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Competitor Intelligence and Analysis (CIA) Model and Online Reviews:

Integrating Big Data Text Mining with Network Analysis for Strategic Analysis

Abstract:

Purpose: This study proposes a competitor intelligence and analysis (CIA) model that can be used for the analysis of a firm's competitors. Empirically, it investigates the application of CIA model on online reviews. This proposed model clarifies the confusion between terms such as competitive intelligence, competitor intelligence, and competitor analysis and provides a more efficient process for managers.

Methodology: The approach of the model integrates text mining techniques as a big data method with network analysis to form a competitor analysis.

Findings: Findings show online reviews may be utilized as a solid source of intelligence. The intelligence maps visualized through the text-net technique is an efficient representation of tourist satisfaction and dissatisfaction with a tourism company and its competitors.

Implications: The proposed approach can be used in the hotel industry along with many others. The implications for scholars and managers and the possible directions for future research are also discussed in the study.

Originality: This article develops a new approach for competitive intelligence practices in the hotel industry and tests a new method for competitor analysis as a part of the competitive intelligence and analysis approach developed in this study.

Abstract

Keywords: competitor intelligence; competitor analysis; competitive intelligence; text mining; network analysis; online reviews; hotels.

1. Introduction

The tourism industry operates in a fiercely competitive environment (Gémar, Moniche, and Morales, 2016; Lee, Oh, and Hsu, 2017; Oses, Gerrikagoitia, and Alzua, 2016; Singal, 2015). Managers and executives must constantly analyze the positions of industry forces, such as those of competitors, buyers, suppliers, and substitute product or service providers to make strategic and operational decisions to gain a sustainable competitive advantage (Porter, 1989; Takata, 2016). Managers develop and use analytical tools, which vary from very basic to very advanced, to produce knowledge that is primarily related to their competitors for tactical purposes to determine the positions of these forces (Attanasio, 1988; Makadok and Barney, 2001; Prescott and Smith, 1989).

Previous studies have offered comprehensive approaches such as competitive intelligence (Bernhardt, 1994; Kahaner, 1997; Rouach and Santi, 2001), business intelligence (Ranjan, 2009), and environmental scanning (Hambrick, 1982) to help businesses sustain a competitive advantage. However, the focus of these studies has usually been limited to strategic group perspectives. Also, there are many issues associated with the application of these perspectives. They may be costly, inapplicable, or time consuming for managers since these offerings ignore the manager needs related to the operational side of a sustainable competitive advantage. The lack of academic approaches that consider operational factors and other potential issues makes it difficult for managers to gain the ability to monitor and analyze their competitors effectively. However, this situation also provides great opportunities for researchers seeking new intelligence and analysis models to help managers understand the practices of their competitors and to further develop theories for strategic approaches and operational viewpoints that improve the competitive edge of managers.

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3 Few studies have addressed the practices for competitor intelligence and/or analysis
4 in tourism and hospitality management are limited (Mohammed, Guillet, and Law, 2014).
5 Existing studies have focused mainly on competitive intelligence (Köseoglu, Chan, Okumus,
6 and Altin, 2019), business intelligence (Mariani, Baggio, Fuchs, and Höepken, 2018), and
7 environmental scanning (Costa and Teare, 2000; Okumus, 2004). One of the main reasons
8 for the limited amount of research on competitor intelligence and/or analysis practices is that
9 researchers may not be able to access the methods or tools employed by managers to monitor
10 and analyze their competitors because they are confidential. Researcher focus then
11 shifted on secondary intelligence sources to develop competitor intelligence and/or analysis
12 literature. One available source is customer online reviews (COR) (Xia, Vu, Lan, Law, and Li,
13 2019).

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15 Many studies (Berezina, Bilgihan, Cobanoglu, and Okumus, 2016; Li, Ye, and
16 Law, 2013; Xiang, Schwartz, Gerdes, and Uysal, 2015) have analyzed COR to understand
17 practices at the industry level rather than of the (in)direct competitors of firms. These types of
18 studies, due to the nature of an overall industry approach, have limited implications for managers
19 for direct use. Few studies employed text mining approaches with COR as big data to
20 support competitor intelligence and analysis practices (e.g., Xia et al., 2019, but they failed to
21 clarify the functional associations of the operations elucidated from the text mining of COR.
22 Therefore, considering the relatively easy access to COR, new approaches to its analysis
23 could fulfil the operational needs of managers.

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25 The main purpose of this study is twofold. First, this paper proposes a generic conceptual
26 *competitor intelligence and analysis* (CIA) model for the hotel industry to use to augment
27 a strategic approach and help managers make decisions at the operational side for a
28 sustainable competitive advantage. Given the infancy of CIA literature in tourism, it
29 becomes of utmost

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3 importance to set grounds for future research on what CIA is, what is not and how it is
4 conducted. Second, this current study proposes a new analytical approach (text-net) within the
5 generic CIA model for identifying functional associations in the operational strategies of
6 competitors by utilizing COR. Following are the sections. In the first section, this paper clarifies
7 what CIA is and follows with the need for this practice. Thereafter, the paper proposes a
8 conceptual model which addresses a number of questions on the utilization of the CIA process.
9
10 The second section explains the research methodology utilized in this study with an emphasis on
11 text-net technique. After the study's findings are presented and discussed, the final section
12 highlights the emerging conclusions by presenting the limitations of the study and suggestions
13 for future research.
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27 **2. Literature review**

28 *2.1 What is competitor intelligence and analysis?*

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31 The authors' discussions with managers showed that a definition of CIA is clear from a
32 practitioner's perspective. The interpretation is that companies collect data related to their
33 competitors and analyze this data to identify practices and react to competitor maneuvers.
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35 However, the academic perspectives in the literature on the definition of competitor intelligence
36 and/or analysis are not as clear. In different studies, competitor intelligence has been considered
37 as competitive intelligence (Bulger, 2016; Köseoglu, Ross, and Okumus, 2016), business
38 intelligence, corporate research, corporate intelligence, company tracking, market intelligence,
39 and commercial espionage (Desai and Bawden, 1993). Competitor analysis, as a separate
40 concept, has also been mixed with competitive intelligence. For example, Bennett (2003) used
41 five definitions to identify competitor analysis. Out of those five, one was defined in Simkin and
42 Cheng (1997, p. 125) as "the process of identifying key competitors; assessing their objectives,
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3 strengths and weaknesses, strategies and reaction patterns; and selecting which competitors to
4 attack or avoid.” Three others are competitive intelligence definitions taken from different
5 studies (Bernhardt, 1994; Rouach and Santi, 2001; Prescott and Gibbons, 1993). The last one is
6 the definition of competitor information systems of Fletcher and Donaghy (1994). It seems that
7 practitioners can easily define what CIA is; however, the definitions found in academic papers
8 are spread out in different areas and have muddled the terms competitive intelligence, business
9 intelligence, and competitor intelligence. To eliminate the confusion among these terms, this
10 paper employs Bulger’s definition (2016, p. 63):

21 ... the robust integration of insights from “intelligence pools” that are identified across
22 the business environment and in collaboration with other functional areas and disciplines
23 that are synthesized to gain a comprehensive picture of a market in its current state and in
24 its probable future state.
25

27 Bulger considered competitor intelligence as a part of an integrated competitive
28 intelligence and defined it as “specifically intelligence about the competitor landscape and the
29 competitors that make up the landscape” (p. 72). Accepting this definition clarifies the
30 confusion; however, it creates a gap between competitor intelligence and competitor analysis as
31 well as between competitor identification and competitor intelligence as components of CIA.
32 Simkin and Cheng’s (1997) definition of competitor analysis does not incorporate competitor
33 intelligence practices. This current study, therefore, proposes competitor intelligence and
34 analysis as a combined concept to minimize confusion in both practice and the literature.
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45 The first step of this combined concept is the clarification of the term “competitor.”
46 Competitors are defined “as firms operating in the same industry, offering similar products, and
47 targeting similar customers” (Chen, 1996, p. 104). Taking the prior work (Bennett, 2003; Bulger,
48 2016; Porter, 1980; Simkin and Cheng, 1997), into consideration, this study defines CIA as:
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3 ... a process of identifying competitors, collecting intelligence related to the practices of
4 competitors in an ethical and lawful manner, storing this intelligence in an easily
5 accessible structure, disseminating this intelligence in timely fashion, as needed, and
6 analyzing collected intelligence to decide how to be more reactive or proactive in the
7 industry and to predict the future actions of competitors via integrating with other
8 intelligences obtained from the other pools of competitive intelligence.
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12 In this proposed definition, “the other pools” refer to the pools of the integrated
13 competitive intelligence practices as proposed by Bulger (2016) and include six pools of
14 economic intelligence, market intelligence, competitor intelligence, customer intelligence,
15 business intelligence, and competitive technical intelligence as subfields of competitive
16 intelligence. To establish a successful CIA system in organizations, the functions of all pools
17 should be considered.
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26 *2.2 Why is CIA needed?*

