaviour and intention*

The analysis showed that purchase intentions and subsequent EVs adoption highly depend on consumer perceptions and confidence concerning different variables (He et al., 2018). The more consumers can control elements such as perceptions of technology, price, availability, or knowledge to use electric and hybrid vehicles, the more likely behavioural intention would evolve (Wang et al., 2016). Specifically, these social and psychological factors utilise the theoretical framework of planned behaviour (Ajzen, 1991), which finds further development within the theory of reasoned action and expectancy-value (Yzer, 2017). As suggested by Yan et al. (2019), the theories allow for identifying determinants of consumer behaviour. The first factor observed in the literature is the reliance on new EVs over traditional diesel or gasoline vehicles (He et al., 2018). Specifically, as defined by the TPB, the stronger the intention to purchase, the higher the final action. According to Mandys (2021), it is possible to classify behavioural attitudes that positively or negatively affect the purchase of EVs.

On a positive side, the analysis denotes factors such as respect for the environment, operating costs efficiency, and the presence of government policies that lower the cost of purchase (Degirmenci & Breitner, 2017; Globisch et al., 2019; Mandys, 2021).

On the negative side, several factors such as battery recycling, use of energy from renewable sources, and reduced number of kilometres driven are included (Li et al., 2015; Neaimeh et al., 2017; Shetty et al., 2020). Therefore, the thematic analysis demonstrates the existence of behavioural factors that affect the final choice of vehicles.

Additionally, it can be argued that consumer choice behaviour towards EVs may be based on socio-demographic characteristics. For example, fewer workers over 40 years old choose EVs than younger workers (Ning et al., 2020). For instance, male consumers are more likely to purchase an EV, and those with high educational qualifications, such as a bachelor's or doctoral degree. There are conflicting views on how income may determine EV choice (Yang & Tan, 2019). The latter factor responds to the perceived behaviour control related to electric cars. As suggested by Yan et al. (2019) and Kumar and Alok (2020), sufficient economic capacity grasps on the perceived control of individual consumer behaviour and the potential, for example, finding charging infrastructure or recreating it directly at their homes.

Finally, it is observed from the literature that a variability in subjective norms significantly affects the geography of EV development (Yzer, 2017). Li et al. (2020) outline theoretical elements with their results, such as the presence of states' conditions to favour EVs over conventional vehicles, which directly affect consumers, creating barriers to other cars.

3.5.2. *Purchase and value*

In this context, three factors may be highlighted that influence EV purchase intention: price consciousness (Cui et al., 2021), environmental concern (Adnan et al., 2018), and consumer perception and personality (He et al., 2018). Consumer perceptions of EV attributes can motivate automakers to improve cars and marketing (Rezvani et al., 2015). According to Zarazua de Rubens (2019), transport policy should be revised to create a space for EVs to operate competitively. Although Wang et al. (2016) have stressed that environmental considerations are essential in purchasing electric and hybrid vehicles, economic factors may be more crucial for potential EV customers (Mukherjee & Ryan, 2020). Finally, the TAM emerged here (Biancone et al., 2021). As indicated in a not-so-recent study by Dudenhöffer (2013), the problems associated with purchasing EVs are primarily psychological and related to technological non-acceptance.

