

Social business intelligence: Review and research directions

Helena Gioti^a, Stavros T. Ponis^{b*} and Nikolaos Panayiotou^b

^a *Hellenic Open University, Greece*

^b *School of Mechanical Engineering, Section of Industrial Management and Operations Research, National Technical University Athens, Greece*

Corresponding author (*): staponis@central.ntua.gr

Received 14 June 2018 Accepted 20 August 2018

ABSTRACT Social business intelligence (SBI) is a rather novel discipline, emerged in the academic and business literature as a result of the convergence of two distinct research domains: business intelligence (BI) and social media. Traditional BI scientists and practitioners, after an inevitable initial shock, are currently discovering and acknowledge the potential of user generated content (UGD) published in social media as an invaluable and inexhaustible source of information capable of supporting a wide range of business activities. The confluence of these two emerging domains is already producing new added value organizational processes and enhanced business capabilities utilized by companies all over the world to effectively harness social media data and analyze them in order to produce added value information such as customer profiles and demographics, search habits, and social behaviors. Currently the SBI domain is largely uncharted, characterized by controversial definitions of terms and concepts, fragmented and isolated research efforts, obstacles created by proprietary data, systems and technologies that are not mature yet. This paper aspires to be one of the few -to our knowledge- contemporary efforts to explore the SBI scientific field, clarify definitions and concepts, structure the documented research efforts in the area and finally formulate an agenda of future research based on the identification of current research shortcomings and limitations.

KEYWORDS Big data, business intelligence, review, social business intelligence, social media

1. INTRODUCTION

In the last decade, business intelligence (BI) has proved, beyond any doubt, that it is a rapidly expanding domain in both research and business terms with the number of BI related scientific publications and organizations embracing BI methodologies, techniques, tools and platforms rapidly increasing year by year. This remarkable growth is directly connected with the abundance of customer/user data as a result of increased bandwidth, technological advancements in information systems and mobile applications and the explosion of user generated content mostly materialized by

social media and other Web 2.0 platforms. Nowadays, social media and BI are converging faster than ever before. The confluence of these two emerging domains is already producing new added value organizational processes and enhanced business capabilities utilized by companies all over the world to effectively harness social media data and analyze them in order to produce added value information such as customer profiles and demographics, search habits, and social behaviors.

This point of convergence is exactly the scientific area where this paper sets its focus and research efforts, i.e. social business

intelligence (SBI), a very new concept trying to capture this transformation of BI systems in the era of Big Data and amidst the social media revolution. This paper constitutes the third -to our knowledge- effort to explore the SBI scientific field, clarify definitions and concepts, structure the documented research efforts in the area and finally formulate an agenda of future research based on the identification of current research shortcomings and limitations.

In doing so, this paper follows a structured literature review approach utilizing data from one of the most established academic databases in the world, i.e. Elsevier's SCOPUS, and imposing a 'search and filter' process based on a carefully selected set of inclusion and exclusion criteria described in detail in the next section. The collected papers were studied thoroughly with the objective to initially eliminate duplicates and critically exclude papers dealing with SBI superficially, fragmentally or not at all. At the end of the literature scrutiny process, 83 papers were selected for further in-depth, full-text examination with the objective to provide the reader with an overview of the main themes and trends covered by the relevant SBI literature. The review process imposed on the 83 papers included in the final review sample produced several interesting findings regarding the current structure of the domain and the necessary prioritization of the research activities for the future.

The remainder of this paper is structured as follows. The next section provides a brief theoretical background of the two domains under study, i.e. BI and social media. It aims to provide the necessary information for understanding the importance of Big Data for BI and the potential impact and transformative nature that social media have on existing BI research and practice with a special focus on User Generated Content (UGC) and trends related to specific social media platforms. In Section 3, the methodological approach to the review and the results of the selection process are presented, followed by the review of the selected papers and the synthesis and taxonomization of the identified research efforts in Section 4. Finally, Section 5 attempts a critical discussion of the review findings in Section 4 and concludes with a proposed SBI domain research taxonomy and a suggested list of priorities and directions for future research.

2. BACKGROUND

Business intelligence (BI) is an "umbrella" term including a wide range of processes, applications and technologies through which various data sources can be gathered, stored, accessed, and analysed in order to gain meaningful information crucial for decision-making (Olszak, 2016). The term, although growing in popularity recently, was first introduced more than seven decades ago to describe "*an intelligence system utilising data-processing machines for auto-abstracting, auto-encoding and profiling of action points in an organisation*" (Luhn, 1958).

However, only recently it turned to a prevailing field for academics and practitioners and a leading commercial concern for most business organisations. According to Chen et al. (2012), there are several reasons explaining this incremented popularity. On the one hand, there is a great opportunity from the rapid expansion of readily available web data sources and on the other, BI tools are becoming more sophisticated, easier to use and find applications in many business processes. Meanwhile, intensive competition and global economic pressures set the success barrier too high, leading companies to a continuous fight for improvement, better quality of service (QoS) and more productive operations.

Chaudhuri et al. (2011) underline the declining cost of data storage and acquisition as an additional reason for the extensive proliferation of BI systems. The same applies to hardware, which is becoming more technologically advanced and less expensive, allowing for more powerful architecture of data warehouses.

The implementation of BI provides modern organisations, even SMEs (Ponis et al., 2013), with the ability to achieve timely and quality decision-making, which constitutes a crucial prerequisite to build a stable competitive advantage. Upon the effective aggregation of "intelligent" data regarding the internal and external business environment, executives are able to take proactive actions preparing their firms for future economic trends and conditions. According to Ranjan (2009), BI is like a "crystal ball" in the hands of managers, revealing the best course of action depending on five major parameters: the company's position in relation to its rivals; the overall strengths and weaknesses of the company; current and future market demographic and economic trends; social, political and regulatory environment; competitions'

decisions and strategy and finally, customer preferences and purchasing patterns.

Beyond any shadow of doubt, the business landscape in the era of a fast paced and intensively competitive environment is dominated by the struggle to proactively respond to changes, satisfy the increasingly demanding customer needs and timely decision making on the best courses to action. BI and sophisticated analytics provide contemporary enterprises with the tools, methods and corporate mentality required to survive the hard business arena and maintain profitable relationships with the whole value chain surrounding their activities.

The concept of participation, on which Web 2.0 is based, has also great economic implications and opens up significant new potentials for enterprises (Tziralis et al., 2009). In this very demanding and fiercely competitive environment, businesses have found a powerful ally in the face of social media applications and their fast-paced advancement and prevalence in the business and internet ecosystem. Social media are online platforms through which users can communicate, share content and connect with each other. Since their first appearance in the early 2000s, social media are constantly increasing in numbers, types and popularity. According to the academic literature, social media constitute a reasonable aftereffect of Web 2.0, an argument that is summarised in Kaplan and Haenlein's (2010) definition: "Social media is a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, which allows the creation and exchange of user-generated content". However, what clearly distinguishes social media from other Web 2.0 applications is the element of social connectivity on a personal level. Within such sites, users pre-select their connections and own privacy control over the content they share (Heijnen et al., 2013).

When it comes to classification, there is no systematic way in which social media can be categorised. Indicatively, Diamantopoulou et al. (2010), propose a rational social media segmentation based on their major activity (i.e. communication, collaboration, share, rate and opinions' expression) and purpose of use (leisure, work/business, democratic engagement). Kaplan and Haenlein (2010), however, suggest a matrix categorisation consisting of two social media dimensions, namely; self-presentation/ self-disclosure and social presence/media richness.

The outburst of social media and their increasing popularity has led to an era of fast and immense internet data generation. Consequently, the notion of social media analytics and its utilisation in BI systems has become a dominant trend in the entrepreneurial world, due to its huge potential in added-value applications (Fan et al., 2015). In the next sections an attempt to structure the current research domain on the intersection of these two disciplines is made, following a systematic literature review approach.