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28 The use of CIA should be considered as an essential approach for both existing firms and
29 investors who wish to enter an industry. To formulate and implement strategies, existing firms
30 need to know who the players in the market are and the strategies that they employ to outperform
31 others. Investor should identify the players so as to understand which products or services they
32 should provide to be competitive and to decide how and when to enter the market. CIA can help
33 managers develop plans and strategies, encourage strategic thinking and behavior, push
34 innovation and change in an organization, contribute to organizational learning, and be used as
35 an early warning system that identifies threats or opportunities in time (Desai and Baeden, 1993).
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37 If, however, managers do not utilize/understand these advantages, their CIA practices can be
38 harmful by wasting time, money, and energy by creating a competition war, can tend to be
39 reactive rather than proactive, and can obtain false signals from competitor actions (Bennet,
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2.3 How does CIA work?

In line with the proposed CIA model, the process starts by identifying competitors (see Figure 1). Gur and Greckhamer (2018) highlighted four approaches for identifying competitors, the first of which is an industry-oriented relationship approach where companies in an industry are accepted as competitors. The second is a strategic, groups-oriented approach which professes that competitiveness among companies depends on their having a similar position in their respectful industry. The third is a manager-oriented technique approach where companies are selected as competitors based on manager preference. The fourth is a customer-oriented approach, a method which selects competitors because they compete to attract potential customers in the same fashion (Gur and Grechamer, 2018).

The second part of competitor identification focuses on competitor types. Since firms are not able to engage with all competitors, managers should identify these competitors based on their types. Bergen and Peteraf (2002) identified three type of competitors: direct, indirect, and potential competitors. The final part of competitor identification is based on competitor focus. Bulger (2016) classified four types of competitors based on level of effort: directly monitoring, directly monitoring but perhaps in a limited fashion, limited focus, and usually monitored by competitive technology leads. In practice, many companies identify up to six competitors for CIA by considering several key factors such as product-service offering, price, geographic proximity, size, and market segment (Mohammed, Guillet, and Law, 2014).

******Insert Figure 1 about here******

After the identification of competitors, the next step is collecting intelligence related to these competitors. Managers should address three issues regarding collecting intelligence: What should be the context of the competitor intelligence? What are the sources of the intelligence? How should the collection process be performed? In practice, when managers talk about

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3 competitor analysis or competitive analysis, they are talking about only the competitors'
4 marketing practices, such as their products/services, advertisements, and prices (Köseoglu, et al.,
5 2016). However, marketing intelligence alone is not enough to understand the current and future
6 plans of competitors (Craft, Fleisher, and Schoenfeld, 1990). Aaker (1995) suggests a framework
7 demonstrating the main streamlines to analyze competitor practices fully. These streamlines, of
8 which a manager should collected related intelligence, are image and positioning strategies,
9 objectives and commitments, current and past strategies, organization and culture, cost structure,
10 size, growth, and profitability. Some earlier works have highlighted that competitor analyses
11 were usually conducted focusing on quantitative information (Ball, 1987). This emphasized that
12 effective competitor analysis should focus on the qualitative aspect of firms, such as corporate
13 culture, leadership, and organizational structure. Managers still rely more on quantitative
14 information in CIA than qualitative information (Köseoglu, et al., 2019a). If managers would
15 like to have effective results from CIA practices, they should focus on a variety of contexts for
16 intelligence instead of just focusing on quantitative information.

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The second part of collecting intelligence is the identification of the sources needed for intelligence. Managers have two general options: primary intelligence sources and secondary intelligence sources. Primary intelligence sources can be based on connections with the competitors' employees. The employees of the dealers or distributors of competitors, specifically their salespeople and their customers can also be used. Secondary intelligence sources can be publications and/or publicly available reports, including but not limited to annual reports, government publications, professionally prepared reports, business magazines, trade shows, press sources, patent information, and sales figures (Calof, Arcos, and Sewdass, 2018; Calof and Wright, 2008; Cottrill, 1998; du Toit, 2003).

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3 In addition to the aforementioned sources, COR have emerged as an important source for
4 CIA in recent years, but these reviews have been used for competitive intelligence or business
5 intelligence purposes rather than for a focus on competitor intelligence. Many studies have used
6 COR for industry-level analyses rather than firm-level analyses (e.g., Guo, Sharma, Yin, Lu, and
7 Rong, 2017; Lee and Bradlow, 2011; Xu, Liao, Li, and Song, 2011; Xu, Wang, Li, and Haghghi,
8 2017). This new approach requires an analysis of COR at the firm level to help managers analyze
9 their competitors and thus make better decisions.

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12 The intelligence collection process is a further issue that requires that, managers respond
13 to three questions when establishing an efficient working process: Who will collect the
14 intelligence related to competitors? Do we have business ethical code guidelines for collecting
15 intelligence on competitors? And, what sources will be considered? Collecting intelligence
16 related to competitors can be very sensitive if the intelligence is collected from primary sources
17 since not all employees in a firm are not able to perform this task. Appropriate employees should
18 be identified or hired and trained for the task as an intelligence agent as defined in Köseoglu, et
19 al. (2019a), but ethical issues may arise during collection which might generate some formal or
20 informal conflict among competitors in the industry. Therefore, firms should develop codes of
21 ethics and apply them in practice (Paine, 1991; Rittenburg, Valentine, and Faircloth, 2007).

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24 The third step is the storage and dissemination of the intelligence. Köseoglu et al.
25 (2019a) focused on an independent full-service hotel whose departments do not have an
26 established central storage system for competitive intelligence practices. Firms should establish a
27 department/unit or appoint persons to manage the storage and dissemination of intelligence, but
28 this storage system must be integrated with the other pools of competitive intelligence practices
29 to run analyses effectively. Managers need to address where they will store, who will store, and
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3 who will use the intelligence throughout the CIA information system (Fletcher and Donaghy,
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5 1994).
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8 The final step is for the analysis and prediction. There are many strategic decision
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10 making tools in the literature that analyze collected intelligence and predict a competitor's next
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12 moves (Bose, 2008). However, many managers or employees are not able to use many of these
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14 tools properly or they may not even be aware of them (Köseoglu, Putra, Yi, Okumus, and Zhao,
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16 2019b), making them misinformed when predicting a competitor's strategic intent and/or
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18 behavior (Hill, Recendes, and Ridge, 2019; Hitt, Tyler, Hardee, and Park, 1995). Considering the
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20 data collected and information available to firms in the big data era, if company can properly
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22 store and disseminate the data as needed, they should be able to analyze this accumulated
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24 intelligence to help the strategic formulation and implementation process. Managers should
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26 consider a big data approach (Chen, Chiang, and Storey, 2012; Minelli, Chambers, and Dhiraj,
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28 2012) to analyze this accumulated intelligence. To predict the strategic intents and behaviors of
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30 competitors, managers should consider the results obtained from other intelligence pools as well.
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32 If this proposed CIA process is integrated with the processes of competitive intelligence offered
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34 by Bulger (2016), firms should be able to make more accurate decisions and executions on the
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36 strategic and operational side of a sustainable competitive advantage.
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42 Big data and social media terms cannot be equated, however, since big data is not only
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44 social media, and not all social media content is big data. A straightforward definition of big data
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46 is "any data that cannot fit into an Excel spreadsheet" (Batty, 2013, p.274). Many scholars
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48 initially proposed three basic properties of big data, referred to as 3V: Volume, Velocity, and
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50 Variety. Demchenko, Grosso, De Laat, and Membrey (2013) explained 3Vs as follows. Of these
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52 3 properties, Volume is the most distinctive and refers to features such as size, scale, and
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3 amount. Data with such volume is usually collected from several transactions. Velocity stands
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5 for the availability of generating big data at high speed. Variety refers to a proliferation of new
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7 types of data from several sources. Demchenko et al., (2013) then recommended two new
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9 properties to the aforementioned by proposing 5Vs. The fourth is Value, representing the extent
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11 to which collected data brings added-value to a certain process or activity. The final property is
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13 Veracity, composed of both the trustworthiness of data and its consistency (or certainty). Social
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15 media content as a whole is usually regarded as big data. However, researchers usually collect
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17 specific content, which is usually a fraction of the big data, from social media sites
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23 *2.4 CIA in the tourism industry*