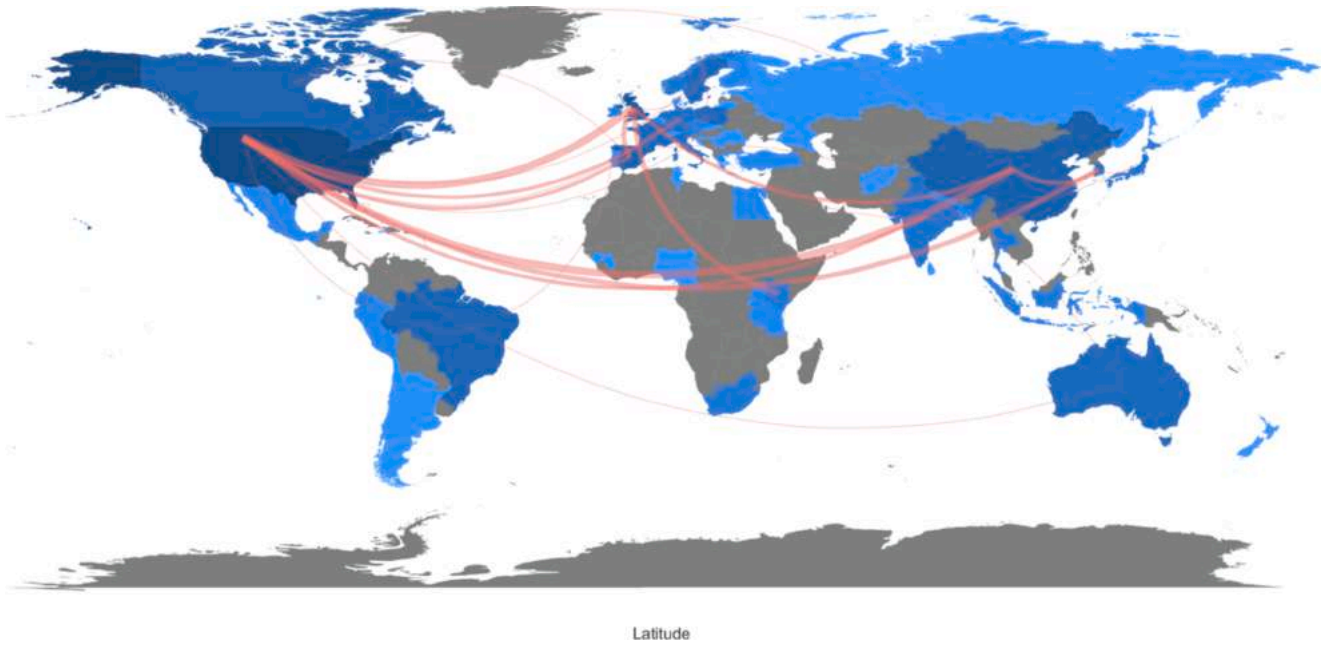

Fig. 9. Country collaboration map. **Source:** Author's elaboration using Bibliometrix.

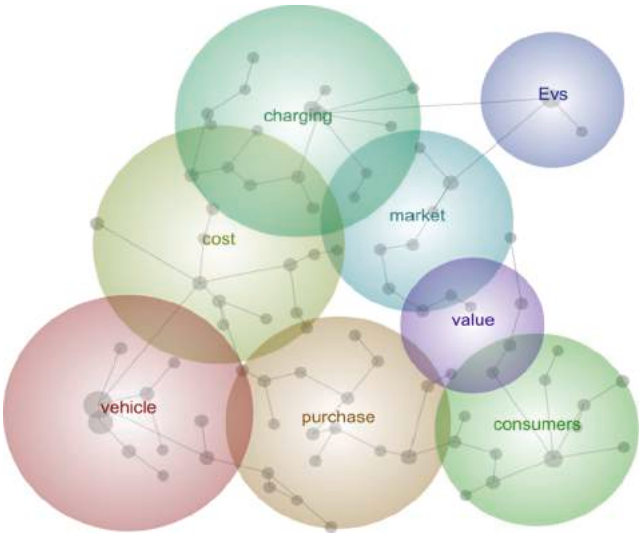

Fig. 10. Key themes and their relationship results of the analysis. **Source:** Author's elaboration using Leximancer.

3.5.3. Market and policy

Based on these consumer drivers, two types of government policies can promote sustainable use and production. The first consists of enforcing green production controls, such as setting fuel-efficiency or pollutant emission standards, imposing a tax on external costs to change consumer behaviour, and the second is related to incentives, which involve providing consumers with a tax subsidy or exemption to encourage green use (Huang et al., 2018). Consumers can also participate in this policy context, from climate goals to air quality goals and the information environment (TyreeHageman et al., 2014). For instance, in San Diego, social media has contributed to a community of shoppers who can allow constant updates anywhere, anytime. Such a sense of community can help overcome consumers' reluctance to purchase, resulting from the lack of adequate specific charging infrastructure, power generation solutions, electricity distribution, and storage (Brătucu et al., 2019).