3. RESEARCH METHOD

According to Hart (1998) a literature review is an objective, thorough summary and critical analysis of the relevant available research literature on the topic being studied. A review of prior and relative literature of a scientific area is an essential feature of academic progress and theory development, since it creates a solid foundation for understanding the current research status quo, while at the same time highlights underdeveloped or unexplored areas as candidates for future research. The literature review should contain processed information from all available sources, be unbiased to the highest possible extent, be free from jargon terminology and supported by a well-defined and consistent search and selection strategy (Hart, 1998).

This review examines literature contributions directly addressing SBI, i.e. the use of social media for BI purposes between 2006 and 2016. Expanding the search before 2006 was deemed unproductive since the advent of social media in its current form is connected with the launch of Facebook in 2004. Previous efforts, like Friendster and MySpace, are not taken into consideration in this study, since they never managed to establish their social media presence and were either defunct (Friendster) or forced to pivot their offerings (MySpace).

In this paper, we utilize a systematic literature review (SLR) approach, which is a trustworthy, rigorous and auditable methodology for evaluating and interpreting all available research relevant to a particular research question, topic, area or phenomenon of interest (Keele, 2007). The selection process was straightforward. Initially, it was decided that the SCOPUS academic database was adequate in order to provide this study with a representative list of relevant contributions, within the context of this paper. Second, the

list of keywords was kept to a representative minimum by using the strings: “social business intelligence”, “social media AND business intelligence”. The keywords were applied to the title, abstract and keywords sections of scrutinized publications included in the SCOPUS database. The search includes publications in scientific journals, peer-reviewed conference proceedings and book chapters. The research focus of our approach led us to the decision to eliminate books and editorial reviews. We decided not to exclude publications in peer-reviewed conference proceedings, since SBI is a rather new and emerging scientific area and will be populated by more than a few first stage publications in the conference dissemination channel. Other types of publications such as notes and short surveys, are also excluded from the study.

The keyword search described above returned 131 papers published from 2006 to

2016, as shown in Table 1 and Table 2 below. These initial results show that contributions using SBI as a term are scarce (14) implying that, indeed, SBI is a scientific area in its infancy.

The collected papers were studied thoroughly with the objective to eliminate duplicates and then critically exclude the ones dealing with SBI issue superficially, fragmentally or not at all, in the case of the publications included in Table 3. Contributions that were included in the initial sample fulfilling the keyword string criteria but not directly dealing with the study subject were excluded from the database. Finally, a sum of 83 relevant papers was selected for in-depth, full-text examination with the objective to provide the reader with an overview of the main themes and trends covered by the relevant SBI literature.

Table 1 Search results for keyword string ‘social business intelligence’.

Source Type	Year of Publication										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<i>Journal Paper</i>										1	
<i>Conference Paper</i>							2	1	1	4	2
<i>Book Chapter</i>									1	2	
Sum = 14 papers							2	1	2	7	2

Table 2 Search results for keyword string “social media AND business intelligence”.

Source Type	Year of Publication										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<i>Journal Paper</i>				1	1	2	5	6	8	12	16
<i>Conference Paper</i>				1	2	5	8	8	11	13	11
<i>Book Chapter</i>							2	3	1		1
Sum = 117 papers				2	3	7	15	17	20	25	28

4. LITERATURE REVIEW

4.1 Descriptive Analysis

As stated in the previous section, the main body of literature identified comprises 83 papers. While 2006 is the first year of publication where contributions were sought, the first published papers found were from the year 2010, further validating the decision not

to extend the study period prior to 2006. The allocation of the publications within the researched period (2006-2016) is presented in Figure 1.

The allocation of papers in the three source types, i.e. journal papers, papers in conference proceedings and book chapters, is presented in Figure 2. It is noted that contrary to what was expected there seems to be an even distribution between journal papers (44.6%) and conference

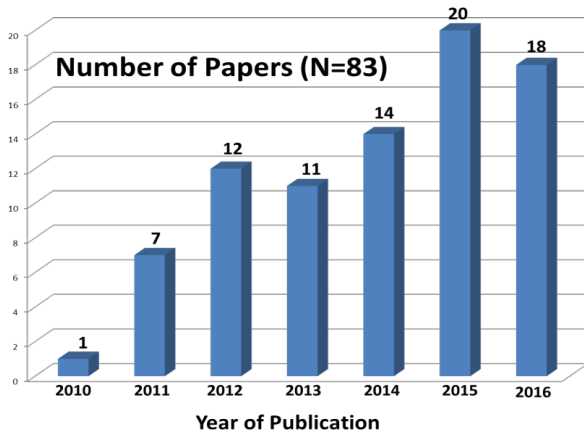


Figure 2 Distribution of publications per year across the study period.

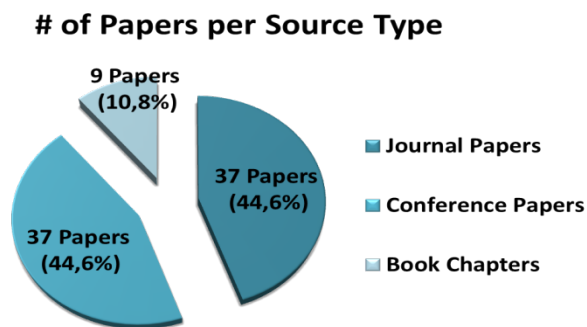


Figure 1 Allocation of publications in source types.

proceedings (44.6%), with book chapters corresponding to the smallest share (10.8%) of the work published on SBI between 2006 and 2016.

A closer look in the data set shows that a significant part of the publications (14 documents or 16.9%) originate from the Institute of Electrical and Electronics Engineer (IEEE) association (10 conference papers, 3 Journal papers and 1 book chapter). This is no surprise, since IEEE is a leading organization with a wide scientific area coverage including the technical background and information systems infrastructure necessary for SBI to be facilitated in companies and other organizations. In the same direction, Association for Computing Machinery (ACM) leads the item count when it comes to publications in peer reviewed scientific journals, with its cross-discipline journal entitled “ACM Transactions on Management Information Systems” leading the relative list with four publications. In Table 3, the number of papers per journal in the dataset is presented. The journals are presented in four categories depending on their main focus and thematic interest, i.e. information systems in management, information and computer

science, social networks and miscellaneous. It is interesting to note the absence of any special issues dedicated to SBI and the scarcity of papers’ appearance in more specific domains, such as social networks and journals.

4.2 Thematic Analysis

SBI, as evidenced from the descriptive statistics in the previous section, is a relatively new area, with the first publications referring explicitly to the term dating back to 2010. For those critically standing before the rapid emergence of the subject, SBI is nothing but the next logical step of BI evolution, providing enhanced collaborative capability in the decision-making process of an organization by adding the analytical capability pertaining to social media. For others, SBI is a BI paradigm revolution, especially when combined with the emergence of Big Data and the ever increasing variety, volume and velocity with which they arrive in front of business systems’ queues for further processing in order to effectively support decision making. Needless to say that this duality of perspectives, coupled with the initial triggering of the term from the IT business area, has led to a plurality of terms describing SBI, still serving different business needs or marketing of IT products, thus creating confusion and reduced clarity on its definition. On the academic front, Dinter & Lorenz (2012), who according to our knowledge provide the single academic reference attempting to develop a framework of research in the SBI area, along the same lines as this paper, argue that lack of definition clarity for SBI might lie in the ongoing use of diverse related terms, coming mostly from industry literature freely accessible on the web. Zeng et al. (2010) provide one of the few available definitions of the term as a set of tools and techniques that “*derive actionable information from social media in context rich application settings, in order to develop corresponding decision-making frameworks and provide architectural designs and solution frameworks for existing and new business applications*”. In this paper, the term SBI is explored in literature and used as the term of focus for the following study.

In that direction, thematic analysis of available literature in the SBI research field is organized into the four following distinct sections: the use of social media data in BI systems, SBI tools and techniques, BI applications in prevalent social media and finally, industry-specific SBI applications.

Table 3 Number of papers per scientific peer-reviewed journal.