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25 In the tourism and hospitality literature, there were a few studies that focused on
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27 competitive intelligence (Köseoglu et al., 2019a; Köseoglu et al., 2016), environmental scanning
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29 (Costa and Teare, 2000; Jogaratnam and Law, 2006; Okumus, 2004; Tavitiyaman, Zhang, Law,
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31 and Lin, 2016; Wu, Costa, and Teare, 1998), and business intelligence (Xu et al., 2017).
32
33 Köseoglu et al. (2016) found that the awareness of hotel managers of competitive intelligence is
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35 low and that hotel firms focus mainly on competitive intelligence at the tactical level, which is
36
37 related to competitor practices. Lam, Ho, and Law (2015) reviewed literature to reveal expansion
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39 strategies of Asian hotel companies for international competitiveness. There have been studies
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41 that have focused on CIA processes for analysis and prediction (Kim and Canina, 2011;
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43 Schwartz, Uysal, Webb, and Altin, 2016; Webb and Schwartz, 2017); however, they were
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45 mainly focused on the industry rather than on individual firms. Other studies (e.g., Bilgihan, Seo,
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47 and Choi, 2018; Xu et al., 2017) have analyzed COR via a big data approach, but they also
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49 provided industry-level assessments. These may be not beneficial for operational-level actions in
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51 firms. One example of a firm-level study was by Xia et al. (2019), which highlighted competitor
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3 analysis by investigating hotel competitiveness, focusing on hotel feature ratings obtained from
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5 COR. This study did not provide any insights into the functional associations of the feature
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7 ratings for each hotel, which managers require to make decisions for the operational side of a
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9 sustainable competitive advantage.
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12 The necessity of the use of information technologies for competitiveness of tourism
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14 businesses has been acknowledged by several tourism studies (e.g., Buhalis, 2019; Law, Sun, &
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16 Chan, 2019; Okumus, Köseoglu, Morvillo, & Altin, 2019; Stylos, 2019). Providers of tourism
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18 services may utilize a number of tools available in an online environment to stand out from their
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20 competitors (Yao, Qiu, Fan, Liu, & Buhalis, 2019). Big data available in social media sites are of
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22 particular importance for the tourism industry (Buhalis, 2019; Williams, Ferdinand, & Bustard,
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24 2019; Zhang, 2019). Not surprisingly, social media studies have seen a dramatic attention over
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26 the last decade (Gretzel, Zarezadeh, Li, & Xiang, 2019; Mehraliyev, Choi, & Koseoglu, 2019).
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28 Recent empirical research has confirmed that social media not only plays a decisive role in
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30 tourist choices (Liu, Mehraliyev, Liu, & Schuckert, 2019) but also influences a business's
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32 financial profitability (Anagnostopoulou, Buhalis, Kountouri, Manousakis, & Tsekrekos, 2019).
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34 Scholars have therefore called to develop new big data analytical techniques to understand
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36 tourist expectation, satisfaction, and behavior (Li, Xu, Tang, Wang, & Li, 2018; Mariani, 2019).
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38 Significant gaps in the literature have been found especially related to how competitor
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40 intelligence and competitor analysis approaches can be implemented and how COR can be
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42 involved in these practices more effectively. Therefore, the following section empirically
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44 demonstrates a new analytical technique called "text-net", which uses COR and integrates big
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46 data mining techniques and network analysis for CIA researchers and practitioners.
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3. Methodology

This section discusses the application of an example of the proposed model employing the text-net approach for big data analytics. A full-service hotel property located in Hong Kong will be used to operationalize the model. Hong Kong was chosen for two main reasons. First, previous studies have suggested that due to their active involvement, Hong Kong hotels provide a useful setting as a case study to investigate online reviews and social media (e.g. Tse, 2013). Second, two of the researchers of this study have higher expertise and familiarity with Hong Kong hotels, which contributes to the effective and accurate interpretation of the obtained results. The researchers assumed that the hotel systematically and continually monitored their competitors to identify their strengths and weaknesses and harnessed COR for customer experiences. The next section explains the step-by-step approach to the operationalization of the model, which employs the text-net approach for the competitor analysis.

3.1. Step 1: Identifying competitors

Since the subject property focuses on their competitors' customer experiences to identify who the competitors are, they have some options. They could assume that all of the properties in Hong Kong are their competitors. Thus, they would focus on all of the people who stayed at hotels in Hong Kong. However, this approach would be problematic since the focus would be on the very large number of properties in all of Hong Kong rather than on their direct competitors, and such an approach would be time consuming and costly. Alternatively, they could focus on just the hotels in their strategic group since they already monitor the competitors in this group. This kind intelligence collection, though, would be on an industry level rather than on the strengths or weaknesses on a firm level. The competitors of the hotel could be listed based upon the experiences and preferences of the hotel managers, focusing on hotels with similar product or services. In this case, a comparison of customer experiences with the identified

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3 might not be achievable. Another possibility is for the property to focus on third-party hotel
4 booking websites to see who are indicated there as competitors. This approach would be very
5 simple, time saving, and costless for the identification of direct or indirect competitors.
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10 There are many third-party hotel booking websites, which provides another challenge for
11 the hotel. The hotel should decide which website(s) should be considered, and the hotel can
12 select one or more of them by considering the following three criteria: the popularity of the
13 website, the necessity for permission to use online reviews, and the technical appropriateness of
14 the online reviews for collection and analysis. Based upon these three criteria, the researchers in
15 this study selected Booking.com based on its popularity, lack of permission requirements for the
16 use of online reviews, and detailed online reviews, including the placement of positive and
17 negative comments in separate columns. This detailed review system helps researchers obtain
18 more accurate results for analysis. When one searches a hotel name on Booking.com, similar
19 competitor hotels and their links can also be seen. The researchers selected the top three hotels
20 listed as direct competitors of the subject hotel since they assumed that these three hotels were
21 more similar to the subject hotel than were the other hotels in the remainder of the ranking. For
22 the rest of this paper, the researchers call the subject property Company A and the
23 competitor hotels Company B, Company C, and Company D.
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42 Researchers did not follow with Company A to get confirmation whether the other hotels
43 are their competitors. Customers would not do this either. Potential tourists almost
44 exclusively rely on online travel agencies to evaluate different hotel options (Liu et al., 2019).
45 While these hotels may or may not be seen as competitors from the perspective of hotel staff,
46 this study took a potential tourist's perspective for competitor identification. Search and
47 recommendation algorithm of online travel agencies consider alternative options in a dynamic
48 manner, and results
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3 are thus not constant. Hotels are encouraged to regularly perform search and compare options
4 from the customers' perspective. It is not to say that third party recommendations (alternative
5 hotel options) are more accurate than hotel staff's longstanding knowledge on who competitors
6 are. Regular search activity, however, is of utmost importance and may reveal competitors that
7 hotel staff could have previously overlooked.
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10 11 12 13 14 15 *3.2. Step 2: Collecting intelligence*

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17 Researchers collected each hotel's COR from their respective Booking.com page.
18 Managers can also use a variety of basic and advanced web scraper tools to extract written
19 reviews. Researchers collected 7,409 reviews on December 3, 2018. Table 1 presents the number
20 of both positive and negative reviews for each hotel.
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26 ******Insert Table 1 about here******
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28 29 *3.3. Step 3: Storage and dissemination*

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31 Storage and dissemination can be performed in a separate unit for competitive intelligence or
32 CIA practices or in the related departments of a property that use their own equipment and
33 software for storage and analysis. Many firms also use cloud storage for storage and
34 dissemination. However, considering the sensitivity of the process, cloud access should be
35 secured and used by authorized users only. This study stored the collected data on eight Excel
36 sheets (positive and negative reviews for each of the four hotels) in a shared drive that could be
37 accessed by the authors of this paper only.
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46 47 *3.4. Step 4: Analysis and prediction*