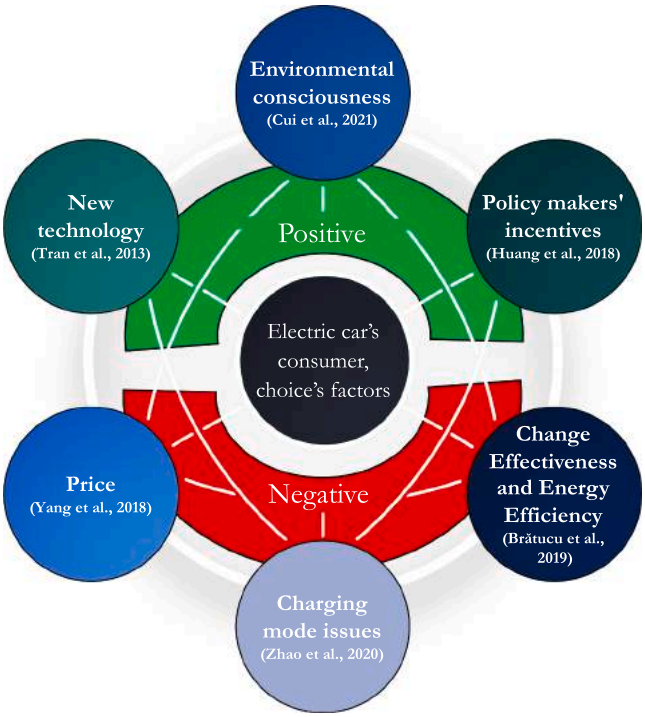

Fig. 11. Positive and negative elements affecting consumer and customer behaviour. **Source:** Author's elaboration.

3.5.4. Vehicle's characteristics

Another finding shows that technological evolution is instrumental in developing the EV and understanding consumer behaviour. It is linked to the environmental issue and determines a part of the value. Emerging technologies are considered intrinsically attractive to electric car buyers. These consumers are usually more positive in their attitudes towards innovations and are more prone to new technologies (Tran et al., 2013). Along with policies to stimulate the industry's viability, this information has helped to attract more consumers, thus pushing the industry towards greater product uptake (Kang et al., 2015). That leads

to consumer choice determinants driven by technical attributes and preferences regarding socio-demographic characteristics, usage profiles, and social influence (Soltani et al., 2015). The same authors assume that consumer choice behaviours are rational and based on performance and price attributes. However, it should also be considered that the surrounding environment influences consumer decisions through social influence processes such as conformity, identification, and internalisation. Additionally, this illustrates how preferences are not defined and static, but choice games and even car purchases are opportunities for preference construction and change (Axsen & Kurani, 2013b).

The cost of EVs is a perceived determinant. Hence, customers with basic needs such as food and clothing will focus more on cost. Therefore, a high price will not stimulate EV adoption, and it is critical for formulating the automotive industry's strategy (Cui et al., 2021). For other customers, price acceptance of EVs has increased, and quality is considered in the selection process (Yang et al., 2018).

Some consumers have emphasised that the hybrid electric car represents the most advanced automotive technology available, reporting it to be a disruptive change from the traditional combustion engine (Heffner et al., 2007). Dramatic changes in the automotive industry require innovation in technology and a shift in focus towards alternative fuel vehicles (He & Chen, 2012). In contrast to the past, understanding consumer choices of alternative fuel vehicles is challenging. The process of preference construction involves aspects beyond traditional engineering considerations, incorporating elements of social influence different from traditional ones (Tian & Chen, 2013). According to Yousif & Alsamydai (2019), consumers prefer EVs with a more extended driving range, shorter charging time, faster top speed, lower pollutant emissions, and lower price. Electrification of the transportation sector could significantly decrease greenhouse gas emissions and oil dependence (Adnan et al., 2017).

3.5.5. *Charging and batteries*

EVs can lead to a 30% to 50% reduction in carbon dioxide and a 40% to 60% increase in fuel efficiency than vehicles that rely on conventional fuels (Asadi et al., 2021). Notably, it is expected that this technological shift could be supported by the exploitation of renewable energy, leading to a reduction in smog and pollution levels and public health benefits (Mukherjee & Ryan, 2020). According to Seebauer et al. (2019), introducing tools such as annual personal carbon budgets would direct consumers towards low-carbon products and services, introducing the concept of individual emission limits.

