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Information and Communication Technologies in Food Services and Restaurants: A Systematic Review

Abstract

Purpose: Information and Communication Technologies (ICTs) are a key player in the food services and restaurants sector, thus the aim of this work consists in studying the previous research on ICTs in food services and restaurants in the context of Tourism and Hospitality through a systematic literature review.

Design/Methodology/Approach: The systematic literature review is performed on full papers published in journals included in the Journal Citation Report of the WoS in the category of Hospitality, Leisure, Sport and Tourism. 165 articles from 28 journals are analyzed, following different criteria, like the research methods, perspectives, statistical techniques, geographical focus, topics, technologies, authors and universities.

Findings: The restaurant sector is more and more based on the creation of experiences and ICTs, through their multiple possibilities, can undoubtedly contribute to adding value to the simple meal and create and recreate experiences to attract and retain customers who are increasingly sophisticated and hooked on ICTs. ICTs are basic for managers taking decision at the highest level in food services and restaurants, so ICTs should not be seen as a technical tool but as an essential element for top management.

Research limitations/Implications: This paper examined articles from very well known Tourism and Hospitality journals, leaving aside others as well as different publication formats such as books or papers presented at conferences.

Originality/value: A significant contribution made with this paper is the availability of a list of topics in the context of ICTs in food services and restaurants. These topics are classified into three areas (Consumers, Suppliers and Environment and Tendencies) that can serve as a future research framework. The paper also provides useful information to restaurant managers about ICTs, to researchers for their future projects and to academics for their courses.

Keywords:

Literature review, ICTs, food services, restaurants, articles, Tourism and Hospitality

Information and Communication Technologies in Food Services and Restaurants: A Systematic Critical Review

1. Introduction

Since the early 90s many researchers have detected the potential of Information and Communication Technologies (ICTs) for the hospitality and tourism industry (Buhalis and Main, 1998). At the end of the past century it was said that ICTs were a competitive advantage as information was a key factor in the description, promotion, distribution, organization and delivery of tourism services (Crichton and Edgar, 1995). Today we can no longer talk about the advantage of ICTs rather the necessity of managing these technologies and not falling behind with new developments in order to satisfy customer demands (Gonzalez et al., 2019).

The development of ICTs has radically altered the way in which tourism firms operate (Ip et al., 2011). Although the tourism industry is not naturally orientated towards technology it is an information intensive industry (Law et al., 2013), given that it is a consumer of various information types and an important user of ICTs. In fact, ICTs have changed how tourism organizations operate, especially the way in which they approach their customers (Abellá Garcés et al., 2004). As a consequence ICTs are ubiquitous in the tourism sector in order to fulfil current objectives and prepare for the future (Law et al., 2014).

Customers are making more and more intensive use of ICTs, and they are even improving their negotiation power in the hospitality and tourism industry by having more information to hand and thus being able to compare and express opinions through social media, which could be used to know their satisfaction levels (Mattila and Mount, 2003) and can influence company reputation (Park and Allen, 2013). Accordingly, the hospitality and tourism sector should listen to its customers and adapt to and anticipate their demands. Technologies such as Big Data can help firms discover market tendencies. Staff are also key users in this sector. In fact, staff use of ICTs can impact on their job satisfaction and their individual and company productivity, improving or worsening company images in the hospitality and tourism industry (Gonzalez et al., 2020).

Alongside the growth in the importance and diffusion of ICTs there has also been an increase in research on technologies in tourism in general and in the hotel sector in particular (Ali et al., 2019; Leung et al., 2015; Ip et al., 2011; Law et al., 2014; Law et al., 2013; Law et al., 2020; Mandić and Praničević, 2019, Mulet-Forteza et al., 2019). Despite the unquestionable revolution taking place in Food Services and Restaurants due to the use of ICTs (O'Connor, and Murphy, 2004, DiPietro, 2017) and despite the studies on food tourism literature (Okumus, 2020; Okumus et al., 2020) studies focused on the literature about the presence and role of ICTs in the food services and restaurants sector are scarce –Moreno and Tejada (2019) being an exception. The present study intends to fill this gap. Hence the goal of this work: to undertake a systematic review of the existing literature devoted to ICT implementation in food services and restaurants in the context of tourism and hospitality.

With this aim in mind we propose the following research questions: Which journals deal with these issues? What research methods are the most often used? Which perspective is adopted to analyze reality? What statistical techniques are more frequently used? What themes and technologies are dealt with? What authors, universities and countries are the most relevant in this research context?

We will answer these questions throught a systematic literature review. The systematic literature review is the best method to produce a structured and quantitative summary of a field and to map what is known about a specific area of study (Antonova et al., 2021, Hart, 1998 Tranfield et al., 2003). It is usually supported by the use of illustrative tables and figures (Kim et al., 2018a). Such a systematic review of research will help us gain more understanding of previous research in the area of ICTs in Food Services and Restaurants and to identify possible

gaps (DiPietro, 2017; Snyder, 2019), additionally allowing us to identify the potential paths to follow in the future, while simultaneously showing tourism sector managers, and particularly those responsible for ICTs in Food Services and Restaurants, which ICTs should be analyze and why.

2. Methodology

Our systematic review is based on renowned articles and we will not examine books or papers presented at conferences. Previous bibliometric studies about the tourism sector have also exclusively revolved around papers in journals (Okumus et al., 2018a, 2018b, Nusair et al., 2019; Shen et al., 2018; Law et al., 2013; Leung et al., 2013).

We focus on articles published in journals indexed in the Journal Citations Reports (2019 edition) of the Social Science Citation Index (WoS database), in the Hospitality, Leisure, Sports and Tourism area, with the exception of those which exclusively refer to the sports area. Previous Bibliometric studies have focused on the WoS database (Rodríguez-López et al., 2020). A research work carried out by Zupic and Čarter (2015) showed that WoS has been used in the 69.1% of bibliometric works in the area of Management. Also this database has been used as the only source to carry out previous literature review analyses in the Tourism area (Gomezelj, 2016). All the journals in our systematic literature review are also indexed in the ProQuest and Scopus databases.

The 2019 WoS lists 56 journals in the category of Hospitality, Leisure, Sports and Tourism, of which 28 are sports orientated, meaning that we analyze the remaining 28 journals. Papers published in those 28 journals containing the terms *Restaurant* or *Food* or *Gastronomy* in their titles, abstracts or keywords were scrutinized —and the abstracts of all these articles were examined to check if they covered the topic of ICTs. These terms were determined by the authors of the present study through brainstorming, after reviewing the previous literature on Food Services and Restaurants in Hospitality and Tourism. This process was grounded on earlier studies (Hung and Law, 2011). We eliminated studies that included Restaurants, or Food or Gastronomy in their titles, abstracts or keywords but only made indirect rather than direct analyses of ICTs. We also eliminated editorial notes, book reviews and short notes, in order to focus our analysis on full papers. A manual search was used to complete the electronic search, with special emphasis placed on searching through the bibliographies of the selected papers, following the processes of previous similar studies (Gonzalez et al., 2019). Through this method, and after making our eliminations, we had a final list of 165 articles from 21 Tourism and Hospitality journals. The list was closed in February 2021, and papers issued up to 2020 were imbodied and analyzed independently by at least two authors of the paper to classify them, following methods used by previous researchers (Hung and Law, 2011; Gonzalez et al., 2019, 2020; Mehraliyev et al., 2020).