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49 The main goal for the hotel in this study is to gather and analyze the strengths and
50 weaknesses of their competitors based on customer comments. A huge amount of text was
51 gathered that required a sophisticated analysis technique to achieve the subject property's main
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3 goal. Researchers decided to enlist the text-net approach, which integrates text mining, big data
4 analytical tools, and network analysis to explore the co-occurrence among concepts or issues
5 while visualizing them on an intelligence map. Figure 2 illustrates this analytical procedure. The
6 same procedure was used for the data stored in each of the eight sheets.
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12 *Reviews into stems.* RapidMiner software was used to perform the following steps in
13 sequential order. First, the reviews were tokenized into words. Frequently used stop words (e.g.
14 always, after, etc.) were filtered due to their slight or lack of contribution to the intelligence
15 analysis. All characters were transformed to lower case to standardize the available words.
16 Terms such as “hotel,” hotel brand names, and the destination name (i.e., Hong Kong) were also
17 filtered out. Words were then transformed into stems to merge those with similar roots into one
18 concept (e.g., amazing, amazed, amazingly → “amaz”).
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29 *Identifying top strengths/issues.* The reviews were now available in stems which could be
30 easily counted. At this step, the results illustrated the satisfiers (in positive reviews) and
31 dissatisfiers (in negative reviews) mentioned by the consumers most frequently. However, the
32 associations between these concepts were not yet available. A top n number of stems must be
33 chosen to prepare the data for network analysis. This number can be increased or decreased
34 depending on the dataset and researcher preferences. As the cut-off point is increased, the
35 network analysis can provide more detailed information; however, the intelligence map becomes
36 noisier. For this study, researchers first used different cut-off points to generate various
37 intelligence maps. After evaluating different intelligence maps, researchers decided to adopt the
38 most frequently used 200 stems as a cut-off point. More (than 200) stems generated more
39 detailed intelligence maps, which require considerable time to interpret and considerable space to
40 discuss results. Such maps can be used by practitioners for detailed analysis. Using fewer (than
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3 200) stems generated simple intelligence maps. These maps may be beneficial for a quick
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5 overview but might not suffice for this study. The consensus was reached among the researchers
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7 to use 200 stems as a cut-off point.
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10 *Stems into reviews.* The stems in each review were again recombined. This produced a
11
12 new dataset, where each review consisted of only stems. This dataset will be used together with
13
14 the top identified stems from the previous step to prepare the data for network analysis.
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17 *Preparing for network analysis.* A number of programs, including the search feature of
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19 Excel, can be used to search for which of the identified 200 stems were used in each of the
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21 reviews consisting of stems (the new dataset prepared in the previous step) and then extract
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23 them. After extracting these words, researchers created a co-occurrence table that counted the
24
25 number of times that each set of two stems appeared in the same document. The frequency of a
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27 co-occurrence reflects an association between the two stems.
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31 *Network analysis.* The network analysis was conducted based on the co-occurrence table.
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33 That is, when two stems co-occur in the same review, they formulate a link together. The more
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35 they co-occur, the stronger the link between the two becomes. By combining all the links
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37 available throughout the dataset, a network map—in this context, an intelligence map—can be
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39 formulated. The stems being measured in the network analysis are called nodes, and the links
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41 between them are called vertices, edges, or paths. Gephi and VOSviewer were used to calculate
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43 the centrality measures and visualize the intelligence maps, respectively.
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47 The network analysis helped us to identify the functional associations among the
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49 resources elaborated by the customers of the hotels. Hence, degree centrality and betweenness
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51 centrality, were used to show these associations. While degree centrality explores the importance
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53 of nodes by identifying the number of co-occurrences in the network, betweenness centrality
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3 highlights the extent to which a particular node lies “between” the various other points in a
4 network. A high score for both indicators tends to be more central than other words. Words with
5 a high degree or betweenness are usually key words in the network (Borgatti, 2005; Gallardo-
6 Gallardo, Arroyo Moliner, and Gallo, 2017).
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13 **4. Findings from Text-net approach**

14 *4.1. Strengths of the hotels at the operational level*

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16 The strengths of the hotels based on the customers’ positive evaluations were identified in the
17 text-net analysis. The degree centrality analysis results (Table 2) show that the main strengths of
18 the hotels are rooms as one of the core products, the staff, and breakfast. However, while
19 Company A has a competitive advantage at the operational level based on the word “free,” it
20 seems to have some disadvantages for location. Seemingly, providing specific extra free services
21 is Company A’s strategy. Company B is clearly following Company A in this strategy and is also
22 providing free services that are noticed and highly valued by customers. To substitute for their
23 disadvantage on location, Company A provides shuttle services that are valued by customers.
24 Stems referring to the minibar and phone, which are not available for the competitor, also have a
25 high degree centrality for Company A, indicating a strategic advantage. Company C’s proximity
26 to a shopping mall is worth monitoring, and to address this, Company A could, for example,
27 offer free shuttle bus services not only to/from the airport but also to the nearest shopping malls.
28 Another piece of intelligence obtained is Company D’s strength from its buffet. Both tangible
29 and intangible resources bring competitive advantages for all hotels at the operational level.
30 However, managers should understand the functional associations among these resources to be
31 able to take action.
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3 Many of the strengths identified for Company A are in degree centrality (e.g., free,
4 phone, minibar) and are also found in the results of the betweenness centrality analysis (Table 3).
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6 The pool also plays a very central role among Company A's strengths. This is an especially
7
8 crucial advantage when competing with Company B. The cleanliness at Company A is not as
9
10 noticeable as at Hotels B and C. The word "free" appears in Company D's central strengths as
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12 well, although it is not as noticeable.
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17 ******Insert Table 3 about here******
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19 In addition to the findings from the network indicators, the visualization of the network is
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21 a very beneficial tool for clearly understanding the functional associations among co-
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23 occurrences. In practice there are two types of visualizations: network visualizations and density
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25 visualizations. In the network visualization type provided by VOSviewer (Van Eck and
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27 Waltman, 2010) as a package program the researchers can identify the strengths of the ties within
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29 the entire network and the positioning of the co-occurrences. The thicknesses of the lines and the
30
31 sizes of the circles in the visualization show which co-occurrences occupy a strong position
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33 within the network. The color of the nodes and lines highlight the incidence of clustering within
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35 the network. In density networks or heat maps, researchers can see the position of the important
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37 co-occurrences in the network. The density networks use colors to show the importance of the
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39 co-occurrences. Warmer colors and bolded fonts highlight concepts that are frequently used, and
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41 colder colors and smaller fonts present words rarely used (Zupic and Čater, 2015).
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47 Figure 3 presents density visualizations of the network generated from the co-occurrences
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49 of the positive COR for each hotel. These visualizations illustrate the strengths of the
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51 resources of the hotels from the customers' perspectives. In Company A's density map, three
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53 groups of words can be distinguished. The first group of words deals with the hotel's core
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55 product, such as
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3 “room” and “breakfast,” staff-related descriptions, such as “friendly” and “helpful,” and hotel
4 attributes, such as “free,” which follows the classifications for hotel guest experiences
5 highlighted by Xiang et al. (2015). The second group of words demonstrates the words related to
6 hotel amenities, such as “pool” and “minibar,” and hotel attributes, such as “view.” The third
7 group indicates the words related to hotel attributes, such as “location,” and evaluations of
8 experiences, such as “comfortable,” “nice,” “good,” and “perfect.” However, words indicating
9 the possible actions of customers, such as “recommend,” are not strongly emerged on the map.
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19 When looking at the competitors’ density map, the hotels are good at aspects related
20 to the room, staff, and location, as could also be seen in Company A’s results. However, the
21 word “clean” as an evaluation of experience emerged very clearly on the Company C’s map.
22 Some other aspects of guest experience, including staying at the hotel due to word-of-
23 mouth, the departure stage of service encounters, the evaluation of the experience, and actions
24 after the stay (Xiang et al., 2015) are not (strongly) observed in the map as a strength of the
25 hotels. While the proximity of the nodes to each other in the map refers to their association
26 with each other, the functional associations of each individual node can be identified more
27 specifically in the network maps (see Appendix A) to help managers take action at the
28 operational level.
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43 ******Insert Figure 3 about here******

44 *4.2. Weaknesses of the hotels at the operational level*

45 The weaknesses of the hotels based on the customers’ negative evaluations
46 were identified in the text-net analysis. Table 4 shows the list of the top 20 negative
47 customer experience-related words with the highest degree centrality. It seems that the staff,
48 breakfast, and especially the core product, the room, are not only satisfiers but also
49 dissatisfiers for all the hotels. This is not surprising due to the high expectations of
50 guests, most of whom have
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3 considered the very high ratings and positive feedback. With such high expectations, hotels of
4 this class have to perform especially well in delivering on what they promise (Akbaba,
5 2006). The stem referring to disappointment occurred in Company A only. This kind of
6 intelligence is of utmost importance for hotel managers. The network of this stem can be
7 carefully examined separately to see where specifically the hotel is not delivering on what is
8 promised. “Floor,” “club,” “shower,” and “location” are all examples of words that can be seen
9 as disadvantages of Company A that cannot be identified among their competitors. Such
10 issues can be further examined, and reactive strategies can be operationalized.