Environmental and energy issues are crucial in achieving the EU's 2050 decarbonisation goals for the electricity and transport sector (Prata et al., 2013). This will be achieved through renewable resources (Mukherjee & Ryan, 2020). However, the introduction of EVs could represent a growing uncontrolled demand from customers, followed by increased energy prices (Kubli et al., 2018). Although they are considered energy-efficient, EVs can produce gas and other pollution sources due to the battery (Brătucu et al., 2019).

Several complications related to batteries emerged from the thematic analysis. Primarily, the lack of charging infrastructure could be a functional barrier for some consumers who may live in apartment buildings or condominiums with no charging station at home (Matthews et al., 2017). According to Zhao et al. (2020), if private facilities participate in the charging market, it would be convenient for electric car drivers to choose a remote charging station at the location closest to their travel destination. Specifically, the charging service can be done through parking space exchanges without queuing or driving to public charging stations if consumers and private stack owners live in the same community. Furthermore, the literature addresses circumstances where the charging platform is private or public. Despite this, it is not considered realistic to expand public charging stacks to meet growing demand. The shortage of land resources in large and medium-sized cities makes parking space a scarce resource (Zhao et al., 2020). Finally, a theme of trust emerges with blockchain technology, which can allow proposing vehicle-to-vehicle electricity trading schemes limiting energy anxiety.

4. Discussion

Policymakers' encouragements (European Parliament, 2019; US EPA, 2021) have effectively stimulated debate regarding decreasing the carbonisation of the transportation system. Hence, this has significantly enhanced the interest of researchers and practitioners in EVs.

The 254 collected articles cover 1983 to 2021, with substantial growth in publications beginning in 2017. This expansion can be considered a consequence of the EU's interest in becoming a world leader in decarbonisation (European Commission, 2017).

The co-citation analysis illustrates that the relevant journals for the topic are Energy Policy Journal, Transportation Research Part A, Transportation Research Part D, and Journal of Cleaner Production and Sustainability. The last two journals present relevant publications on sustainable choices based on the TPB and EV purchase factors (Adnan et al., 2017; Asadi et al., 2021; Carlucci et al., 2018) which are consistent with this study's results. Moreover, the authors' co-cited analysis shows four research strands: consumers' impact on electric car purchases (Axsen & Kurani, 2013a; Axsen & Sovacool, 2019), studies on vehicle performance and sustainable consumption (Skippon, 2014), sustainability drivers (Jansson et al. 2017), and customer satisfaction on electric car maximum mileage (Franke et al., 2017).

At the level of keyword co-occurrences, the analysis demonstrates four research clusters related to environmental sustainability, the need for suitable transportation infrastructure to incentivise EVs, the role of batteries, and finally, purchase formulas along with battery use. These results add some evidence to the previous literature. Especially considering Cordera et al. (2019), the research confirms the role of incentives in lowering the purchase price of EVs but adds how additional purchase variables can be linked to sustainability factors and the availability of charging infrastructure.

Geographic analysis indicates how the United States (137) has the most publications on the topic, followed by China (100), the United Kingdom (35), and Canada (31). It also reveals how many areas are not yet engaged in the debate. Except Saudi Arabia (4), no oil-producing country has attempted to address the topic in the Middle East. The collaboration map allows observing that the most solid collaboration occurs between China and the United States and between the United States and Europe.

Finally, the thematic analysis of the papers allowed us to identify several vital themes such as 'Consumer', 'Purchase', 'Market', 'Vehicle', and 'Electric Vehicle'. Specifically, three factors can be identified as capable of affecting EV purchase intention: price awareness (Cui et al., 2021), environmental concern (Adnan et al., 2018), and consumer perception and personality (He et al., 2018). Two government policy streams were also indicated to promote sustainable use and production. The first consists of controls on green production, while the second is related to incentives, which involves providing consumers with a subsidy or tax exemption to encourage green use (Huang et al., 2018). Furthermore, another finding from the analysis shows how technological evolution is instrumental to the development of the electric car, as it determines part of its value (Kang et al., 2015). The research reveals that purchasing an electric vehicle is both rational and irrational (Ajzen, 1991). Therefore, the need for the description of the electric car as a positional good, able to bring out the willingness of the buyer to be environmentally aware and to change technology, is highlighted (Hale et al., 2002). Finally, the demographic aspect was considered. Specifically, male consumers with high educational qualifications are more likely to purchase an EV (Ning et al., 2020). Therefore, the results extend the results of Higueras-Castillo et al. (2021), adding new acquisition variables by customers than range, incentives, and reliability.