To be precise, the inclusion/exclusion criteria for our systematic review was as follows:

a) *Inclusion Criteria*

- Full academic papers.
- Articles issued in the 2019 WoS included in the section of Hospitality, Leisure, Sports and Tourism, not based on Sports.
- Papers whose titles, abstracts and keywords include the terms Restaurant, Food, or Gastronomy, with themes relating to ICTs.
- Papers published up to 2020.

b) *Exclusion Criteria*

- Books, Conference papers, non-academic papers, editorial notes, short papers.
- Papers published in journals not included in the category of Hospitality, Leisure, Sports and Tourism of the 2019 WoS list.
- Papers focused on Sports.

- Papers not dealing with ICTs and without Restaurants, Food, or Gastronomy in their Title, Abstract or Keywords.
- Articles published after 2020.

Table 1 results from applying this process, showing the number of articles to be analyzed from each journal[1]

INSERT TABLE 1

We use a spreadsheet to codify the articles to be analyzed and the relevant categories are identified with clear definitions (Nusair, 2020). The categories include: a code assigned to each article, its title, the journal it is published in, the date of publication, the research method used, the perspective of the article, the statistical techniques used, the geographical scope of the paper, the topic analyzed, technologies studied, the authors and their universities. Two researchers independently performed the codification, with a third acting as an arbiter in cases of conflict. A qualitative, descriptive review of the literature was made, with no use of statistical analysis techniques, following previous systematic literature reviews (Lin et al., 2020; Law et al, 2020).

3. Results

The systematic review begins with the specification of the journals and the time frame of the articles. It continues with the research methods, perspectives and statistical techniques employed, along with the geographic focus of the studies. Our attention is then directed to the research topics and thematic areas, the technologies analyzed in the sample studies and the most productive researchers and countries in the study of ICTs in Food Services and Restaurants. Most of these issues have aroused the interest of previous literature reviews in Tourism and Hospitality. To quote but a few examples, Ip et al. (2011) dealt with the issues of journals analyzed and articles published; Leung et al. (2015) and Wut et al. (2021) examined the research method; Leung et al. (2015) analyzed the statistics utilized, Booth et al. (2020) examined the geographic focus of the research, Ip et al. (2011) dealt with the most common topics or themes; and finally, Hung and Law (2011) paid attention to authorship analysis.

3.1.Journals and Time Period

Table 1 shows that the journal that has published the most Tourism and Hospitality articles on ICTs in restaurants and food services is IJHM, followed by IJCHM and JH&TT.

The only temporal limit we applied to our article search was the previously mentioned limit of including articles published up to 2020. In order to assess the evolution of the literature, the articles were divided into three time periods, namely: (a) those published before 2000 (3 articles; 1.8%); (b) those published between 2001 and 2010 (12, 7.3%); and (c) those published between 2011 and 2020 (150, 90.9%). The spectacular growth of articles published about the topic of ICTs in food services and restaurants over the last decade is clearly visible.

3.2.Method, Perspective, Statistical Techniques and Geographic Focus

3.2.1. Research Methods

Research methods define the way in which researchers approach the object of their study and how they collect the necessary data to be transformed into information able to support their research outcomes. Previous bibliometric studies such as the pioneering study of Van Horn (1973) and those of Gonzalez et al. (2019, 2020) served as the basis to classify the articles according to the methods utilized.

INSERT TABLE 2

Table 2 shows that empirical works are more frequent than theoretical ones and how the disproportion between empirical and theoretical works has considerably increased over time.

[1]Readers can request for an APPENDIX with further details about all the papers analyzed.

Field Studies were the most used methodology to collect quantitative data that could be fully extrapolated from the reality analyzed in most of the studies, and in all the temporal periods analyzed (such as Chien et al., 1998; Kang et al., 2014; Hwang and Kim, 2020).
Studies based on Content Analysis were then used to analyze secondary information, such as those in databases (Kim et al., 2015), in web pages (Daries et al., 2018) and above all in social media (Huang, 2017).
Great importance was also given to Experiments; they occupy third place in the ranking of methodologies. In social sciences, experiments consist in subjecting organizations to a simulated situation in order to identify their behavior, analyzing results both individually and at an organizational level (such as Leung et al., 2020).
Like the present study, 4 of the studies analyzed are Literature Reviews. Finally, 3 of the papers are based on Case Studies and another 3 use a combination of Case Studies and Field Studies. Case Studies serve to collect mainly qualitative —rather than quantitative— information through interviews, analyses of documents or the observation of reality; therefore, generalizing results is more complicated than with the surveys typical of Field Studies, as in the case of Chen and Tsai (2016). Case and Field studies are combined in the papers of Vajirakachorn and Chongwatpol (2017), Duignan et al. (2017) and Wong et al. (2019).
Since the highest number of articles come from the last period examined (since 2011), it is clear that the use of different research methods has also increased during this period. However, the use of Field Studies and Content Analysis deserves to be highlighted, essentially, in this last case, due to the trend to do research from secondary data, mostly from information contained on social media.

3.2.2. Perspective

The articles were classified into three groups: those which analyze the study object from the *Supply* perspective, for instance, from information provided by restaurants or hotels, or derived from the events examined related with food services; those which look at reality from the *Demand* point of view, i.e. that of customers; and those which adopt a broader and more integrated perspective, because they obtain information from both supply and demand (*Both*).
It can be seen that the demand or customer perspective is the most frequently utilized in the articles under study (78.8%) followed by the supply perspective, the number of studies which include both perspectives being much lower. As for time-related trends, there is growing interest in analyzing reality from the demand point of view.

3.2.3. Statistical Techniques

Following previous bibliometric studies (Gonzalez et al., 2019, 2020) we will analyze the statistical techniques used in our sample articles. Although the articles may use more than one statistical technique, we counted the most complex techniques used in each paper. This complexity shows an upward trend from exclusively Descriptive techniques, going through Univariate statistical analyses (such as means difference, the use of Chi-square and crosstabulation, or the ANOVA and ANCOVA analyses), Multivariate analyses (which explain how a wide range of variables influence an effect or a result, e.g. regression, discriminant, factor or cluster analysis, or multidimensional scaling), or Structural Equation Modeling (SEM) or Path analysis, which despite also involving multivariate statistics, can be distinguished from the previous techniques by their relevance and originality. Among the papers that use SEM/PATH techniques (41, as shown in Table 2, and all published in the last decade) those that use PLS (Partial Least Squares) stand out, such as Anaya-Sánchez et al. (2019), Ebrahimi et al. (2020), Okumus et al. (2018a), Phillips et al. (2017) and Šerić and Praničević (2018).
Table 2 reveals that most of the articles use Multivariate techniques, followed by SEM/Path models, and Univariate techniques; or expressed differently, more complex techniques prevail over simpler ones. To this must be added that only 7.9% of the articles do not use any statistical

technique whatsoever. As for time evolution, we can see the outstanding growth of Multivariate techniques, and also that SEM/PATH analyses are exclusively used in the most recent articles.