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22 Managers should also simultaneously develop strategies based on their
23 competitors’ disadvantages. For example, customers of Company B and Company D had
24 issues with arrival. This intelligence should be investigated further to learn the competitors’
25 disadvantages. Possibly, these problems could be for a group of customers from a specific
26 country (or countries) that arrive earlier than the check-in time. Proactive strategies can be
27 operationalized based on this intelligence. For example, the front office and housekeeping
28 departments could be alerted when guests are expected from this region(s) and prepare rooms in
29 advance for the possibility of early check-ins. Alternatively, lounges with refreshments could be
30 prepared and made available until check-in to ease the process. All four hotels seem to have had
31 issues with check-in/-out services. Competitors can also consider collaborative strategies for
32 such issues to investigate the problem thoroughly and come up with solutions.

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49 The betweenness centrality analysis results (Table 5) predominantly show issues similar
50 to those identified in the degree analysis. Additional issues identified for Company A are related
51 to its pool and lounge. Since having a pool was a competitive advantage for Company A, this
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3 result also seems to be associated with high expectations. The key rule of delivering on what is
4 promised based on the very high ratings and amount of positive feedback for this hotel on the
5 webpage seems to have been applied in this context as well. Several positive words are also
6 available with high both degree and centrality in the negative reviews. This is not surprising
7 given that the overall positive ranks (between 8.5–9.0) of the chosen hotels. Many negative
8 comments start with “everything was good, however/only/but...”; therefore, both positive and
9 negative reviews have to be analyzed simultaneously to have a better understanding of the
10 strengths and weaknesses of a hotel and its competitors.
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22 ******Insert Table 5 about here******
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24 Figure 4 presents the density visualizations of the network generated from the co-
25 occurrences of negative COR for each hotel. The intelligence map of both the issues and
26 strengths and the central issues identified in tables complete each other and give a better picture
27 when read together. For example, location as an issue for Company A is clearly visible on
28 the intelligence map of issues. This could be good intelligence to use to investigate possible
29 issues related to the hotel’s shuttle services. Towards the upper part of the map, the bathroom
30 and door appear together in the same concentration area. Similarly, the shower, water, and
31 cold appear together. Price issues appear between breakfast and buffet. These are hints
32 that help to understand the details of the mentioned issues on which further investigations can
33 be made and reactive strategies can be developed. However, not all the details of the issues
34 can be seen. Similar strengths, unique networks of specific issues can be investigated through
35 network maps (Appendix B).
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51 The competitors’ maps can also be utilized strategically. For example, Company D seems
52 not to have serious issues with breakfast. Their breakfast services can therefore be learned as a
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3 best practice and implemented. However, the room seems to be the central problem of Company
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5 D. This intelligence can be harvested ethically to develop strategies accordingly. Similarly, a
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7 construction issue is a central problem for Company D. While it is not clear whether this is a
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9 temporary or longer-term issue, this weakness can be used to target Company D's target
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11 audience.
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15 ******Insert Figure 4 about here******
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17 18 **5. Discussion**

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20 This study has proposed a competitor intelligence model that can be used to analyze a
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22 firm's competitors. CIA is one of the most important yet least discussed topics in the hospitality
23
24 context. Recent developments in technologies and access to customer profiles and experiences in
25
26 big data provide an invaluable means for hotels to gain intelligence about themselves and their
27
28 competitors. Previous studies have illustrated that monitoring online review sites and responding
29
30 to customer reviews are important predictors of hotel performance (Xie, Zhang, Zhang, Singh,
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32 and Lee, 2016). However, the means to gain and efficiently analyze intelligence about
33
34 weaknesses and disadvantages has rarely been discussed.
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39 Online review sites provide valuable metrics for the measure of the average performance
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41 of hotels in terms of cleanliness, breakfast, and other factors. However, it has an important
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43 limitation in that many strengths and/or weaknesses, such as free services, shuttles, buffets,
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45 views, minibars, and construction, are usually not available among them. It is important to get
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47 intelligence beyond average ratings to more deeply understand hotel performance and develop
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49 strategic management practices. The textual data provided by customers fits well for the
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51 purposes of identifying hidden topics crucial for such intelligence.
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Currently, the big data literature in the tourism and hospitality industry has focused mainly on techniques such as sentiment analysis, latent Dirichlet allocation modelling, regression modelling, and others. Despite these valuable contributions, new techniques are needed to understand the implications of the hidden topics in unstructured data for the different contexts of tourism and hospitality (Li et al., 2018). The text-net approach has proved to be a valuable technique for collecting and analyzing intelligence about a hotel and its competitors. Degree and betweenness centrality measures can be used first to identify the most central strengths and weaknesses of a hotel and its competitors. The visualization of key topics in intelligence maps helps to show a bigger intelligence picture and provides hints into the details of the strengths and weaknesses. While this study used heat to depict the implications of findings, hotel managers can go further and use network maps to understand the network of each topic of interest.

These research findings suggest that, for the four hotels in this study, the room is the core product, and the room along with the staff and breakfast are both the main satisfiers and dissatisfiers. The strengths and weaknesses unique to Company A as well as those to its competitors were found. By no means is this is meant to generalize the results to hotels overall in Hong Kong and/or other regions. Instead, this study is meant to illustrate the applicability of the text-net approach within the proposed conceptual CIA model as a successful means to gain and analyze intelligence upon which operational steps can be performed.

6. Conclusions

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Since research in the area of competitor intelligence and analysis is in its infancy, the contributions of this study to the body of knowledge are multifold. The first aim of this paper was to propose a generic CIA analysis model. Specifically, this paper proposed a conceptual model (Figure 1) addressing a number of questions on the utilization of the CIA process.

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3 Theoretical contributions of this paper lie in the extension of conceptual knowledge and
4 understanding in regards to competitor intelligence and analysis. First, this study performed a
5 conceptual review to clarify and synthesize definitions of competitor intelligence and analysis.
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8 The practitioner definitions are clear; however, academic definitions vary greatly and are
9 confusing. The first contribution of this study is to provide a clear definition of CIA by
10 explicating and clarifying the concept. Since CIA research in hospitality literature is in its
11 infancy and little is known on what the term refers to, this contribution becomes essential
12 because it sets a floor or a common understanding on the concept, which, in turn, aids
13 researchers to avoid an inaccurate or interchangeable use of the term or the use of an inaccurate
14 term in future studies.
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26 Surprisingly, little is known in the literature on how hotels practice CIA. This study
27 contributed to the tourism and hospitality literature with a conceptual framework explaining how
28 hotels conduct CIA. The methodology section then reinforced this model by providing a four-
29 step guide on how the researcher implemented it in this paper. The provided framework and its
30 implementation sought to set a groundwork and serve as a reference point for future studies on
31 CIA.
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40 The second aim of this was to provide methodological contribution by applying a new
41 analytic approach (i.e. text-net). The text-net technique was presented in Figure 2 and explained
42 in detail throughout the methodology section. Researchers and practitioners have long been
43 scrapping data from online review sites, while the question of debates was an efficient way of
44 understanding such an amount of data. The visualization of online reviews in a form of an
45 efficient intelligence map through text-net technique is a unique contribution of this paper. First,
46 these maps are efficient because of their accuracy. Different from other basic visualizations (e.g.
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3 word clouds), text-net intelligence maps have solid scientific basis because of their application of
4 relational quantitative analysis (i.e. network analysis). This analysis insures that not only words,
5 but also *the location of each word* in the map is highly accurate and provides insights to
6 the intelligence. Words are located near each other based on the frequency to which they
7 appear in the same comment. This helps the reader of the map to understand specific aspects
8 of tourist experiences and feelings associated with certain products. Second, text-net intelligence
9 maps are efficient in terms of the financial and time costs associated with them. Researchers
10 may utilize low-cost or free network analysis software to draw intelligence maps.
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22 Today's tourism ecosystem is increasingly smart, and so it has become a must for tourism
23 businesses (Senders, Govers, & Neuts, 2013), hospitality businesses (D. Buhalis & Leung,
24 2018), tourist attractions (Wang, Li, Zhen, & Zhang, 2016), and even destinations (Boes,
25 Buhalis, & Inversini, 2016; Dimitrios Buhalis & Amaranggana, 2014) to gather insights
26 from online reviews. The applicability of text-net and intelligence maps to the aforementioned
27 settings deserves future scholarly attention. With google encouraging its users to review
28 businesses in almost all sectors (e.g. banks, barbershops, and car rental services),
29 advancement in hotel industry in terms of social media analytics can be a role model for other
30 industries as well. Text-net can be used by relevant sectors to gather and visualize competitor
31 intelligence.
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44 This paper offers a step-by-step practical guideline for the model proposed, bridging
45 the gap between academic researchers and practitioners. Because this approach focuses on the
46 firm level rather than the industry level, it may contribute more to the understanding managers
47 have of their competitors. Considering the issues related to the limited access to
48 confidential information on competitors, managers can employ other relatively easy-access
49 resources such as COR to access the strategies of competitors. The text-net method is offered
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3 and very strong technique for gathering and analyzing intelligence about self and competitors by
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5 using hotel guests as the main source of information.
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8 9 **7. Limitations and future research**