Journal Title	# of Publications	Main Thematic Focus
ACM Transactions on Management Information Systems	4	Information Systems in Management
Decision Support Systems	1	
Journal of Enterprise Information Management	1	
Journal of the University of Pardubice	1	
Management Decision	1	
Production and Operations Management	1	
Technology Analysis & Strategic Management	1	
Journal of Decision Systems	1	
Journal of Destination Marketing & Management	1	
International Journal of Services Technology and Management	1	
Intelligent Systems in Accounting, Finance and Management	1	
Procedia Manufacturing	1	
	15	
Information Systems	1	Information & Computer Science
International Journal of Computer Technology and Applications	1	
Information Systems Frontiers	1	
Frontiers in Artificial Intelligence and Applications	1	
IEEE Computer Graphics and Applications	1	
IEEE Transactions on Knowledge and Data Engineering	1	
International Journal of Engineering & Technology	1	
IEEE Transactions on Visualization and Computer Graphics	1	
KSII Transactions on Internet and Information Systems	1	
Knowledge and Information Systems	1	
Scandinavian Journal of Information Systems	1	
Knowledge-Based Systems	1	
Mobile Networks and Applications	1	
Sensors	1	
Information Visualization	1	
Journal of Computer Information Systems	1	
Procedia Computer Science	1	
	17	
Journal of Internet Social Networking & Virtual Communities	1	Social Networks
International Journal of Sociotechnology and Knowledge Development	1	
Social Network Analysis and Mining	1	
	3	
The Decision Sciences Journal of Innovative Education	1	Miscellaneous
The Scientific World Journal	1	
	2	

4.2.1 The use of social media data in BI systems

Meredith and O'Donnell (2010; 2011) and Sathyanarayana et al. (2012) were among the first to detect the value of social networks in BI

systems, beyond sales and marketing applications. They developed a framework to classify the social media functions that foster the Web 2.0 core concepts of user collaboration and contribution, and used it in order to exploit how it can “*create more effective and ‘active’ BI applications*”. Shroff et al. (2011) introduced

the term “*Enterprise Information Fusion*” to describe an emerging BI need across multiple industries, such as manufacturing, insurance and retail. The term includes the publicly available data, derived from social media, that can potentially be of immense business value for the enterprise ecosystem. On the same account, Ruhi (2014) attempted to outline the undeniable value of social media analytics, incorporated in a BI perspective. As he explains, the advantage of social media analytics in the business environment is twofold, as it can help organisations “*formulate and implement measurement techniques for deriving insights from social media interactions*” and, alongside “*evaluate the success of their own social media initiatives*”. Wongthongtham and Abu-Salin (2015) emphasise the need of evaluation of traditional BI warehouses, which are more focused on handling structured internal enterprise data, in order to support the tremendous volume of valuable, yet unstructured, social media information, such as customer reviews and brand-related posts. Finally, Ram et al. (2016) conducted a survey in IT consultants and managers in various industry sectors of China, in order to prove the paradigm shift that social media have dictated in business strategies globally. With a semi-structured questionnaire, they managed to identify the critical issues in creating value through Big Data and social media analytics for BI systems.

Alongside the prevalence of social media in BI applications, several traditional business terms were redefined in academic literature in order to incorporate the new social trends, i.e. social customer relationship management (SCRM), digital marketing (Luo et al., 2015), voice of customer (VoC) and voice of market (VoM). Bachmann and Kantorova (2016) separate the original concept of CRM “*based rather on face-to-face and offline communication in the physical environment*”, from social CRM which is mainly conducted “*through social networks and relationships within online communities*”. Beverungen et al. (2014) argue that the global penetration of social networks constitutes a fertile ground for novel CRM strategies (Rosemann et al., 2012). After introducing the social CRM emerging field of research, the authors propose a framework to exploit Facebook data in CRM strategies and testify its applicability by building management reports for the retail industry. Berlanga et al. (2014, 2016) use advances in opinion mining techniques and

sentiment analysis to describe the new opportunities arising in the VoM and VoC concepts in BI applications. As they explain, organisations can take advantage of the wealth of sentiment data in massive social media (e.g., social networks, product review blogs, forums) to ‘listen’ to their customers’ needs and extract valuable business insights. In the same context, Lotfy et al. (2016) propose a framework to integrate customer opinion streams extracted from social media, with pre-existing corporate data, so as to constitute an integrated data warehouse. According to them, such a multidimensional data base “*can perform advanced analytical tasks and lead to better insights that would not have been possible to gain without this integration*”.

Chan et al. (2015) deliberately examine the challenges faced by contemporary BI systems, associated with user-generated content (UGC) derived from social media communication channels. According to them, the available social data is not fully exploited for three main reasons: its unstructured format, its subjective nature and tremendous volume. On that account, they propose a systematic approach to social media data analysis, which counterbalances the aforementioned challenges and captures the real value of online social content for BI applications. Likewise, Tayouri (2015) also draws attention to risks associated with social media in the corporate environment, highlighting cyber security issues, such as fraud through social media activities, leakage of sensitive business information and damages to a firm’s reputation. Hence, he suggests a consistent cyber security training framework supported by social media site monitoring tools, able to assist companies in building a robust SBI strategy by keeping track of correlated malicious activities and threats.

4.2.2 SBI Tools and Techniques

SBI tools and techniques is a predominant research field in academic literature. Data visualization tools; online analytical processing (OLAP); UGC and natural language processing (NLP) techniques; sentiment and opinion mining in the social media context; and user profiling and personalized marketing tools are some of the core thematic areas associated with contemporary SBI practices.

4.3 Visual Analytics

Zimmerman et al. (2015), Zimmerman & Vatrappu (2015) and Sigman et al., (2016)

highlight the importance of visual analytics (VA) toolkits in assisting the interpretation of the unstructured data derived from social media into meaningful business or educational insights. Their research project provides a series of visual dashboards able to comprehensively project the analytics related to a brand and its marketing campaigns outcomes. The technical architecture and the specific characteristics of this set of dashboards is further explained and defined in ‘*Social Newsroom*’, a prototype VA tool for SBI, which was developed to “*provide practitioners with user interfaces that can assist them in interpreting social media data and taking decisive actions*” (Zimmerman et al., 2015). Lu et al. (2014) proposed a VA toolkit able to handle “*noisy, unstructured data and use it for trend analysis and prediction*” in sales forecasting and advertisement analysis. Their data visualization tool was successfully applied in Twitter users, in order to predict movie revenue and ratings. Moreover, Pu et al. (2016) focused on the valuable geo-location data available in social media applications by introducing the ‘*Social Check-in Fingerprinting (Sci-Fin)*’ tool which offers organisations “*the opportunity to capture and analyze users’ spatial and temporal behaviors*” through social network check-in data. Respectively, Wen et al. (2016) suggested an alternative VA system, called ‘*SocialRadius*’ that can interactively explore spatio-temporal features and check-in activities, in a variety of applications, ranging from BI applications to transportation and information recommendation systems. Meanwhile, Kucher et al. (2014; 2016) presented a VA tool for social media textual data that “*can be used to investigate stance phenomena and to refine the so-called stance markers collection*” with respect to sentiment and certainty. Lastly, Wu et al. (2014) introduced ‘*OpinionFlow*’ a VA system detecting opinion propagation patterns and providing gleaned insights in government and BI applications.

4.4 OLAP techniques, UGC and NLP tools

Gallinucci et al. (2013; 2015) defined SBI as the “*discipline of combining corporate data with user-generated content (UGC) to let decision-makers improve their business, based on the trends perceived from the environment*”. In order to enable contextual topics extraction and aggregation at different levels, they introduced ‘*Meta-Stars*’, a model based on UGC

and real-time OLAP techniques. Golfarelli (2014) demonstrated an empirical application of a prototype demo of the model in real-world marketing campaigns, in order to prove its technical robustness and methodology. He furthermore presented the available OLAP solutions, for UGC analysis, that enable decision-makers analyze their business environment based on trends perceived from social media. Lin and Goh (2011) proposed a least-square (LS) algorithm to model sales performance and business value derived from social network data, by emphasizing the role of social marketer-generated content in influencing UGC sentiment and attitude. The authors actually suggest that there is a positive relationship between “*the richness of information embedded in both user-and marketer-generated content and firm sales performance*”. Finally, Ferrara et al. (2014) provide a classification of the available UGC extraction tools in two main categories, namely the enterprise and social web data extraction (WDE) tools, through a structured literature review. In a natural language processing (NLP) context, Dey et al. (2011) discuss a series of methodologies that can be followed in order to “*obtain competitive intelligence from different types of web resources, including social media, using a wide array of text mining techniques*”. As they explain, social media do not only provide valuable competition insights but also constitute an open forum where customers express their opinions about different brands’ offerings. Sleem-Amer et al. (2012) introduce ‘*DoXa*’, a semantic search engine for the French language, with NLP capabilities and social BI application. Centering their work on two separate business cases, the authors explain how ‘*DoXa*’ can be applied to discover “*hidden patterns in social media data, using rich linguistic resources*”. Lastly, Bjurström and Plachkinova (2015) propose a controlled natural language that does not require advanced technical skills and can be directly compiled into executable code, for automated social media data extraction.