3.2.4. Geographic Focus

Figure 1 shows the geographic area on which the papers are focused. The United States is the most often analyzed country, followed at a certain distance by China, and then South Korea, Taiwan and the United Kingdom. There are 24 articles which study ICTs in food services and restaurants in Other countries (one or several at the same time). These countries are in Europe (Spain, Italy, Portugal, France, Greece, Switzerland, Sweden, Denmark, Finland, Norway, the Netherlands), Asia (Japan, Thailand, Singapore), Africa (Zambia, Zimbabwe), the Middle East (Iran, Israel), and Oceania (Australia). 29 papers are not based on any country, either because they are theoretical articles or literature reviews or because they are based on secondary information not sourced exclusively from one country.

INSERT FIGURE 1

3.3. Topics and Technologies

3.3.1. Topics

Even though all the articles examined fulfil the requirement of referring to ICTs and their use in food services and restaurants, there are parallel topics which emerge in the different articles. The identification of topics is partially based on previous studies that contained reviews of the literature about ICTs, Tourism and Hospitality Management (Hung and Law, 2011; Law et al., 2013, 2014; Leung et al., 2015). We tried not to limit categories, though. Instead, new topics progressively arose as we studied more articles; in other words, it is an open classification that has been taking shape with the progress of the classification process. Furthermore, some articles exclusively revolve around a single theme, while others deal with several themes simultaneously. Previous systematic reviews in the tourism area have allowed researchers to categorize some papers in more than one topic (Chi et al., 2020). For that reason, one can see in Table 3 that the sum of all topics equals 254, and not 165. In cases where a paper has various topics we have only classified topics related to the use of ICTs in restaurants and food services and the field of tourism and hospitality. Accordingly, 17 topics were identified.

The 17 topics are grouped into 3 large areas: a) Consumers area, b) Suppliers area, c) Environment & Tendencies area. These areas are examined below.

INSERT TABLE 3

a) Consumers area

The studies in the *Consumers area* show how consumers or potential consumers of restaurants and food services use technologies or react to them, how these technologies help them select restaurants, tourist destinations or gastronomic destinations (Oliveira and Casais, 2019), how they influence other consumers by criticizing or praising certain restaurants, destinations or food (Ganzaroli et al., 2017). Social media platforms such as Twitter, facilitate customer engagement in certain restaurants, and customers can become real endorsers or fans of some brands, co-creating value through their positive reviews (Sashi et al., 2019). Food associated experiences have moved from the table to the digital word, with the best and worst dishes judged by photos and comments (Wong et al., 2019). Restaurants use content uploaded by customers to understand the determinants of their satisfaction, for example whether they place more value on the quality of the food, the experience or the quality or speed of the service (Keller and Kostromitina, 2020). Speed of service with the use of ICTs should be balanced by the human touch (Park et al., 2014), and the greater or lesser acceptance of technology depends on customer age, as shown by studies on generations X and Y (Hwang and Kim, 2020). The Consumers area is the most studied one in our sample articles, although it was hardly studied at all before 2010, its importance has risen spectacularly in recent years.

The topics included in the *Consumers area* are *EWOM*, *Innovation/ICTs Use Demand*, *Satisfaction* and *Consumers Decision Making.*

EWOM. Electronic Word Of Mouth is covered by the highest number of articles (99 or 39% of the total). The aim of these articles is to explain how online user generated content —in terms of advice or recommendations about specific establishments, food or tourist areas— spreads rapidly through social media. EWOM thus strongly influences the decision-making of future customers when it comes to choosing where —or what— to eat (Lee and Ro, 2016). Enterprises like restaurants or any other food services must bear this content in mind in order to moderate, refute or incorporate them into their own decision-making about what to offer, at which prices and how (Israeli et al., 2017).

Innovation/ICT Use Demand. This topic is the second most often studied, with 26 articles. These articles provide information about the benefits of technologies as well as their possible applications for food services and restaurants, from the customer point of view. Most of these articles use the Technology Acceptance Model (TAM) and its derivatives, and examine how users react to the adoption of technological innovations (Salehi-Esfahani and Bulent Ozturk, 2019), bearing in mind the level of usability of the technology and its user-friendliness (Lu et al., 2019). Thus these studies have analyzed client reactions to self-service technology (Ahn and Seo, 2018), to robots (Hwang et al., 2020), or to social networks (Salehi-Esfahani and Kang, 2019) among others.

Satisfaction.Twenty three articles revolve around the topic of customer Satisfaction achieved through the utilization of ICTs in food services and restaurants —as in the article by Wei et al., (2017), focused on satisfaction with self-service technologies— or measured by means of ICTs —for example, the work of Li et al., (2013), which assesses satisfaction with the services offered by a hotel (including F&B) thanks to EWOM. It is worth mentioning that articles have only dealt with the satisfaction theme recently, during the last period examined.

Customers' Decision-Making. There are also 17 papers (6.7%) which focus on how ICTs can influence the decisions made by customers. For instance, e-menus by means of tablets and the presence or absence of nutritional components in menus affect customers' decision-making (Yepes, 2015). In turn, Internet use influences how users plan a trip, including the choice of restaurants and other tourist attractions (Smith et al., 2009).

b) Suppliers area

The papers included in the *Suppliers area* study how restaurants and food service firms in general take on and integrate ICTs, which factors make them more innovative or favor the adoption and use of these technologies (Farsani et al., 2016). They also have a logical focus on the justification of these investments, thus the necessity of analyses that relate ICTs with performance (Kim et al., 2016) that have been developed in all of the periods analyzed. They have also covered how ICTs can be a vehicle for CSR policies (Sung et al., 2020) and improve (or not) the reputation of restaurants (Sparks and Bradley, 2017), as ICTs act as a reputation amplifier. The area of HR is one of the most affected by these technologies; employees can improve their work but can also find themselves substituted or stressed by the use of ICTs (Weber et al., 2017). As ICTs act as a shop window to display what a restaurant offers, various studies focus on Web Characteristics (Phelan et al., 2013). ICTs should also help to improve decision making (Chen and Tsai, 2016) through different tools that facilitate data analysis or simulation. The topics belonging to the Suppliers area include the following: *Performance, Innovation/ICTs Use Supply, Webs Characteristics, Reputation & CSR, HRs* and *Supply-based Decision Making.*

Performance. The productivity paradox (Brynjolfsson and Hitt, 1998) questioned the assumption that investments in ICTs directly influence firms' productivity. Hence why articles relating ICTs to business performance are so badly needed. 16 articles (6.3%) deal with this topic —and they were published in all three study periods. In the 90s, Huo (1998) used a longitudinal study to analyze how ICTs influence the financial results of restaurants and how they could strengthen sustainable competitive advantage. Subsequently other authors have

analyzed the influence of ICTs on performance, such as Kim et al. (2015) who found a positive effect of restaurant social media activity on firm value. More recently, Leung et al, (2020) analyzed the performance of e-menus compared to traditional paper menus to justify the better results of the former. One can state that this is a classical theme, since its interest does not flag but increase.