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11 Despite numerous timely contributions to research and practice, this study comes with
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13 limitations. In consideration of the limited space, this study gave greater emphasizes on the last
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15 step of the conceptual model (analytics) compared to the first three (identifying competitors,
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17 collecting intelligence, storage and dissemination). Empirical and conceptual works on each step
18
19 are required. Different techniques that hotels may utilize to identify competitors, collect
20
21 intelligence, and store and disseminate it can be investigated. Another limitation is that this study
22
23 performed property-level analysis for hotels. An intriguing question is whether text-net approach
24
25 can be extended for brand-level or region level analysis. Technically it can, but the real question
26
27 is how effective intelligence maps on a bigger scale will be. The analysis has been conducted on
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29 four hotels in Hong Kong, and the applicability of the findings to other hotels in Hong Kong and
30
31 elsewhere should be tested in future research. This study has considered two centrality metrics -
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33 degree centrality and betweenness centrality- to identify the functional associations among the
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35 resources elaborated by the customers of the hotels. Future studies can use other network
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37 indicators such as closeness centrality, eigenvector centrality, and a combination of multiple
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39 metrics (Bell, Atkinson, & Carlson, 1999; Das, Samanta, & Pal, 2018) to acquire deeper
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41 understanding on functional associations.
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Table 1. Number of Reviews

Reviews	Hotel A	Hotel B	Hotel C	Hotel D	Total
Positive	1126	740	1860	550	4276
Negative	733	560	1449	391	3133
Total	1859	1300	3309	941	7409

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Table 2: Top 20 primary words in strengths of the hotels via degree centrality

Rank	Hotel A		Hotel B		Hotel C		Hotel D	
	Words	Degree	Words	Degree	Words	Degree	Words	Degree
1	room	207	room	218	locat	203	room	196
2	staff	207	staff	218	room	203	view	196
3	great	207	locat	205	good	203	staff	192
4	help	207	great	205	staff	203	servic	186
5	free	207	stai	201	clean	203	locat	184
6	stai	207	view	200	great	203	breakfast	182
7	view	206	breakfast	200	stai	203	harbour	181
8	breakfast	206	help	195	mall	202	great	181
9	servic	206	good	190	shop	202	excel	179
10	good	206	friendli	188	nice	202	stai	174
11	shuttl	205	excel	185	breakfast	202	amaz	167
12	excel	204	harbour	181	help	201	help	158
13	friendli	203	servic	180	friendli	201	restaur	156
14	phone	203	comfort	176	excel	201	friendli	151
15	food	203	walk	176	station	200	good	151
16	pool	202	restaur	172	comfort	198	pool	149
17	nice	201	clean	171	food	198	food	149
18	love	201	free	162	pool	197	lobbi	144
19	amaz	200	nice	158	moko	196	buffet	141
20	mini	199	food	156	love	195	comfort	140
	floor	199						

Table 3: Top 20 primary words in strengths of the hotels via betweenness centrality

Rank	Hotel A		Hotel B		Hotel C		Hotel D	
	Label	Betweenness	Label	Betweenness	Label	Betweenness	Label	Betweenness
1	excel	91.511	locat	627.251	locat	115.461	locat	492.915
2	pool	89.365	great	549.773	excel	110.428	room	407.329
3	help	86.529	room	521.526	mall	104.042	excel	397.728
4	nice	85.834	help	474.075	good	103.304	harbour	354.575
5	free	84.751	staff	459.690	great	103.304	great	353.982
6	phone	83.756	good	452.122	friendli	98.612	staff	293.967
7	great	82.991	excel	425.343	help	97.893	servic	292.631
8	good	81.436	friendli	417.223	nice	94.685	help	245.199
9	food	79.913	harbour	388.923	love	93.451	breakfast	226.556
10	mini	78.702	nice	354.368	conveni	90.331	pool	219.144
11	love	77.716	stai	344.663	food	89.713	lobbi	212.035
12	room	76.943	comfort	334.133	clean	85.529	stai	199.854
13	locat	76.340	free	294.362	pool	85.074	good	190.408
14	floor	76.147	servic	285.130	moko	84.970	friendli	187.402
15	kowloon	73.664	restaur	278.019	place	82.020	food	184.092
16	friendli	73.393	club	262.813	east	81.444	night	170.623
17	breakfast	73.104	breakfast	256.358	connect	79.440	restaur	167.853
18	includ	70.982	clean	253.461	comfort	76.582	fantast	159.974
19	servic	70.546	facil	250.783	easi	74.454	free	157.650
20	shuttl	69.177	love	246.798	mongkok	73.394	harbor	155.306

Table 4: Top 20 primary words in weakness of the hotels via degree centrality

Rank	Hotel A		Hotel B		Hotel C		Hotel D	
	Label	Degree	Label	Degree	Label	Degree	Label	Degree
1	room	186	room	184	room	198	room	194
2	staff	156	book	143	breakfast	188	view	148
3	servic	142	staff	136	staff	185	construct	136
4	breakfast	141	view	132	time	185	check	127
5	restaur	137	stai	132	check	183	pool	119
6	time	134	servic	130	good	179	time	110
7	floor	130	look	123	stai	178	restaur	109
8	good	129	check	119	take	176	breakfast	109
9	food	123	time	113	pool	159	expens	108
10	club	122	night	111	peopl	156	stai	104
11	disappoint	119	good	105	area	155	price	102
12	stai	118	made	101	servic	154	work	102
13	shower	112	make	98	food	149	servic	102
14	locat	110	busi	98	book	149	staff	99
15	area	108	breakfast	96	star	147	make	97
16	great	104	peopl	94	smell	144	arriv	95
17	price	103	star	92	make	142	book	93
18	check	101	arriv	87	want	142	build	91
19	offer	101	help	87	night	140	charg	90
20	free	100	told	87	chang	139	door	89

Table 5: Top 20 primary words in weakness of the hotels via betweenness centrality

Rank	Company A		Company B		Company C		Company D	
	Label	Betweenness	Label	Betweenness	Label	Betweenness	Label	Betweenness
1	room	927.623	room	1189.824	room	321.536	room	2986.834
2	good	597.723	look	467.533	good	287.863	pool	931.870
3	locat	489.966	night	407.085	peopl	188.808	expens	910.536
4	servic	440.615	good	357.689	night	183.461	construct	766.549
5	food	411.807	servic	352.021	pool	179.035	make	760.368
6	restaur	386.485	book	348.564	staff	172.330	price	643.070
7	great	353.388	staff	278.484	food	168.804	restaur	612.940
8	floor	348.855	check	269.621	stai	166.270	staff	601.659
9	staff	338.967	stai	257.344	check	166.147	food	590.039
10	free	293.759	help	251.945	locat	156.119	check	502.315
11	guest	287.574	make	235.321	time	146.798	time	467.973
12	disappoint	257.747	made	231.333	make	142.241	stai	430.666
13	find	255.730	hour	224.609	guest	136.701	servic	420.814
14	time	243.378	extra	217.407	expens	135.649	good	401.212
15	offer	236.335	peopl	188.841	look	133.678	door	389.269
16	price	232.277	time	180.748	floor	132.072	loung	313.149
17	stai	223.417	find	176.108	take	131.735	disappoint	272.831
18	shower	220.610	monei	174.275	servic	128.893	monei	270.898
19	pool	214.616	floor	169.309	inform	126.055	front	262.691
20	loung	207.662	view	161.916	light	118.452	charg	258.059

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Figure 1. Competitor Intelligence and Analysis Model