4.5 Sentiment Analysis and Opinion Mining

Sentiment Analysis and Opinion Mining techniques are two research areas that attracted the academic interest from the early stages of introduction of social media as a powerful leverage for BI systems. Upon the rise of Web 2.0 and the increasing popularity of social network sites (SNS), Castellanos et al.

(2011), in collaboration with HP and its BI software solutions, introduced ‘*LCP*’, a prototype sentiment analysis platform able to extract sentiment from textual data in real-time. The platform’s interface consisted of multiple chart and visualization options that dynamically changed as soon as new data was ingested, exploiting state-of-the art sentiment analysis algorithms. A year later, Yang and Shih (2012) proposed a rule-based sentiment analysis (R-SA) technique “*to automatically discover interesting and effective rules capable of extracting product features or opinion sentences for a specific product feature*”. That way, they offered a means of effective and real-time analysis of the tremendous volume of data, hidden in social media applications, regarding customer reviews about business offerings. In the same direction, Liu and Yang (2012) developed a buyer behavior prediction technique, using dynamic social network analysis and behavior pattern mining algorithms on e-commerce purchases and viral marketing applications. Qazi et al. (2014) focused on the suggestive type of customer reviews, found on online review forums, by combining machine learning techniques and sentiment analysis. Their findings suggested that sentiment analysis “*achieves maximum performance when employing additional preprocessing in the form of negation handling and target masking, combined with sentiment lexicons*”. Later, Colombo et al. (2015) compared two novel methodologies for sentiment analysis with cross-industry application, by using secondary unstructured textual data from Twitter, Yelp and Cars.com, while Kim and Jeong (2015) applied their opinion mining methodology in online reviews about the oldest instant noodle snack in Korea. Finally, Nithya and Maheswari (2016) implemented a scoring system technique to identify the most promising features of a product offering, consisted of two rating attributes, namely the ‘*sentiment score*’ and the ‘*feature score*’. Their technique provides managers with valuable insights regarding future demand, brand promotion and product penetration.

4.6 User Profiling and Personalized marketing tools

SBI tools and techniques for customer-centric marketing applications constitute another popular research field in academic circles. Personalized advertising messages, based on intelligent user profiling, is top priority for the

contemporary business world, striving to survive in a highly competitive and globalized environment. Ranjan et al. (2014), using an association rules mining (ARM) algorithm, exploit social media data to locate tie-strength networks and active friends, in order to be used as a basis for targeted and relevant advertising campaigns. Yang and Chen (2014) introduce a novel profile expansion mechanism which enhances the effectiveness of personalized recommendation systems in social bookmarking sites to assist companies in developing “*effective service offerings that are better tailored to their customers’ needs*” (Gronroos, 2008). In a more targeted approach about accurate profiling of social media users, Liu et al. (2014; 2015) develop ‘*HYDRA*’, a solution framework to identify linkages across multiple social networks and discover correlations between different user profiles. The authors argue that ‘*HYDRA*’ can be a profitable addition to existing BI solutions, as it was successfully implemented in a ten-million data base and correctly identified real user linkage, across seven dominant social network platforms, outperforming “*existing state-of-the art algorithms by at least 20% under different settings*”. Finally, Yang and Chang (2015) highlight the knowledge gained from social tagging system (also known as folksonomy) as an invaluable asset for enhancement and upgrade of existing BI applications. On that account they employ Delicious, an established social bookmarking service, to construct “*a statistical-based thesaurus, which is then applied to support personalized document clustering*”. Their empirical study indicated that such services improve the overall quality of SBI systems, and promote their efficiency in handling targeted marketing applications.

4.6.1 BI applications in prevalent social media

A fairly important percentage of existing academic literature on BI focuses on specific social media use-cases and their potential applicability on corresponding systems. Tools and techniques able to extract value added data from popular social network platforms, such as Twitter and Facebook blogs or websites containing customer review content, are among the most preferable research subjects.

4.7 Twitter

Rui and Whinston (2011) argue that Twitter hides a huge business potential as a base

platform for BI applications, given its valuable structural information and the tremendous volume of data flows that are produced by its users in real-time. Within this context, they introduced a Twitter-based BI system for revenue forecasting, which was successfully implemented in movie box office revenue prediction, achieving remarkable results. Seebach et al. (2012) focused on the corporate reputation management area and how firms can use social media intelligence in order to handle reputation threats timely and effectively. By using sentiment and manual content analysis techniques on Twitter, regarding posts about a large American bank, they showed *“how social media might impact corporate reputation and what organizations can do to prepare themselves”*. Lee et al. (2013) used Twitter as a real-time event detection system for crisis management and BI applications. Their proposed framework is able to detect emerging events from social network streams and *“accurately extract ontology entities associated with specific events for decision supporting applications”*. O’Leary (2015) highlights ‘Twitter Mining’ as an invaluable asset for the majority of Fortune 100 companies. In his paper he reviews some of the most prevailing BI applications of Twitter data extraction on a prediction, discovery and informative basis. In the same year, Arora et al. (2015) applied sentiment analysis tools in order to investigate whether tweets provide a sufficient ground to gain useful insights on competitive brands, using the smart-phone industry. Their results showed that although Twitter data is rich regarding customer sentiments, the exposure of different brands varies significantly making their comparison a rather ambiguous task. In a similar approach, Chilhare et al (2016) designed a marketing-driven competition analysis tool to *“recognize specific areas in which businesses are leading and lagging”*. In their paper, they propose a methodology combining NLP techniques and sentiment benchmarks, in order to analyze and structure multilingual Twitter data for competitive FMCG companies into meaningful business insights. Sijsma et al. (2016) introduced ‘*Tweet-viz*’, an interactive tool to assist companies in actionable information extraction from unstructured textual Twitter data. In their paper, they prove that Twitter can provide BI systems, customer preferences, demographics and location data. Completing the Twitter BI academic cycle, Piccialli and Jung (2016) summarize the business-

generated tweet content in three categories; namely informative, advertising or a hybrid of the two. According to their estimations, the hybrid approach increases customer engagement and promotes UGC activity with brand related content.

4.8 Facebook

According to scholars, Facebook, apart from being the most dominant social network on a global basis, contains such a high volume of UGC data that it could also turn to an alternative customer relationship management (CRM) platform, replacing traditional in-house corporate software. Bygstad and Presthus (2013), conducting a case study on two Scandinavian airlines' pages on Facebook during the ash crisis in April 2010, showed that CRM through the platform proved more effective in terms of dynamic interaction and customer engagement. Milolidakis et al. (2014), aiming to provide a generic framework for social media data extraction and transformation into meaningful business insights, used Facebook fan pages of three Greek communication service providers as their case study. According to their findings, Facebook includes data capturing of all the standard BI indicators, and moreover provides additional user sentiment information through artifacts features, such as the “like” button, that can turn to intelligent business statistics through visual excavation tools.