Innovation/ICT Use Supply. Fifteen of our sample papers analyze how restaurants and food service firms implement innovations related to ICTs, how they are adopted, their implications and potential benefits, from the firm point of view. The study of Cavusoglu (2019) is one of the largest on the application of ICTs in the restaurant industry, including front of house and back of house applications, and mobile technology. Cavusoglu (2019) concludes that customers expect more technologies than the restaurant industry is capable of taking on. Jeon et al., (2019) make recommendations around providing free or charging for Wi-Fi in restaurants, cafeterias and fast food outlets. Alsetoohy et al. (2019) analyze the skills of hotel managers in the use and adoption of Intelligent Agent Technology in food supply chain management. They conclude that factors related to technology (such as its complexity and cost), the organization (for example staff and management profiles) and the environment (such as uncertainty or pressure from suppliers) promote a greater or lesser acceptance of new technologies.

Webs Characteristics. We classify within this thematic area the 7 papers which explain what websites related to tourism destinations —especially restaurants— should be like in order to deliver a better service and to be more useful. Some papers focus on the contents of government websites promoting gastronomic tourism (Horng and Tsai, 2010). Also private institutions, like the Michelin Guide, provide websites with restaurant information in different countries (Daries et al., 2018). Pioneering studies warned that not having a web page for a restaurant was foolish (Litvin et al., 2005). Later it was seen how the information in web pages should affect the emotions of potential customers, creating an exciting, fun image but providing useful information (Hwang et al., 2011). Restaurant and food services web pages have helped them spread the word about their tendencies and specialties, such as a commitment to sustainability (Ham and Lee, 2011) or a focus on a certain type of customer or cuisine, such as Halal (Yousaf and Xiucheng, 2018).

Reputation & CSR. Six studies refer to reputation management and Corporate Social Responsibility (CSR). Both terms are tied together because CSR impacts directly on business reputation and in many cases CSR practices are a tool to improve and maintain a positive reputation. User comments on social media may damage the reputation of a restaurant (Jun et al., 2017), and these articles analyze what kind of responses should be given to negative comments on such networks (Sparks and Bradley, 2017). Analyzing social media, including the techniques of big data, can help determine how to improve the reputation of a restaurant or food services business (Wen et al., 2020). ICTs can be useful for CSR policies, for example, for donations (Hanks et al., 2016). CSR messages through social media can directly affect business reputation (Sung et al., 2020).

HRs (Human Resources). A total of 4 papers analyze the links between ICTs and the HR of restaurants or food services in general. These papers explain the way in which such technologies can become a training and learning tool for workers, or on the contrary, how ICTs are likely to cause stress amongst workers, when they or their company are the target of criticism on social media (Bradley et al., 2015). The pioneering study of Chien et al. (1998) showed that ICTs were used in restaurants in the form of applications for labor/time/attendance keeping and for employee scheduling. Noone and Culter (2012) studying robotic technology conclude that it can help cook-decision, scheduling and labor planning algorithms.

Supply-based Decision Making. ICTs can prove helpful not only for the customers of these services but also for the restaurants themselves when the time comes to make decisions related to food services, this subject is also covered in 2 papers. Chen and Tsai (2016) analyze how the

location decision of a restaurant or chain can be helped by big data technology, while Guo and Zeng (2017) examine the price strategies of restaurants that are cooperating with third-party websites.

c) Environment & Tendencies

The papers included in the area of *Environment & Tendencies* deal with issues that are difficult to place in only one of the areas of consumers or suppliers, as they affect the environment or are tendencies in the restaurant and food services sector that can affect both customers and suppliers. The topic of *Destination Management* should be the responsibility of public administrators, but the results without doubt affect the greater or lesser acceptance of the restaurants of a city or region. For example, Nelson (2016) conclude that food creates an opportunity to change the image that visitors have of the city of Houston. *Food Delivery* is a fashionable tendency in recent years, thanks to applications that allow customers to search for restaurants and menus and request home delivery (Gunden et al, 2020b). *E-Menus* have also facilitated communication between restaurants and customers, they are a tool that can make menus more appetizing and incentivize higher spending by making meals more attractive and seducing customers (Lee and Kim, 2020). *Gastro-Tourism* is another growing trend among tourists that apart from sights or landscapes are looking for new flavors and experiences through food. *Meal Sharing* is a way to access restaurant services that also combines food with experiences as it entails complicity and dialogue between hosts and guests (Mhlanga, 2020). Although *Covid-19* is a topic that can hopefully be dropped soon we have included it in this review because ICTs have had and will have an important role in controlling the pandemic, as we have seen in the studies on Covid-19 and home delivery. Finally, the literature review is in this section because it constitutes, as stated by Moreno and Tejada (2019), an overview of the study area as it enables us to analyze and understand the environment in which the research is carried out.

Destination Management. Twelve papers (4.7%) have as their aim to examine how the image of a tourism destination or event can be forged with the help of ICTs. The photographic and textual content that users post on social media has an influence on the image of the tourism destination. Li et al. (2015) analyzed how tourist blogs can influence the image of destinations such as Taiwan. Public administrations, such as the national tourism organization, should also contribute through these technologies to improve destination management instead of leaving it in the hands of amateur tourists (Mak, 2017).

The topic of electronic menus or *E-Menus* receives attention in 6 articles (2.4%). E-menus are more effective than traditional paper menus both in terms of information quality and as far as user satisfaction and friendliness are concerned (Beldona et al., 2014). E-menus have even been used in hospitals, due to the importance of nutrition in patient satisfaction and recovery (Hartwell et al., 2016). E-menus that offer customers the possibility of interacting with a screen, seeing photos, videos and recipes encourage customers to want to eat and are a very efficient communication tool between restaurant and customer (Lee and Kim, 2020).

Gastro-Tourism. Six of the articles examined have Gastronomic Tourism as their main concern. In this respect, videos can be valuable for gastronomic tourism promotion, inducing different impacts on different customer generations (Kim et al., 2018b). Also, government web pages are influential in promoting gastronomic tourism (Horng and Tsai, 2010). Social media, such as Instagram, can also be used by public administrations to preserve and revive the gastronomic culture of a destination (Yu and Sun, 2019).