4.1. Theoretical implications

Several theoretical implications emerged from the research. The research extends Liao et al.'s (2017) study by contributing to the literature through bibliometric, co-citation, thematic, and geographic analyses. The latter meets the needs identified by Degirmenci and Breitner (2017), thus revealing the main areas of research on the topic and where the interest of scholars and academics is being focused. Moreover, the research approach allowed a systematised understanding of consumer and customer behaviour in the EV context to offer a compendium of the fragmented and discordant literature, exploring Ajzen's (1991) TPB in the EV context. This connotes a novelty stimulus for research, providing a theoretical basis for consumer study in the increasingly debated academic dialogue regarding the electric car market. It also uses a thematic analysis methodology through Leximancer 4.0 software, which is generalisable and applicable to other contexts.

However, the foremost vital contribution is in terms of the TAM. Starting from this research interest, thematic analysis's contribution intends to provide the enabling elements for this technology in Table 5.

First, the analysis shows how early adopters of technologies can be crucial for an EV purchase. Furthermore, the electric car consumer was identified as being sensitive to sustainability issues and affordable energy access. According to Tran et al. (2013), attraction to the technology is a prime factor leading to consumers' approach to the product, standing in contrast to He et al. (2018), who argued that purchasing an EV depends more on how the consumer perceives the vehicle rather than its technology components. Nevertheless, the literature presents sustainability and environmental consciousness as crucial to the choice of an EV (He et al., 2018). An extracting variable is related to facilitating conditions. Accordingly, it is observed that policymakers' incentives are key positive purchase drivers (Huang et al., 2018; Nie et al., 2016). Moreover, the findings suggest that blockchain could increase trust for vehicle-to-vehicle electricity trading schemes and energy traceability (Xia et al., 2020).

Additionally, the study identifies the lack of charging infrastructure for consumers who live in apartment buildings or do not have a charging station in their homes as a psychological barrier (Neaimeh et al., 2017). The study adds novel consumers' characteristics to those already identified by (Degirmenci & Breitner, 2017), whose behaviours are driven by environmental performance, price, and reliance on autonomy. Moreover, a new relevant barrier is introduced to those already established by Degirmenci and Breitner (2017) and Egbue and Long (2012). Finally, if these variables are negatively analysed, the price of EVs does not facilitate the purchase and transaction of new forms of mobility for consumers (Yang et al., 2019).

4.2. Managerial implications

This study identifies the consumer profile of the electric car as a managerial implication of the research. Specifically, the outlined consumer is inherently attracted to emerging technologies. In other words, they are positive in terms of their attitudes towards innovations and prone to technologies (Tran et al., 2013). Additionally, they actively participate in communities informing users about climate goals, air quality goals, and the environment (TyreeHageman et al., 2014). This sense of community empowers the consumers to overcome reluctance to purchase, arising from the lack of appropriate specific charging infrastructure, power generation solutions, electricity distribution, and storage (Axsen & Kurani, 2013b; Liu & Santos, 2015). Although consumer choice behaviours are rational and based on performance and price attributes, the surrounding environment influences decisions through conformity, identification, and internalisation (Axsen & Kurani, 2013b). However, for those whose cost of EVs does not sacrifice primary goods (Cui et al., 2021), price acceptance of EVs has increased due to quality considered in the selection process (Yang et al., 2018), consequently contrasting views on how income can determine EV purchase factors (Yang & Tan, 2019). Although consumers prefer EVs with a more extended driving range, shorter charging time, faster top speed, lower pollutant emissions, and lower price (Yousif & Alsamydai, 2019), environmental concerns (Adnan et al., 2018) and technology attributes (Gil & Taiber, 2014) are still crucial drivers in the EV choice.

Table 5
Technology Acceptance Model for electric vehicles.