4.9 Blogs and Micro-Blogs

Banerjee and Agarwal (2012) used a nature-inspired theory to model collective user behavior from blog-originated data in order to explore its application on BI systems. Based on swarm intelligence, *“where the goal is to accurately model and predict the future behavior of a large population after observing their interactions during a training phase”*, they concluded in promising results about blog value in trend prediction applications. Meanwhile, Kulkarni et al. (2013) draw attention on the importance of social media brand propagation enablers. On that basis, they study the degree of customer engagement through blog contents and the corresponding analytics for BI systems. Obradović et al. (2013), in the context of the ‘*Social Media Miner*’ project combined textual analysis methods with a blog processing technique to *“aggregate blog articles of a specific domain from multiple search services, analyze the social*

authorities of articles and blogs and monitor the attention they receive over time", in order to provide a highly automated BI tool. Lastly, Jingjing et al. (2013), using as a reference the Chinese micro-blogging platform 'Sina Weibo', conduct a social influence analysis to discover *"information retrieval, recommendations and businesses intelligence opportunities"*. According to their findings, their proposed framework can overcome difficulties related to volume and complexity found on micro-blogging platforms and can find numerous applications in BI systems.

4.10 Amazon.com

Social media, based on principles and technologies deriving from the user-centered Web 2.0, constitute by definition an open platform where users can express their sentiments, share their knowledge and build a social environment. Within this context, consumers exchange their opinions towards different brands, share their experiences through word-of-mouth (WOM) and provide their own reviews. The importance of social activity related to brand offerings and the added-value of publicly available customer reviews has naturally attracted the interest of the business and academic world. Zhang and Chen (2012) studied the business impact of social media and UGC in sales and marketing, by applying text mining techniques and a set of innovative metrics focusing on customer reviews on two popular e-commerce websites, namely BN.com (Barnes&Noble) and Amazon.com. According to their findings, user-generated reviews have serious effects on product sales and should be consistently processed by BI systems, through carefully selected measures. Similarly, Ngo-Ye and Sinha (2012) argue that customer-generated reviews in e-marketplaces *"are playing an increasingly important role in disseminating information, facilitating trust, and promoting commerce"*. On that account, they developed an Amazon.com based tool to automatically identify the most important reviews and provide meaningful customer feedback. Finally, Zhang et al. (2013) in an attempt to further explain how WOM is affecting product sales, they combined network analysis with textual sentiment mining techniques to build product-comparison networks consisted of customer reviews. Their empirical study on Amazon.com suggests that it is imperative for firms to understand and manipulate the WOM process taking place in social media, in order to

survive in the increasingly competitive online landscape.

4.10.1 Industry-specific SBI applications

The integration of social media analytics in BI systems is a need soon realized both by organisations and academia. SBI tools and techniques are not limited in a specific area but have rather a cross-industry application, a fact that is clearly reflected in the existing literature. Heijnen et al. (2013) argue that the potential of social medial data is invaluable for multiple facets of BI systems, yet it is *"largely unused by companies, and it remains unclear what data can be useful for which industry sectors"*. Their findings indicate that key performance indicators typically differ between industry sectors and therefore SBI metrics should accordingly adapt to their corresponding needs. The need to approach the matter from industry-specific perspectives led to a series of academic publications focusing on distinct sectors: education, automotive, pharmaceutical, cosmetics, tourism, fashion, government and politics.

4.11 Education

Moedeen and Jeerooburkhan (2016) focus on the higher education sector to explore how *"social media strategies can be aligned with business strategies to help universities gain a competitive edge"*. Using the Facebook page of a university as their case study, they argue that higher education organizations pay attention solely to advertising and reputation management aspects, while neglecting other business objectives that could be met through a holistic SBI application.

4.12 Government and Politics

Bendler et al. (2014) associate static environmental characteristics with dynamic user-generated content from social media to explain and predict criminal activity in metropolitan areas. By combining traditional statistics, such as zero-inflated Poisson regression and geographically weighted regression with social media data, they provide a framework that enhances the accuracy of criminal activity forecasting. Meanwhile, Chung et al. (2014) developed an approach to pinpoint opinion leaders in social networking sites that could be approached by policy makers to collaborate and *"bring about change in the communities and the general public welfare"*. In a more generic approach, Golfarelli

(2014; 2015) studies SBI options in politics. According to him, processing of user-generated content through a robust SBI system could prove invaluable for political entities in order to align their governmental decisions with environmental trends and public opinion. Finally, Beigi et al. (2016) explore crisis and disaster management through sentiment analysis and social media visual analytics. According to them, individual posts in social media about natural disasters and emergencies can be used as inputs in governmental SBI systems *“to improve situational awareness and crisis management (...) while assisting in locating people who are in specific need during emergency situations”*.

4.13 Automotive

Abrahams et al. (2012) introduce a decision support technique for vehicle quality management designed to identify and prioritise automotive defects, deriving from reviews in vehicle enthusiasts' online forums. They suggest that conventional sentiment analysis does not suffice to efficiently detect customer complaints and therefore, BI systems should incorporate advanced text mining algorithms specifically designed for social media applications. Baur et al. (2015) also focus on the vehicle industry by exploring Chinese auto forums as a new proactive means of market research. According to them, although the increasing popularity of social media offers a fertile ground for novel marketing techniques, there is a number of arising challenges to be confronted, namely the tremendous volume of posts, their unstructured format and the wide range of user languages requiring complex natural language processing techniques. On that basis, they propose *'MarketMiner'* a novel framework for *“search, integration, and analysis of cross-language user-generated content”*, specifically designed for the competitive automotive sector. One year later, Baur (2016) examines alternative applications for *'MarketMiner'* in public administrative bodies and commercial firms. His results indicate that the tool can significantly improve the processing of multi-source and multi-language social media generated content and apply to cross-industry SBI systems.

4.14 Pharmaceutical

According to Basset et al. (2012) the social media sphere is a challenging environment for the pharmaceutical industry, as it is associated

with a number of ethical and legal issues imposed by governments globally. However, SBI systems can prove valuable to such an antagonistic sector mainly for marketing, customer relationship management and competition monitoring applications. Bell and Shirzad (2013a; 2013b) propose a social media data extraction model to assist pharmaceutical companies to effectively position themselves in new marketplaces. According to them, social media networks offer a channel of communication for business-to-business environments and can enable companies to connect with all the actors of their value chain (i.e. customers, partners and even competitors) on a real-time, global basis. Finally, He et al. (2016) using the three biggest drugstore chains in US as their case-study, suggest a model for competitive strategy formulation by applying quantitative analysis, sentiment analysis and text-mining techniques in social media UGC content. Their findings indicate that such tools can prove invaluable if adopted by existing BI systems.

4.15 Tourism

Online social networks, and Web 2.0 applications in general, are rapidly becoming a significant marketing channel for the tourist industry which is challenged by new and emerging business models utilizing social media and other crowd sourcing and shared economy applications, such as Airbnb. In this new and turbulent environment, social BI can be a source of critical competitive advantage in a very demanding and customer-service intensive industry such as tourism. In that direction, Palacios-Marqués et al. (2015) study the effect of online social networks on firm performance and explore ways of adding value to established market competences. The authors conduct a large survey in one of the world's largest tourist destination, Spain, with the participation of top managers from 197 four- and five-star hospitality firms. Their results show that social BI has a significant positive relationship with firm performance by enhancing market intelligence and knowledge management competences, thus leading to the acquisition of a significant advantage over the competition. Remaining in the same geographic territory but penetrating one layer deeper in the social BI area, Marine-Roig and Clave (2015) study the usefulness and applicability of big data analytics for the industry and specifically for a smart city tourist destination, Barcelona. The authors

study the online image of the city by analyzing more than a hundred thousand travel blogs and online travel reviews by people who have visited the destination in the last decade. By extracting BI through these large volumes of user generated content, the authors provide an efficient decision support tool for industry executives and city officials to develop and evaluate competition, marketing, branding and positioning strategies and policies, which will enhance the city's image as a smart tourist destination.