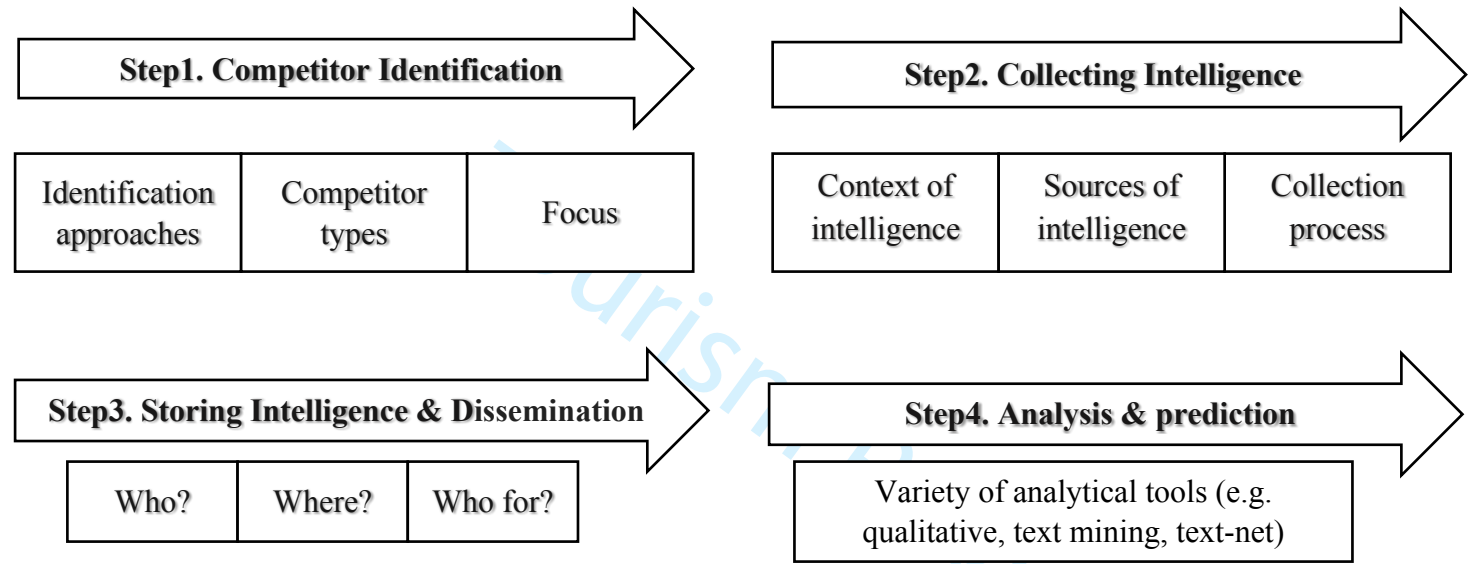
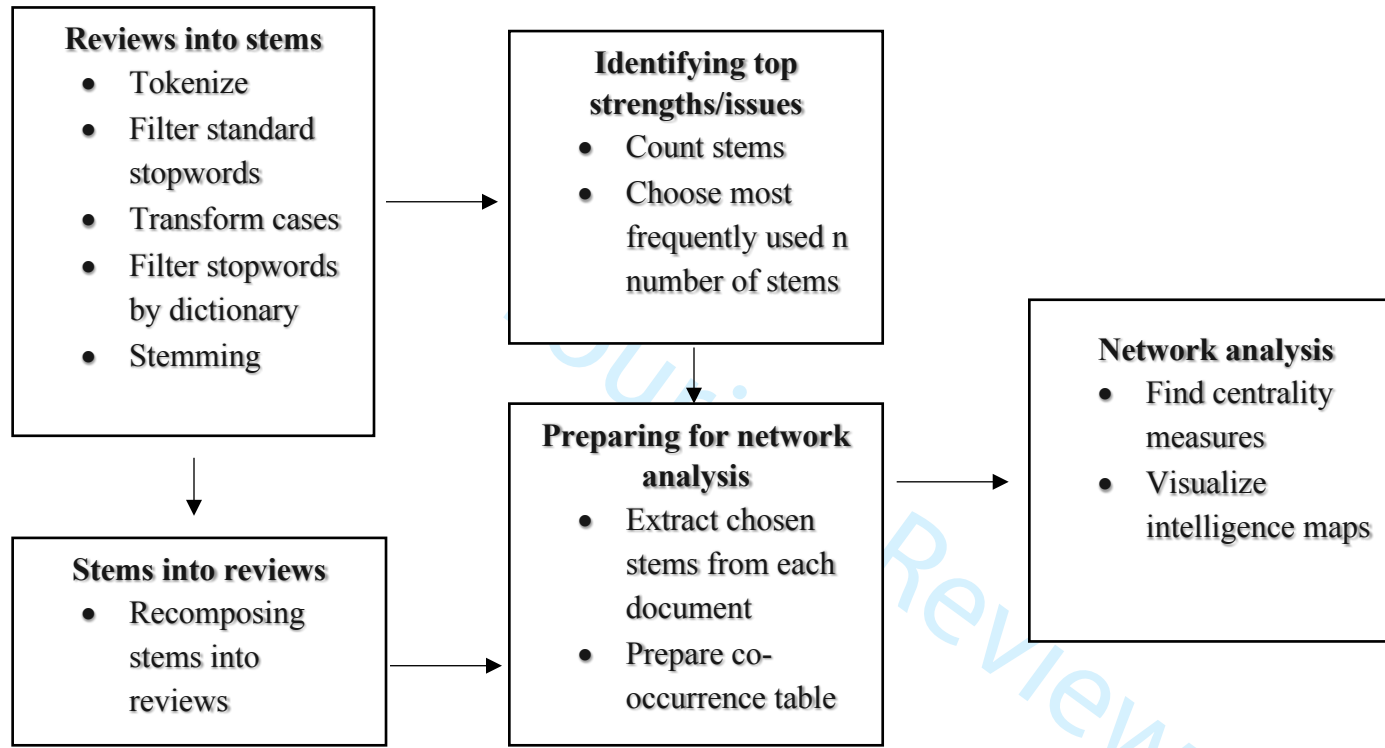
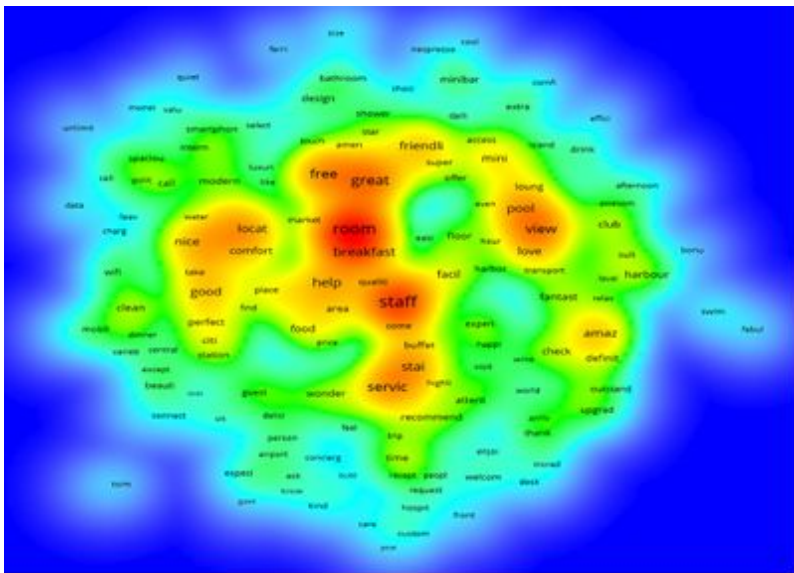