Variables	*Enabling factors*	*Citations*
Social influence	Sustainability and environmental consciousness	(Asadi et al., 2021; Cucchiella et al., 2015; Tran et al., 2019; Wang et al., 2016)
Facilitating conditions	Policy makers' incentives	(Huang et al., 2018; Nie et al., 2016)
Trust	Blockchain	(Xia et al., 2020)
Technological anxiety	Charging modes and energy efficiency	(Degirmenci and Breitner, 2017; Neaimeh et al., 2017)
Resistance	Price	(Yang et al., 2019)

Source: Author's elaboration.

4.3. Limitations

This study has some limitations. First, to avoid data duplication, the authors limited the sample of articles using only the Scopus database. Although the search query string seems holistic, it is not possible to exclude numerous publications useful for the research. The study does not rule out the possibility of losing information from countries that do not use the Scopus database for the same reasons. Second, although it decreases the sample's subjectivity, the adopted methodology can overlook significant findings and inspirations from the selected study. Third, the analysis is based on a snapshot in time, a visual approach, which can change as EVs become more widespread. Moreover, the interdisciplinary nature of the topic may limit future methodological lines of research because of the different research approaches. Finally, this research does not consider practitioner input that could improve the effectiveness of EV consumer habits contributions.

5. Directions for future research

Building on the premises of Massaro et al. (2016) and Paul & Criado (2020), this study develops a bibliometric and thematic analysis. Furthermore, future RQs are summarised in Table 6. The research provided a general overview of consumer and customer behaviour research in the EV domain for structuring and consolidating existing knowledge. Additionally, the in-depth literature review led us to a consumer identification that can explain the main drivers in choices and doubts around non-adoption. Using the approach of Chen et al. (2021) and based on this systematic review and analysis of the existing literature, the authors delineate an agenda for future research to stimulate further field progression. Based on the research result and implications, this section distinguishes among theory, context, consumer characteristics and methodology (TCCM) (Chakma et al., 2021).

5.1. Theory

Due to the multi-disciplinary nature of the topic, the types of research conducted by scholars are varied and understand consumer and customer behaviour in detail. TPB (Ajzen, 1991) aims to comprehend the variables that may influence behavioural intentions based on knowledge and experience, implying that resistance will be persistent even where technical issues are overcome. Although many studies have emphasised that consumer behaviour is driven by ecological and environmental issues (e.g. Adnan et al. (2018)), future studies should base their analyses on identifying external and subjective factors that push the acquisition of EVs.

Table 6
Future research avenues.

Topic	*Research area and questions*
Charging	(1) How will it be possible to implement a charging system powered by entirely sustainable energy?(2) How will the evolution of charging technology affect sales of electric and hybrid vehicles?
Cost	From the perspective of the identified consumer, which cost element is shown to be most acceptable?
Market	(1) What consequences might an all-electric perspective have on the global energy market?(2) How international car makers can enhance their market share on electric or hybrid vehicles?
Consumer	(1) How can consumer reluctance regarding charging barriers be overcome?(2) Regarding battery autonomy, what is the break-even point at which consumers would be willing to purchase electric vehicles?(3) How could applying the Technology Acceptance Model's theory provide a deeper understanding of consumer drivers to purchase?
Vehicle	(1) What are the prospects for conventionally powered vehicles?(2) What are the changes to the traditional business model for introducing electric or hybrid cars?
Purchase	(1) Which one among the factors uncovered has the most impact on carmakers and for customers/consumers? What has changed in terms of electric or hybrid vehicle purchases during COVID-19?
Value	How does the valorisation of environmental aspects influence the purchase of electric or hybrid vehicles?
EVs	(1) How can a circular economy model encourage the recovery of materials in the pursuit of a sustainable business model?(2) What is electric or hybrid vehicles' impact on the sustainable business model from an academic and practitioner perspective?

Source: Author's elaboration.

Additionally, different research experiences should further explore the TAM's theory (Davis, 1989) to understand perceived usefulness and ease of use better. According to Tran et al. (2013), many users of EVs are early adopters of the technologies, purchasing for experiments and playing a pioneering role. Therefore, future research should include case studies extending interest in this market to even the most reluctant consumers.

Furthermore, Degirmenci & Breitner's (2017) study on consumer and customer characteristics in the electric car market highlights how environmental performance, price, and confidence in range determine the drive to purchase. The study outlines a new field of research by spotlighting the barrier related to the charging stations and ethical and community use. Scholars should qualitatively investigate how much an ethical and sustainable approach may matter compared to the consumer habits of traditional combustion vehicles.