4.16 Fashion and Luxury

The fashion and luxury products industry has for many years resisted the adoption of the e-commerce channel, since they associated anything digital with malpractices such as discounting, counterfeiting and brand dilution. This is not the case anymore and currently emblematic brands, such as Ferragamo, have entered the e-market arena, which according to a report from McKinsey and Altagamma (2015) has reached €14 billion in 2014, a 50% increase from 2013. This change has created the need for managing user-generated content in order to better understand customer profiles, identify preferences and determine trends, with the latter playing a crucial role for product development of companies in the fashion industry. In that direction, Petychakis et al. (2016) turn their research focus on a very important aspect of social media analysis, which is the identification of opinion makers within the social media ecosystem, the monitoring of their behavior and the extraction of targeted campaigns utilizing their media presence. The authors present a platform providing marketers and product designers with data analytic services for influencer identification and trend analysis and evaluate it in a single case from the fashion industry. Fourati-Jamoussi (2015) explores the concept of e-reputation by applying BI practices to analyze the social media presence of four companies from the organic cosmetics industry. The author attempts to compare the reputation of the participating brands by using different monitoring tools, conducts user profiling for each brand and finally proposes recommendations for enhancing marketing strategies.

5. CONCLUSIONS

In this paper 83 papers, which were published in the period from 2006 to 2016 dealing with SBI concept, management, tools and

applications, were collected. The review of these papers and the analysis of their content, presented in the previous chapter, produced useful information, in order to synthesize a comprehensive research agenda for SBI including major directions and identified shortcomings that seem to shape the future of research in this area. The core focus of the research, as expected, seems to be the unearthing of the currently unused, to its full potential, value of SBI and put it to good use for the benefit of businesses and organizations around the globe. In that direction, academic literature in the novel research field of SBI is essentially developed around three main pillars of research orientation.

The first pillar attempts to provide answers to the question '*What is SBI and how can it help a business or organization*', putting SBI's business validation and real-life applications in the epicenter of research, thus given the title 'business descriptive'. Papers in this pillar are attempting to highlight the prevalent acceptance of social media as a source of business value and the parallel expanded usage of BI systems through social media data for multiple operations within companies, in a variety of industry-specific applications. In doing so, they provide mostly definitions, methods, models and frameworks, which support a wide range of corporate activities, spanning but not limited to strategic decision-making functions, business processes' optimization, operational efficiency improvement and revenue management. Within this pillar, one can identify two discrete waves of publications that can be organized together based on their focus and objectives.

The first identified wave of publications within the business descriptive pillar deals mostly with determining the current status quo of BI in contemporary organizations and provides means of expanding its reach through the exploitation of social media. The first step in this direction is the identification and validation of social media potential and functionalities to act as a consistent BI decision-making support tool through solid argumentation and empirical tools like surveying experts in interested business areas. At the same time, the second wave of publications attempts to deal with SBI by exploring the enhanced capabilities that it gives to traditional BI systems and how these can be rethought and restructured in order to be ready to absorb and process the abundance and large variety of data that social media

produce. What is interesting at this point is the determination of SBI usefulness and transformative impact on other established business functions such as marketing and customer relationship management (CRM). The introduction of novel marketing and CRM strategies such as social CRM, VoM and VoC as a result of information harnessed by SBI practices is explored in depth by many publications and specific algorithmic SBI techniques and tools, e.g. opinion mining, sentiment mining, are mentioned as playing a critical role for business success and competitive advantage. Finally, the main barriers/shortcomings identified in this pillar of literature are the following:

- Probably the most important issue identified is that of data security and privacy. There are major concerns for all levels of data usage, i.e. data creators (users), data suppliers (e.g. Facebook or Telco companies) and businesses in need of the data. What makes the situation even more complicated is the fragmentation of legislation between continents and nations, which make compliance a cumbersome and sensitive task, especially in the case of companies operating at a global level.
- The second most important issue identified in this pillar of literature is data governance by businesses. In other words, the ability of companies to streamline their processes and systems in order to provide more accurate information, achieve increased visibility and in essence better analytics. There seems to be a consensus that much more is needed to be accomplished in this area.
- Finally, the third prominent issue identified in this pillar is process governance. The huge impact of social media data on current established business processes and its transformative effect on every-day operations, coupled with the need for the use of more advanced analytical systems, creates the need for research on business process management and reevaluation of traditional processes and their efficient transformation.

The second pillar attempts to reveal ‘under the hood’ knowledge and answer the question “*How does SBI work?*”. It sets technical implementation in the epicenter of research,

thus this pillar is given the title, ‘technical descriptive’. Papers in this pillar provide mostly technical information on algorithms, techniques and tools that are used in order for SBI to process social media data and produce meaningful information to be used directly or passed for further processing by traditional BI systems. The prevalent techniques, which seem to dominate the research interest in this pillar are those dealing with three major issues of SBI at the technical level: user profiling, user (customer) voice translation into actionable information and data visualization. The main shortcomings identified in this pillar of literature are the following:

- There is an increased demand for new AI algorithms for the automation of the user generated content extraction and translation procedure. Current algorithmic efforts in research are many. Still their validation in actual commercial environments does not commensurate with the materialized research. The need for a switch towards an AI based, data-scientist agnostic SBI process is evident in the literature.
- User profiling and the underlying targeted marketing and personalized recommender systems are very important issues in the SBI literature especially for companies that are forced to enter the paid advertising arena by increased competition and the need to sustain profitability. Although profiling models and algorithms present a rapid increase in numbers and variety of approaches there are still several unexplored areas in profiling that need intensified research and investments.
- Data visualization has seen many advances in the last few years with the emergence of the dashboard logic in data presentation and display. Although there is a fair number of social media tools already providing services like data collection, aggregation and analysis into key performance indicators, there is still a deficiency in visualizations, especially when it comes to standards and design principles, thus making the support from data scientists and supplementary systems mandatory.

Finally, the third trend attempts to answer the question “*Does SBI work in real life?*” Real-

life cases of SBI applications in practice are the focus of research in this pillar, which thus is given the title “case descriptive”. Two discrete waves of publications can be identified. The first focuses on industry-specific applications and describes how SBI can provide valuable services for businesses operating in these industries. In doing so, papers in this pillar explore successful applications of SBI in real business cases, highlighting the cross-industrial nature of SBI and its potential impact for a variety of industries and governmental organizations. Specifically, they provide focus on the impact of SBI in traditional business models and processes and its operational fit in order to support industry-particular requirements. The second wave of publications includes papers focusing on specific social media use-cases, with Twitter and Facebook being the platforms most widely used as data providers and application test beds. Tools and techniques able to extract value added data from popular social network platforms, blogs or websites containing customer review content, are among the most preferable research subjects. The main shortcomings identified in this pillar of literature are the following:

- Utilizing SBI to support real-life cases is a cumbersome task demanding a holistic approach, including technological and organizational aspects, leading to a complex transition requiring high executive competences supported by a global strategy. This is not the case dealt within the publications studied in this pillar. Empirical evidence provided is rather fragmented and cases seem isolated from the business ‘big picture’, while

connection with ‘bottom line’ metrics is loose.

- There is a, to some point justifiable, strong focus of SBI research on social networking giants, like Facebook and Twitter. Still, there is an abundance of social networking sites and other emerging social media business models like Snapchat, Vine and Reddit for example, for which the possibility of more open data extraction and enhanced algorithmic testing could take place, that are currently not sufficiently explored.

At this point, a research agenda can be formed including eight discrete research directions, each one dealing with the shortcomings identified in literature and discussed previously in this section. In Table 4, a summary of the literature review’s main findings is presented. The three main pillars’ research offerings are shortly described and specific publications are assigned to each one of the pillars in accordance with their number in the reference list at the end of this assignment. The eight research directions comprising the future research agenda for SBI are categorized per pillar and presented in Table 4.

Finally, it has to be noted that adoption of this paper’s findings should take into account the inherent limitations of this study, which are:

- The big difference between current and published capabilities of academia, especially coupled with the fast pace of the SBI scientific field. The author is certain that several research efforts providing innovative approaches and empirical use

Table 4 SBI future research directions.