Food Delivery. Recent years have seen a proliferation of food delivery applications (Gunden et al., 2020a), many of them based on mobile technology (Kang and Namkung, 2019; Cho et al., 2019; Zhao and Bacao, 2020). The ease of use of these applications has made home delivery a possibility not only for fast food establishments but for all restaurants. However, in this section

we include a pioneering study (Cummings, 1987) in which the technology of the time was combined with landlines for home deliveries.

Literature Review. Four articles analyzed are, as is the present study, literature reviews. The paper by Law et al. (2013) refers to ICTs in hospitality as a whole, analyzing its progress and development through a study of papers published in the Cornell Hospitality Quarterly and its predecessor. Ivanov et al. (2019) base their paper on the study of robotics in hospitality and tourism, while Moreno and Tejada (2019) is more like the present paper in that it studies the progress of ICTs in the restaurant industry, analyzing 68 papers from 29 journals. Finally, Rodríguez López et al. (2020) analyze research on restaurants over two decades but without focusing on ICTs.

Meal Sharing. The sharing economy is a widely extended phenomenon in tourism, with Airbnb being perhaps the most celebrated platform in terms of rentals. In the culinary world there are also platforms based on ICTs through which users can search for restaurant services in private homes, such as EatWith. Two of our sample papers analyze this tendency (Ketter, 2019; Mhlanga, 2020).

Covid-19. Two papers include the theme of Covid-19 (Cai and Leung, 2020; Zhao and Bacao, 2020), in both cases related to the use of online food delivery applications, which have been so important for the restaurant industry due to the movement restrictions imposed on the population.

With regard to the evolution of the areas, it is clear that they have all been further developed in recent years. We can see that the Consumers area has received the most attention of the 3 areas analyzed, although it is a much more recent area of study than the Suppliers area. This second area is analyzed in all our sample periods, but although it is an area of growing importance, its growth has not been as marked as that of the areas of Consumers or Environment & Tendencies. The topic of EWOM is by far the most analyzed, and its study is very recent. However, among the topics studied over a longer period the most studied are Performance and the use of Innovations/ICTs by suppliers.

3.3.2. Technologies

The articles were classified at the bottom of Table 3 according to the technology covered. Needless to say, a single article may deal with several technologies at the same time, in which case the classification is based on the use of the most advanced and/or complex technology.

There is a predominance of papers about various social media, which have been divided into two sections: General Social Media and Business Social Media. The term *General Social Media* describes those which are not specifically dedicated to the business field, but usually act as mass media and work as a means to share common interests and contents on the Internet. A total of 52 articles (31.5%) study this type of social media, with a special proliferation of works about Blogs, Facebook, Twitter, Instagram, Telegram, Google map, and Weibo (in the case of China).

In turn, *Business Social Media* are different platforms which serve to make known various services, amongst them food services and restaurants, with tools for reservations, location or for payments, to quote but a few, but which, in any case, offer the possibility for users to express opinions —subsequently shared on social media— about the different establishments (45 articles —27.3%—). The Business Social Media examined in the articles include Trip Advisor, Yelp, Groupon or Foursquare. Some correspond to a specific geographic area or to a country like China, as exemplified by Openrice, Koubei or Diaping.

A total of 15 articles were classified within the section General ICTs. They study the influence of ICTs on food services and restaurants but do not deal with one technology in particular.

Nevertheless, although there are fewer articles —only 10— about Mobile ICTs (e.g. using applications for tablets or mobile phones), one can see that this technology is increasingly

present in publications. Internet and Web Technology appear in 12 articles, as does Self-service Technology.
It is interesting to see that the technologies that have appeared in the past decade, although not studied in as many papers, are currently generating great interest in the field of restaurants and other food services. This is the case with robotics, e-tablets and other technologies or applications such as Meal Sharing Platforms, Data Mining, Video, or Virtual Reality.
As for the temporal evolution of the technologies examined, Social Media —both business and general— have become more and more popular during the last period. Mobile ICTs are being increasingly analyzed instead of ICTs in general. Self-Service technologies have appeared recently, during the last of the three periods examined. Furthermore, the technologies mentioned in fewer studies are the most recent and those that will probably generate the most attention in the future. Examples include Robotics, Data Mining associated with Big Data, the use of E-tablets and Virtual Reality.

3.4.Authors and Universities

Only 18 of the 165 papers analyzed had a single author, the great majority had coauthors. Table 4 shows authors and universities with more publications. N (N. in Table 4) is used to represent the number of articles published by each author, either alone or on a co-authorship basis, and we selected the university where the researcher was working when the paper was issued. There are also authors who were developing their professional activity at several universities when their publications appeared, as can be seen in the case of some authors listed in Table 4.
The most prolific authors belong to Hong Kong Polytechnic University, Florida Atlantic University and University of Central Florida, and Chinese and US universities are clearly the ones which obtain the best results in terms of number of articles published in this area.
INSERT TABLE 4

4. Conclusions, implications, limitations and future research

4.1.Conclusions

The aim of this paper was to review the previous research about ICTs in food services and restaurants in internationally renowned journals, belonging to the field of Tourism and Hospitality. A total of 165 articles from 21 journals were selected for this purpose, covering a 33-year time period.
In agreement with Moreno and Tejada (2019), there is clear growing interest in ICTs in the food services and restaurants sector, since a large proportion of the articles examined appeared after 2010. The research methods chosen in this area were mainly empirical, to the detriment of merely theoretical, illustrative or conceptual papers. Similar conclusions were found in previous bibliometric studies in food and gastronomy research (Okumus et al., 2018b). Chief amongst the empirical articles are field analyses and those based on content analyses. The articles were mainly written from the demand perspective. This attests a change in the way of investigating the role of ICTs in food services and restaurants, because the oldest papers paid greater attention to the supply perspective. This trend is explained by the high expectations aroused by social media as data sources, and the accessibility and user-friendliness of technology for users. This causes an imbalance in ICT study because research is done on what each customer thinks, on how they interact with the restaurateur, on what recommendations they make or on the extent to which they are satisfied with the service, amongst other things. However, ICTs are not only useful in the external relationship between restaurateurs and customers; a wide range of possibilities also exist to exploit ICTs in the internal side of the firm (for staff selection, for training or professional development, for decision-making in general, and with regard to location, for example, as a means to analyze trends). Hence the need for researchers to adopt the supply perspective too —a perspective which is absent in a large number of the articles examined. It would additionally be advisable to adopt a holistic perspective which can allow us

to obtain data from both supply and demand, this being an issue dealt with in few of the papers examined.

Consumers create online travel communities that provide information to potential tourists through EWOM, and are determinants of their decisions around food and drink (Arsal et al., 2010) before arriving at an establishment. Once they have arrived, technologies such as mobile table technology can also influence their food choices (Yepes, 2015). Technologies such as Self Service (e.g., kiosks and touch screen tables for ordering food) are increasingly used in restaurants and food services, which makes it necessary to find the factors that lead to customers' willingness or resistance to use them (Kim et al., 2012). The use of technology undoubtedly influences customer satisfaction, which is an essential element of the restaurant sector and highlights the need to continue analyzing the impact of technologies such as e-menus on customer satisfaction (Beldona et al., 2014).