5.2. Context

The results identified numerous geographic regions and different economies affected by the academic debate, mainly in regions that have to counter increasing pollution, such as the USA, China, and European countries. Strategies should be implemented to reduce pollution (Foell et al., 1995; Štreimikiene & Esekina, 2008). Furthermore, as the price has emerged as one of the critical issues related to electric car purchase (Yang et al., 2018), further studies should evaluate the help dimension of tax incentives and how they lead the consumer to purchase. Although there has been a globalisation of markets, evaluation of tax incentive practices should be studied in different market contexts. For example, it would be interesting to perceive the impact on consumer needs to generalise results and theories and elucidate what regional parameters might drive the adoption of an EV. Finally, the theme of mobility must necessarily be addressed. If several international organisations understand mobility as a service (European Union, 2021; United Nations, 2020), then the role of the car customer is bound to change. Therefore, further studies should consider the context and define how the consumer and the sector-specific customer may understand and interpret the future approach advocated by international authorities.

Finally, future studies could investigate whether changes in consumer habits have occurred with the COVID-19 pandemic.

5.3. Consumer characteristics

Regarding the specific theme investigated, the review reveals the characteristics held by the EV consumer. The analysis of the topic areas enabled us to find significant factors to drive the market and the entire industry's future. Despite this, some open questions remain, and future research should focus on developing and analysing the revealed complications. Policymakers should reconsider policies to create a suitable space for EVs to operate competitively (Zarazua de Rubens, 2019). Therefore, future research should consider exploring best practices for extending spaces appropriate for market expansion in the urban context.

Moreover, if the price remains a determinant for EV purchase (Cui et al., 2021), further studies should offer a cost mapping that is more acceptable to the customer. The extensive literature review showed that although they are considered energy efficient, EVs can produce greenhouse gases and other sources of pollution due to the battery (Yang et al., 2019). Therefore, further studies should provide a fully sustainable scenario. Specifically, the efficiency would only exist when the charging stations are powered by sustainable energy (Zhao et al., 2020). Therefore, it would be of interest to the research field to investigate what perspectives there might be in a market powered by entirely sustainable energy and how the evolution of charging technology affects EV sales. In addition to the barriers related to price and charging modes already expressed, a critical barrier that emerged from the literature concerns battery autonomy (Degirmenci & Breitner, 2017). In this sense, of particular interest to managers should be an investigation of what might be the autonomy break-even point at which consumers would be willing to purchase EVs.

Given several changes, the expansion of the EV market might introduce the outlook for combustion vehicles. From a circular economy perspective (European Commission, 2019), the potential should be identified for component recovery in EV production, finally following the objectives and goals expressed above, the EVs' impact on the sustainable business model from an academic and practitioner perspective.

5.4. Methodology

From a methodological standpoint, this topic has been addressed considerably quantitatively. Additionally, several action studies have investigated the energy perspective and consumer expectations on autonomy. Future researchers will need to implement studies related to the qualitative aspect of the study. Although this study uses a thematic analysis of the academic research present on the topic, future studies must consider the practitioner aspect. According to Bonciani et al. (2018), analysing practitioners' papers can reveal new information that can provide theoretical applications. Moreover, this aspect can also be studied through interviews with experts and patent owners. Finally, beyond the current knowledge on the topic, a conceptual study can extend the domain of knowledge on consumer habits toward EVs.

6. Conclusion

This literature review examines consumer behaviour in the electric car market using the techniques of bibliometric and thematic analysis. It offers guidance for future researchers regarding consumer characteristics, theories, context, and methodologies. Based on the conducted review, we revealed primary networks of co-citation among journals and authors, major research centres worldwide, and five significant topics of discussion and theoretical underpinnings in electric car purchase decisions. Given the context and the critical demand to advance future mobility owing to climate change, promotion, creation, and exchange of knowledge in this area is essential. We hope that our contribution will

renew the debate on this topic and direct future research in such a challenging context.

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CRediT authorship contribution statement

Silvana Secinaro: Methodology, Investigation, Conceptualization. **Davide Calandra:** Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Federico Lanzalonga:** Writing – review & editing, Writing – original draft, Visualization, Investigation. **Alberto Ferraris:** Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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