	TITLE (MAIN RESEARCH OFFERINGS)	RESEARCH DIRECTIONS		
FIRST PILLAR	Business Descriptive (Definitions, Methods, Models & Frameworks)	RD1: Data Security & Privacy	RD2: Data Governance	RD3: Process Governance
SECOND PILLAR	Technical Descriptive (Algorithms, Techniques and Tools)	RD4: Improvement / Development of new AI Algorithms - SBI Process Automation	RD5: User Profiling	RD6: Data Visualization
THIRD PILLAR	Case Descriptive (Empirical Evidence / Industry Focus & Social media Focus)	RD7: Holistic SBI Approaches - Enhanced Validation	RD8: Extend Research Coverage in Social Media	

cases highlighting novel applications of techniques do exist, that are either in development or already finished but yet unpublished. Unfortunately, the academic publishing pipeline has a lead time of six to eighteen months in some cases and work in progress papers are relatively low in numbers, thus creating problems to researchers who conduct a literature review.

- Furthermore, significant research on SBI is done by or on behalf of big players in this area, such as social media platforms, big advertising companies and global brands. These studies are based on home-grown methodologies, use proprietary tools and perhaps focal datasets and thus never made public, making the task of the researcher who conducts the review even more difficult.
- Finally, the reader, before adopting the results of this study, has to consider its methodological limitations, related to the selection of the academic library, i.e. Elsevier's SCOPUS, the inclusion of specific source types, i.e. peer reviewed journal papers, conference proceedings and book chapters and finally the selection of the search keywords for conducting the review.

6. REFERENCES

- Abrahams, A.S., Jiao, J., Wang, G.A. and Fan, W. 2012. Vehicle defect discovery from social media. *Decision Support Systems*, 54(1), 87-97.
- Arora, D., Li, K.F. and Neville, S.W. 2015. Consumers' sentiment analysis of popular phone brands and operating system preference using Twitter data: A feasibility study. In: *Proceedings of Advanced Information Networking and Applications (AINA) IEEE 29th International Conference*, pp. 680-686.
- Bachmann, P. and Kantorová, K. 2016. From customer orientation to social CRM. New insights from Central Europe. *Scientific papers of the University of Pardubice*, Series D, Faculty of Economics and Administration, 36/2016.
- Banerjee, S. and Agarwal, N. 2012. Analyzing collective behavior from blogs using swarm intelligence. *Knowledge and Information Systems*, 33(3), 523-547.
- Basset, H., Stuart, D. and Silbe, D. 2012. *From Science 2.0 to Pharma 3.0 Semantic Search and Social Media in the Pharmaceutical Industry and Stm Publishing*. A volume in Chandos Publishing Social Media Series.
- Baur, A., Lipenkova, J., Bühler, J. and Bick, M. 2015. *A Novel Design Science Approach for Integrating Chinese User-Generated Content in Non-Chinese Market Intelligence*.
- Baur, A.W. (2016). Harnessing the social web to enhance insights into people's opinions in business, government and public administration. *Information Systems Frontiers*, pp.1-21.
- Beigi, G., Hu, X., Maciejewski, R. and Liu, H. 2016. An overview of sentiment analysis in social media and its applications in disaster relief. *Sentiment Analysis and Ontology Engineering*, pp. 313-340, Springer International Publishing.
- Bell, D. and Shirzad, S. R. 2013. Social media business intelligence: A pharmaceutical domain analysis study. *International Journal of Sociotechnology and Knowledge Development (IJSKD)*, 5(3), pp. 51-73.
- Bell, D. and Shirzad, S.R. 2013. Social Media Domain Analysis (SoMeDoA)-A Pharmaceutical Study. *WEBIST*, pp. 561-570.
- Bendler, J., Ratku, A. and Neumann, D. 2014. Crime mapping through geo-spatial social media activity. In: *Proceedings of 35th International Conference on Information Systems*, Auckland 2014.
- Berlanga, R., Aramburu, M.J., Llidó, D.M. and García-Moya, L. 2014. Towards a semantic data infrastructure for social business intelligence. *New Trends in Databases and Information Systems*, pp. 319-327, Springer International Publishing.
- Berlanga, R., García-Moya, L., Nebot, V., Aramburu, M.J., Sanz, I. and Llidó, D.M. 2016. Slod-bi: An open data infrastructure for enabling social business intelligence. *Big Data: Concepts, Methodologies, Tools, and Applications*, pp. 1784-1813, IGI Global.
- Beverungen, D., Eggert, M., Voigt, M. and Rosemann, M. 2014. Augmenting Analytical CRM Strategies with Social BI. *Digital Arts and Entertainment: Concepts, Methodologies*,

- Tools, and Applications*, pp. 558-576, IGI Global.
- Bjurstrom, S. and Plachkinova, M. 2015. *Sentiment Analysis Methodology for Social Web Intelligence*.
- Bygstad, B. and Presthus, W. 2013. Social Media as CRM? How two airline companies used Facebook during the “Ash Crisis” in 2010. *Scandinavian Journal of Information Systems*, 25(1), 3.
- Castellanos, M., Dayal, U., Hsu, M., Ghosh, R., Dekhil, M., Lu, Y., ... & Schreiman, M. 2011. LCI: a social channel analysis platform for live customer intelligence. In *Proceedings of the 2011 ACM SIGMOD International Conference on Management of data* (pp. 1049-1058). ACM.
- Chan, H.K., Wang, X., Lacka, E. and Zhang, M. 2015. A Mixed-Method Approach to Extracting the Value of Social Media Data. *Production and Operations Management*.
- Chaudhuri, S., Dayal, U. and Narasayya, V. 2011. An overview of business intelligence technology. *Communications of the ACM*, 54(8), 88-98.
- Chen, H., Chiang, R.H. and Storey, V.C. 2012. Business intelligence and analytics: From big data to big impact. *MIS quarterly*, 36(4), 1165-1188. ISO 690
- Chilhare, Y.R., Londhe, D.D. and Competiti, E.M. 2016. Competitive Analytics Framework on Bilingual Da Bilingual Dataset of Amazon Food Product. *IJCTA*, 9(21), pp. 179-189.
- Chung, W., Zeng, D. and O'Hanlon, N. 2014. Identifying influential users in social media: A study of US immigration reform. In: *Proceedings of the 20th Americas Conference on Information Systems*, Savannah, 2014.
- Colombo, C., Grech, J.P. and Pace, G.J. 2015. *A controlled natural language for business intelligence monitoring*. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 9103, pp. 300-306.
- Dey, L., Haque, S.M., Khurdiya, A. and Shroff, G. 2011. Acquiring competitive intelligence from social media. In: *Proceedings of the 2011 joint workshop on multilingual OCR and analytics for noisy unstructured text data*, p. 3. ACM.
- Diamantopoulou, V., Charalabidis, Y., Loukis, E., Triantafillou, A., Sebou, G. Foley, P., Deluca, A., Wiseman, I. and Koutzeris, T. 2010. *Categorization of Web 2.0 Social Media and Stakeholder Characteristics*. Nomad Project. EU. pp.19. Available at: <http://www.padgets.eu/Downloads/Deliverables/tabid/75/ctl/Versions/mid/623/Itemid/56/Default.aspx> [Accessed 2 March 2017]
- Dinter, B. and Lorenz, A. 2012. Social business intelligence: a literature review and research agenda. In: *Proceedings of the 33rd International Conference on Information Systems*, Orlando 2012.
- Fan, S., Lau, R.Y. and Zhao, J.L. 2015. Demystifying big data analytics for business intelligence through the lens of marketing mix. *Big Data Research*, 2(1), 28-32.
- Ferrara, E., De Meo, P., Fiumara, G. and Baumgartner, R. 2014. Web data extraction, applications and techniques: A survey. *Knowledge-Based Systems*, 70, 301-323.
- Fourati-Jamoussi, F. 2015. E-reputation: A case study of organic cosmetics in social media. In: *Proceedings of the Information Systems and Economic Intelligence (SIEE) 6th International Conference*, pp. 125-132, IEEE.
- Gallinucci, E., Golfarelli, M. and Rizzi, S. 2013. Meta-stars: multidimensional modeling for social business intelligence. In: *Proceedings of the 16th international workshop on Data warehousing and OLAP*, pp. 11-18, ACM.
- Gallinucci, E., Golfarelli, M., & Rizzi, S. 2015. Advanced topic modeling for social business intelligence. *Information Systems*, 53, 87-106.
- Golfarelli, M. 2014. Social business intelligence: OLAP applied to user generated contents. In: *Proceedings of the e-Business (ICE-B) 11th International Conference*, pp. IS-11, IEEE.
- Golfarelli, M. 2015. Design Issues in Social Business Intelligence Projects. In *European Business Intelligence Summer School* (pp. 62-86). Springer International Publishing.
- Gronroos, C. 2008. Service logic revisited: Who creates value? And who co-creates? *European Business Review*, Vol. 20, No. 4, pp. 298-314.
- Hart C. 1998. *Doing a Literature Review*. Sage Publications, London
- He, W., Tian, X., Chen, Y. and Chong, D. 2016. Actionable social media competitive analytics for understanding customer experiences. *Journal of Computer Information Systems*, 56(2), 145-155.