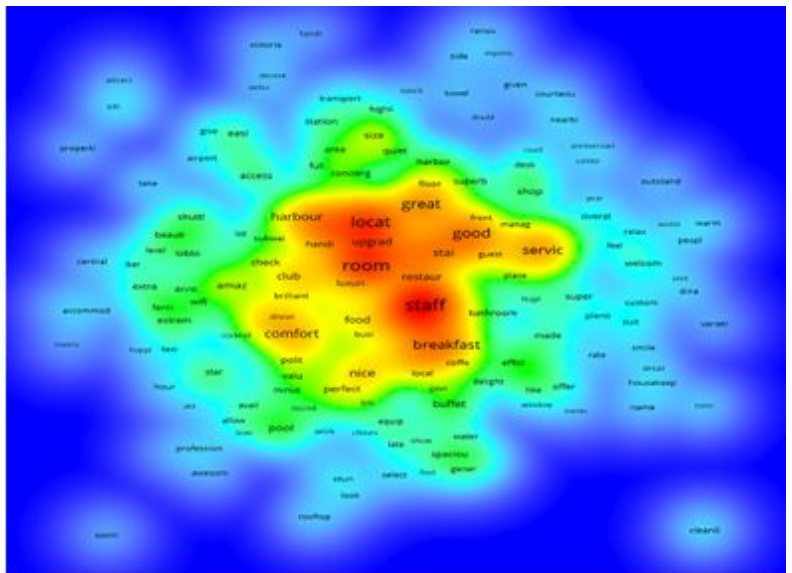
Figure 2. Text-Net Technique



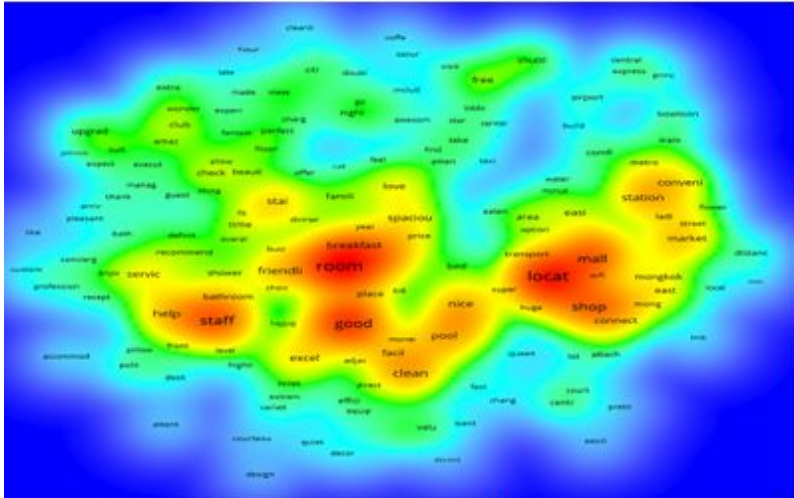
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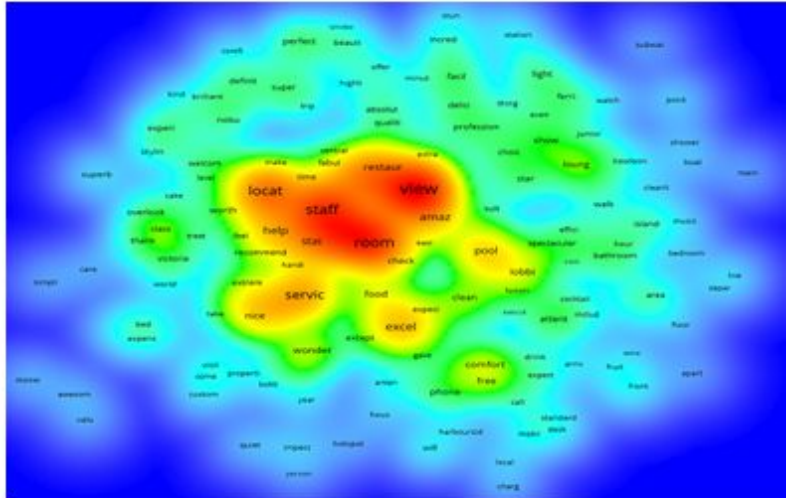
Company A



Company B

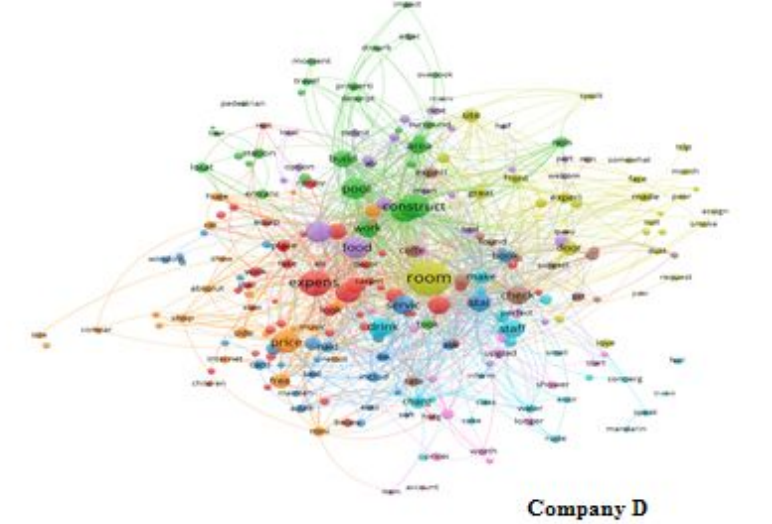
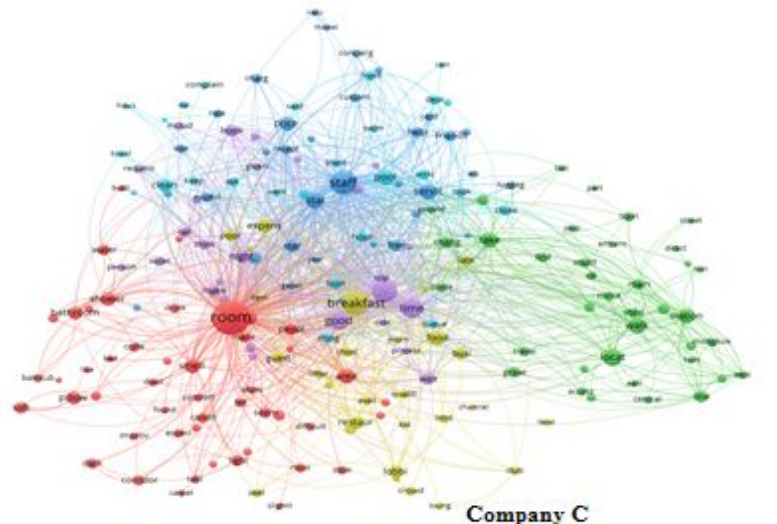
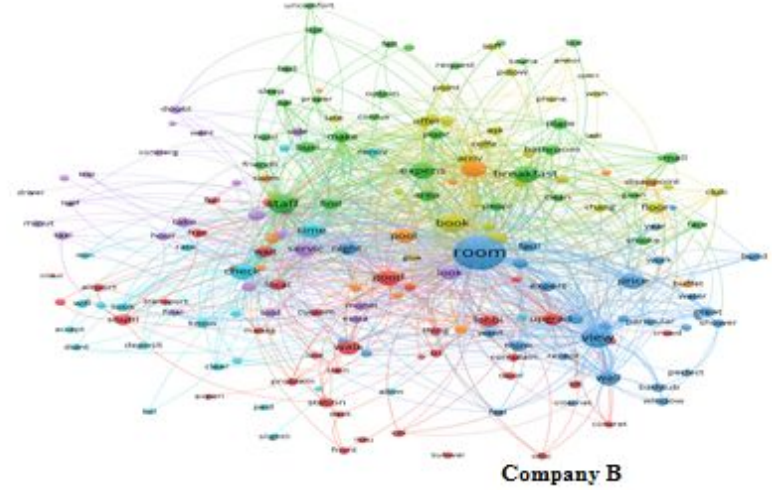
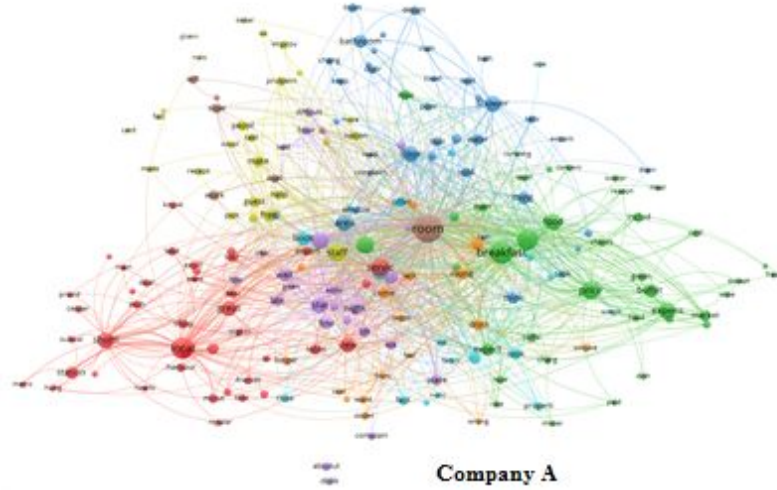


Company C



Company D

Figure 3: Density network visualization of each company for positive COR



Appendix B: Network visualization of each company for negative COR