Food Services and Restaurants firms (Suppliers) can improve their performances, for example revenues, through the use of ICTs such as mobile applications (Lee et al., 2010); innovation and the use of new ICTs by restaurants (e.g., robotics) can help predict demand or plan production, but they also pose challenges to Human Resources as they can lead to knowledge being stored, managed and transferred through software rather than person to person (Noone and Coulter, 2012). Issues such as Corporate Social responsibility that affect the whole firm can benefit from the use of social media, as seen in the study of Sung et al. (2020). A restaurant's web site can help define its digital personality (Phelan et al., 2013), which makes it important to analyze which aspects of its personality are worth emphasizing.

The environment and new tendencies around Food Services and Restaurants are also influenced by the use of ICTs. In this way social media can be used to manage a destination, either a city or an event, such as a gastronomic festival, as in the study of Duignan et al. (2017). Tendencies such as Food Delivery have been fomented by the use of different apps (Cho et al., 2019). In other situations it has been the ICTs themselves that have created a tendency – such as E-menus (Suarez et al., 2019). Gastronomic tourism is another rising tendency; thus, the study of Yu and Sun (2019) on the city of Macao, analyzes how Instagram has played a decisive role in the preservation and revitalization of the city's gastronomic culture. The sharing economy is a widely developed concept in tourism, with platforms such as Airbnb and Uber; the sharing economy has reached the world of food through meal-sharing platforms that, according to Mhlanga (2020) pose no real threat to restaurants.

The USA, followed by China, and at a much greater distance by South Korea and Taiwan, were most used as reference countries for the empirical part of the works examined.

As for the statistical techniques utilized, an increasing trend exists to use more complex techniques such as multivariate analyses or SEM/PATH analyses, which clearly suggests a growing sophistication in this area. Few articles failed to use statistical techniques or exclusively utilized descriptive ones.

Finally, studying the authors who have done the most research on ICTs in food services and restaurants in the sample articles allows us to say that Chinese and US researchers are the most prolific when it comes to these themes, thus matching —as anticipated above— the countries most often analyzed in this area. This outcome confirms the findings of previous bibliometric studies (Shen et al., 2018), which refer to the USA and China as the two powers in the context of tourism research. The Hong Kong Polytechnic University is clearly the most productive in this area, in line with previous research (Mulet-Forteza et al., 2019; Gonzalez et al., 2020).

4.2. Theoretical Implications

Our study has identified the journals that have published the most papers relating to ICTs in Foods Services in the field of Hospitality and Tourism; the most prolific being the International Journal of Hospitality Management, the International Journal of Contemporary Hospitality Management and the Journal of Hospitality & Tourism Technology.

A significant contribution made with this paper is the availability of a list of topics in the context of ICTs in food services and restaurants, insofar as they can tell us which issues may be of interest in this area and which ones could be further explored in the future. In this respect, it is clear that the use of social media, EWOM, and the exploitation of information generated by social media arise as themes of maximum interest in the articles examined. Nonetheless, attention has also been paid to: the incorporation of ICTs for internal innovation purposes; the study of customer satisfaction in food services and restaurants; how ICTs can help in image creation for a destination or an event (Mandić and Praničević, 2019); the influence or support that ICTs provide in customers' decision-making and the link between investments in ICTs and performance or results. In short, one can see that the articles pay a lot of attention to the customers' perspective, with less emphasis being placed on the perspective of the supplier.

The analyzed topics were placed into three areas: Consumers area, Suppliers area, and Environment and Tendencies. The first two areas were chosen based on the literature review of ICTs in the restaurant industry by Moreno and Tejada (2019), the third refers to the Environment and the Tendencies among both consumers and suppliers. The Consumers area has received the most attention, especially in recent years. Studies on the Suppliers area were more numerous until the first decade of the 21st century but they were overtaken by the Consumer perspective. This effectively indicates that, thanks to ICTs, consumers have more power, they use many technologies and greatly influence people they know and do not know in their purchase decisions.

The classification of topics around ICTs in Food Services and Restaurants into three areas (Consumers, Suppliers and Environment and Tendencies) is one of the contributions of this study that can serve as a future research framework. The efforts of academics in the field of marketing have made the Consumer area the most analyzed by far as they have studied the relationships between firms and their customers. However, there is a need for more studies on the use of ICTs from the point of view of firms in Foods Services and Restaurants (internal organization, HR development, firm acceptance of new technologies, productivity and performance, reputation management, decision making based on tendency analysis around ICTs). There is also a need for more research on ICTs in Food Services tendencies and environment, for example Gastro Tourism and its diffusion though ICTs (Okumus, 2020); new platforms that allow Meal Sharing should also be analyzed to see the extent to which they compete with or complement restaurants. The relationship between our study subject and Covid-19 is interesting but future studies should analyze the use of ICTs to manage health and security problems, not only through Food Delivery, but also through artificial intelligence tools, robotics or augmented reality, which substitute part of interpersonal contact, creating a stronger sensation of security in consumers (Van et al., 2020). Destination Management and its relationship with food, eating and ICTs is another area that should receive more academic attention.

The geographic focus used for this research shows that there are large regions of the world, such as large parts of the Americas (except the USA) and Africa, with very scant research on the use of ICTs in restaurants and food services. However, they include countries with great tourism potential, partly due to their restaurants and food services, which suggests the need for further research in this area, and in new geographic regions.

The paper is also original because it identifies the technologies explored in the literature related to ICTs in food services and restaurants. Social media, whether business in general or those specific to the tourism sector, including food services and restaurants, are once again the most frequently analyzed technologies. There are also many articles dedicated to ICTs in general, and mobile technologies have received more attention in the last few years. Some scarcely used technologies which are only analyzed in the most recent papers show a promising future, not only for academics but also for managers in food services and restaurants, a special mention

should be made at this stage to data mining associated with big data (Stylos et al., 2021) as an effective way to extract information from large databases that can enable us to identify trends. Also virtual reality, e-tables, video, robotics and self-service technologies should be taken into account.

4.3. Managerial Implications

Given that this is a literature review paper the managerial implications are less important than the academic implications (Moreno and Tejada, 2019). However, the paper transmits the idea that ICTs are basic for managers taking decision at the highest level in food services and restaurants, so ICTs should not be seen as a technical tool but as an essential element for top management. In this sense, this study can help reduce the gap between food services and restaurant managers and ICT experts (Law et al., 2013); the study of the previous literature shows how service quality could be improved thought technology and to discover the usefulness of ICT tools. Moreover, ICTs impact on the performance of Food Services and Restaurants, which is not only relevant but a key point to be analyzed by managers in this sector (Zhang et al., 2014).

Accordingly, it is necessary to continue investing in ICTs and in staff training so that firms can combine these technologies with their own creativity to realize their full potential (Gonzalez et al., 2020). The restaurant sector is more and more based on the creation of experiences and ICTs, through their multiple possibilities (artificial intelligence, robotics, virtual reality, social media, videos, etc.), can undoubtedly contribute to adding value to the simple meal and create and recreate experiences to attract and retain customers who are more and more sophisticated and hooked on ICTs.

4.4.Limitations and Future Research

Amongst the limitations of this work stands out the fact that it is confined to a series of articles, leaving aside publications in books or papers presented at conferences. Nevertheless, many other studies which provide literature reviews are based on articles published in journals, which means that this limitation is shared with other works (Nusair et al., 2019; Law et al., 2013). Without a doubt, we are likely to have missed some important studies about ICTs in food services and restaurants – for example, we have included articles from Hospitality and Tourism journals, but not from journals specializing in ICTs, or in the Food area-; in this regard, perhaps not all the publications which would deserve to be included form part of this paper, but all those examined are indeed relevant, since the journals from which the articles were selected have the highest level.

We have classified the literature on ICTs in Food Services and Restaurants into three thematic areas and different topics, we have also analyzed the research methods used but we have not found a relationship between the areas and topics on the one hand and the research methods used in these areas, as was found in previous systematic literature reviews in the field of tourism (Antonova et al., 2021). Future research could analyze these relationships to see which methods are most suitable for each thematic area.

All in all, we think that this work can help make progress in this research area, showing technologies and their uses, study perspectives and contexts, which may also serve to inspire new ICT applications for food services and restaurant managers.

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Figure 1: Country on which papers focus

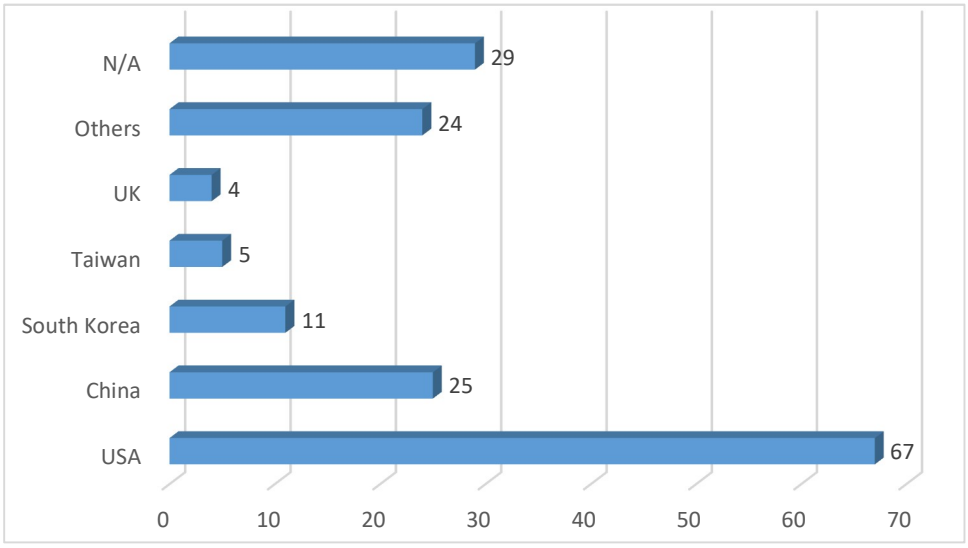

Table 1: Journals and Papers analyzed

JOURNAL	N.	%
International Journal of Hospitality Management	45	27.3
International Journal of Contemporary Hospitality Management	22	13.3
Journal of Hospitality & Tourism Technology	17	10.3
Journal of Hospitality Marketing & Management	13	7.9
Journal of Hospitality & Tourism Research	13	7.9
Tourism Management	13	7.9
Cornell Hospitality Quarterly	8	4.8
Current Issues in Tourism	5	3.0
Journal of Travel & Tourism Marketing	5	3.0
Journal of Travel Research	5	3.0
Asia Pacific Journal of Tourism Research	4	2.4
Journal of Hospitality & Tourism Management	3	1.8
Annals of Tourism Research	2	1.2
International Journal of Tourism Research	2	1.2
Tourism Geographies	2	1.2
Journal of Destination Marketing & Management	1	0.6
Journal of Vacation Marketing	1	0.6
Scandinavian Journal of Hospitality & Tourism	1	0.6
Tourism Economics	1	0.6
Tourism Management Perspectives	1	0.6
Tourism Review	1	0.6
TOTAL	**165**	**100.0**

Table 2: Research Methodologies and Statistical Techniques by period

	METHODOLOGIES							
	Until 2000		**2001-2010**		**2011-2020**		**Total**	
	N.	**%**	**N.**	**%**	**N.**	**%**	**N.**	**%**
EMPIRICAL	*2*	*1.2*	*11*	*6.7*	*146*	*88.5*	*159*	*96.4*
Field Studies	1	0.6	4	2.4	60	36.4	65	39.4
Content Analysis	1	0.6	5	3.0	56	33.9	62	37.6
Experiments	0	0.0	1	0.6	21	12.7	22	13.3
Literature Review	0	0.0	0	0.0	4	2.4	4	2.4
Case/Field Studies	0	0.0	0	0.0	3	1.8	3	1.8
Case Studies	0	0.0	1	0.6	2	1.2	3	1.8
THEORETICAL	*1*	*0.6*	*1*	*0.6*	*4*	*2.4*	*6*	*3.6*
	PERSPECTIVE							
Demand	0	0.0	6	3.6	124	75.2	130	78.8
Supply	2	1.2	3	1.8	12	7.3	17	10.3
Both	0	0.0	1	0.6	7	4.2	8	4.8
N/A	1	0.6	2	1.2	7	4.2	10	6.1
	STATISTICAL TECHNIQUES							
Multivariate	1	0.6	4	2.4	58	35.2	63	38.2
SEM/Path A.	0	0.0	0	0.0	41	24.8	41	24.8
Univariate	1	0.6	1	0.6	29	17.6	31	18.8
Descriptive	0	0.0	3	1.8	14	8.5	17	10.3
N/A	1	0.6	4	2.4	8	4.8	13	7.9
TOTAL	**3**	**1.8**	**12**	**7.3**	**150**	**90.9**	**165**	**100.0**

Table 3: Areas, Topics and Technologies by Periods

		Until 2000		2001-2010		2011-2020		Total	
	TOPICS	***N.***	***%***	***N.***	***%***	***N.***	***%***	***N.***	***%***
AREAS	**a. CONSUMERS**	**0**	**0.0**	**6**	**2.4**	**159**	**62.6**	**165**	**65.0**
	EWOM	0	0.0	4	1.6	95	37.4	99	39.0
	Innovation/ICTs Use Demand	0	0.0	1	0.4	25	9.8	26	10.2
	Satisfaction	0	0.0	0	0.0	23	9.1	23	9.1
	Consumers Decision Making	0	0.0	1	0.4	16	6.3	17	6.7
	b. SUPPLIERS	**6**	**2.4**	**10**	**3.9**	**34**	**13.4**	**50**	**19.7**
	Performance	2	0.8	4	1.6	10	3.9	16	6.3
	Innovation/ICTs Use Supply	3	1.2	4	1.6	8	3.1	15	5.9
	Webs Characteristics	0	0.0	2	0.8	5	2.0	7	2.8
	Reputation & CSR	0	0.0	0	0.0	6	2.4	6	2.4
	HRs	1	0.4	0	0.0	3	1.2	4	1.6
	Supply-based Decision Making	0	0.0	0	0.0	2	0.8	2	0.8
	c. ENVIRONMENT & TENDENCIES	**1**	**0.4**	**2**	**0.8**	**36**	**14.2**	**39**	**15.4**
	Destination Management	0	0.0	1	0.4	11	4.3	12	4.7
	Food Delivery	1	0.4	0	0.0	6	2.4	7	2.8
	E-Menus	0	0.0	0	0.0	6	2.4	6	2.4
	Gastro-Tourism	0	0.0	1	0.4	5	2.0	6	2.4
	Literature Review	0	0.0	0	0.0	4	1.6	4	1.6
	Meal Sharing	0	0.0	0	0.0	2	0.8	2	0.8
	Covid-19	0	0.0	0	0.0	2	0.8	2	0.8
	TOTAL	**7**	**2.8**	**18**	**7.1**	**229**	**90.2**	**254**	**100.0**
	TECHNOLOGIES	***N.***	***%***	***N.***	***%***	***N.***	***%***	***N.***	***%***
	General Online Social Networks	0	0.0	1	0.6	51	30.9	52	31.5
	Business Online Social Networks	0	0.0	2	1.2	43	26.1	45	27.3
	General ICTs	3	1.8	4	2.4	8	4.8	15	9.1
	Internet/Websites	0	0.0	4	2.4	8	4.8	12	7.3
	Self-service Technology	0	0.0	0	0.0	12	7.3	12	7.3
	Mobile ICTs	0	0.0	1	0.6	9	5.5	10	6.1
	Robotics/AI	0	0.0	0	0.0	8	4.8	8	4.8
	E-Tablet	0	0.0	0	0.0	4	2.4	4	2.4
	Others	0	0.0	0	0.0	7	4.2	7	4.2
	TOTAL	**3**	**1.8**	**12**	**7.3**	**150**	**90.9**	**165**	**100.0**

Table 4: Papers Published by Authors and Universities

Author (N.)	*University (Country)*	*Author (N.)*	*University (Country)*
Bilgihan, Anil (8)	Florida Atlantic Uni.. Uni. Central Florida (USA)	Cho, Meehee (2)	Kyung Hee Uni. (South Korea)
Law, Rob (8)	Hong Kong Polytec. Uni. (China)	DeFranco, Agnes (2)	Uni. of Houston (USA)
Zhang, Zili (6)	Harbin Institute of Technolohy (China)	Fiore, Ann M. (2)	Iowa State Uni. (USA)
Li, Hengyun (5)	Hong Kong Polytec. Uni. (China)	Gunden, Nefike (2)	Uni. of Houston (USA)
Tang, Liang (5)	Iowa State Uni. (USA)	Gursoy. Dogan (2)	Washinton State Uni. (USA)
Hwang, Johye (4)	Kyung Hee Uni. (South Korea)	Ham, Sunny (2)	Kyungwon Uni. (South Korea) Uni. of Kentucky (USA)
Zhang, Ziqiong (5)	Harbin Institute of Technology (China)	Hanks, Lydia (2)	Florida State Uni. (USA)
Ozturk, Ahmet Bulent (4)	Uni. Central Florida (USA)	Hlee, Sunyoung (2)	Kyung Hee Uni. (South Korea)
Bradley, Graham L. (3)	Griffith Uni. (Australia)	Israeli, Aviad (2)	Kent State Uni. (USA)
Christoloulidou, Natasa (3)	California State Uni. (USA)	Jia, Susan (Sixue) (2)	Shangai Normal Uni. (China)
Hua, Nan (3)	Uni. Central Florida (USA)	Kim, Woo Gon (2)	Florida State Uni.. Oklahoma State Uni. (USA)
Kang, Jee-Won (3)	Kyung Hee Uni. (South Korea)	Koo, Chulmo (2)	Kyung Hee Uni. (South Korea)
Kang, Juhee (3)	Uni. Central Florida (USA)	Lee, Jimin (2)	Kyung Hee Uni. (South Korea)
Kim, Eojina (3)	Iowa State Uni.. Virginia Tech Uni. (USA)	Leung, Daniel (2)	Hong Kong Polytec. Uni. (China)
Kim, Jungsun (3)	Texas Tech Uni.. Uni. Of Nevada (USA)	Li, Jun (Justin) (2)	South China Normal Uni. (China). Florida State Uni. (USA)
Lee, Hee Andy (3)	Hong Kong Polytec. Uni. (China)	Meng, Fang (2)	Uni. of South Carolina (USA)
Lee, Seoki (3)	Temple Uni.. The Pennsylvania State Univ. (USA)	Morosan, Cristian (2)	Uni. of Houston (USA)
Leung, Xi Y. (3)	Univ. Of North Texas (USA)	Pan, Bing (2)	College of Charleston (USA)
Lu, Lu (3)	Temple Uni. (USA)	Seo, Soobin (2)	Washington State Uni. (USA)
Mattila, Anna (3)	Pennsylvania State Uni.. Uni. Park (USA)	Susskind, Alex (2)	Cornell Uni. (USA)
Namkung, Young (3)	Kyung Hee Uni. (South Korea)	Torres, Edwin N. (2)	Uni. of Central Florida (USA)
Okumus, Bendegul (3)	Uni. Central Florida. Valencia College (USA)	Weber, Karin (2)	Hong Kong Polytec. Uni. (China)
Salehi-Esfahani, Saba (3)	Uni. Central Florida (USA)	Wei, Wei (2)	Uni. of Central Florida (USA)
Sparks, Berverly A. (3)	Griffith Uni. (Australia)	Yang, Sung-Byung (2)	Kyung Hee Uni. (South Korea)
Zhang, Lu (3)	Michigan State Uni. (USA)	Yang, Wan (2)	California State Polytechnic University (USA)
Berezina, Katerina (2)	Univ. of Mississippi. Uni. South Florida (USA)	Ye, Qiang (2)	Harbin Institute of Technology (China)
Bonn, Mark A. (2)	Florida State Uni. (USA)	Yoo, Michelle (Myongjee) (2)	California State Polytechnic University (USA)
Cai, Ruiying (2)	Colorado Mesa Uni. (USA)	Yu, Chung-En (2)	Salzburg Univ. of Applied Sciences (Austria)
Chang, Ya Ping (2)	Huazhong Uni. Science and Techn. (China)	Zhu, Dong Hong (2)	Huazhong Uni. Science and Techn. (China)