- Heijnen, J., De Reuver, M., Bouwman, H., Warnier, M. and Horlings, H. 2013. Social media data relevant for measuring key performance indicators? A content analysis approach. In: *Proceedings of the International Conference on Electronic Commerce*, pp. 74-84, Springer Berlin Heidelberg.
- Jingjing, W., Changhong, T., Xiangwen, L. and Guolong, C. 2013. Mining Social Influence in Microblogging via Tensor Factorization Approach. In: *Proceedings of Cloud Computing and Big Data (CloudCom-Asia)*, December 2013 International Conference, pp. 583-591, IEEE.
- Kaplan, A. M. and Haenlein, M. 2010. Users of the world, unite! The challenges and opportunities of Social Media. *Business horizons*, 53(1), 59-68.
- Keele, S. 2007. Guidelines for performing systematic literature reviews in software engineering. In *Technical report*, Ver. 2.3 EBSE Technical Report. EBSE.
- Kim, Y. and Jeong, S. R. 2015. Opinion-Mining Methodology for Social Media Analytics. *TIIS*, 9(1), 391-406.
- Kucher, K., Kerren, A., Paradis, C. and Sahlgren, M. 2014. Visual analysis of stance markers in online social media. In: *Proceedings of Visual Analytics Science and Technology (VAST)*, 2014 IEEE Conference, pp. 259-260, IEEE.
- Kucher, K., Schamp-Bjerede, T., Kerren, A., Paradis, C. and Sahlgren, M. 2016. Visual analysis of online social media to open up the investigation of stance phenomena. *Information Visualization*, 15(2), 93-116.
- Kulkarni, A. V., Joseph, S., Raman, R., Bharathi, V., Goswami, A. and Kelkar, B. 2013. Blog Content and User Engagement-An Insight Using Statistical Analysis. *International Journal of Engineering and Technology*, 5(3), pp. 2719-2733.
- Lee, C., Wu, C., Wen, W. and Yang, H. 2013. Construction of an event ontology model using a stream mining approach on social media. In: *Proceedings of the 28th International Conference on Computers and Their Applications*, 2013, CATA 2013, pp.249-254.
- Lin, Z. and Goh, K. Y. 2011. Measuring the business value of online social media content for marketers. In: *Proceedings of the 32nd International Conference on Information Systems*, Shanghai.
- Liu, S., Wang, S. and Zhu, F. 2015. Structured learning from heterogeneous behavior for social identity linkage. *IEEE Transactions on Knowledge and Data Engineering*, 27(7), 2005-2019.
- Liu, S., Wang, S., Zhu, F., Zhang, J. and Krishnan, R. 2014. Hydra: Large-scale social identity linkage via heterogeneous behavior modeling. In: *Proceedings of the 2014 ACM SIGMOD international conference on Management of data*, pp. 51-62, ACM.
- Liu, X. and Yang, J. 2012. Social buying met network modeling and analysis. *International Journal of Services Technology and Management*, 18 (1- 2), 46-60.
- Lotfy, A., El Tazi, N and El Gamal, N. 2016. SCIF: Social-Corporate Data Integration Framework. In: *Proceedings of the 20th International Database Engineering & Applications Symposium*, June 2016, pp. 328-333, ACM.
- Lu, Y., Wang, F. and Maciejewski, R. 2014. Business intelligence from social media: A study from the vast box office challenge. *IEEE computer graphics and applications*, 34(5), 58-69.
- Luhn, H. P. 1958. A business intelligence system. *IBM Journal of Research and Development*, 2,14-31
- Luo, J., Pan, X. and Zhu, X. 2015. Identifying digital traces for business marketing through topic probabilistic model. *Technology Analysis & Strategic Management*, 27(10), 1176-1192.
- Marine-Roig, E., & Clavé, S. A. 2015. Tourism analytics with massive user-generated content: A case study of Barcelona. *Journal of Destination Marketing & Management*, 4(3), 162-172.
- McKinsey and Altagamma 2015. *Digital inside: Get wired for the ultimate luxury experience*. Available at: <https://www.mckinsey.de/files/dle-2015-global-report.pdf> [Accessed 5 March 2017]
- Meredith, R. and O'Donnell, P. A. 2010. A Functional Model of Social Media and its Application to Business Intelligence. In: *Proceedings of the 2010 conference on Bridging the Socio-technical Gap in Decision Support Systems: Challenges for the Next Decade*,

- August 2010, pp. 129-140, IOS Press, Netherlands.
- Meredith, R. and O'Donnell, P. A. 2011. A framework for understanding the role of social media in business intelligence systems. *Journal of Decision Systems*, 20(3), 263-282.
- Milolidakis, G., Akoumianakis, D. and Kimble, C. 2014. Digital traces for business intelligence: A case study of mobile telecoms service brands in Greece. *Journal of Enterprise Information Management*, 27(1), 66-98.
- Moedeen, B. W. and Jeerooburkhan, A.S. 2016. Evaluating the strategic role of Social Media Analytics to gain business intelligence in Higher Education Institutions. In: *Proceedings of Emerging Technologies and Innovative Business Practices for the Transformation of Societies (EmergiTech)*, IEEE International Conference, pp. 303-308.
- Ngo-Ye, T. L. and Sinha, A.P. 2012. Analyzing online review helpfulness using a regression ReliefF-enhanced text mining method. *ACM Transactions on Management Information Systems (TMIS)*, 3(2), 10.
- Nithya, R. and Maheswari, D. 2016. Correlation of feature score to overall sentiment score for identifying the promising features. In: *Proceedings of Computer Communication and Informatics (ICCCI) International Conference*, January 2016, pp. 1-5, IEEE.
- O'Leary, D. E. 2015. Twitter Mining for Discovery, Prediction and Causality: Applications and Methodologies. *Intelligent Systems in Accounting, Finance and Management*, 22(3), 227-247.
- Obradović, D., Baumann, S. and Dengel, A. 2013. A social network analysis and mining methodology for the monitoring of specific domains in the blogosphere. *Social Network Analysis and Mining*, 3(2), 221-232.
- Olszak, C.M. 2016. Toward better understanding and use of Business Intelligence in organizations. *Information Systems Management*, 33(2), 105-123.
- Palacios-Marqués, D., Merigó, J. M. and Soto-Acosta, P. 2015. Online social networks as an enabler of innovation in organizations. *Management Decision*, 53(9), 1906-1920.
- Petychakis, M., Biliri, E., Arvanitakis, A., Michalitsi-Psarrou, A., Kokkinakos, P., Lampathaki, F. and Askounis, D. 2016. *Detecting Influencing Behaviour for Product-Service Design through Big Data Intelligence in Manufacturing*. In: *Proceedings of Working Conference on Virtual Enterprises*, pp. 361-369, Springer International Publishing.
- Piccialli, F. and Jung, J. E. 2016. Understanding Customer Experience Diffusion on Social Networking Services by Big Data Analytics. *Mobile Networks and Applications*, 1-8.
- Ponis, S. T., & Christou, I. T. 2013. Competitive intelligence for SMEs: a web-based decision support system. *International Journal of Business Information Systems*, 12(3), 243-258.
- Pu, J., Teng, Z., Gong, R., Wen, C. and Xu, Y. 2016. Sci-Fin: Visual Mining Spatial and Temporal Behavior Features from Social Media. *Sensors*, 16(12), 2194.
- Qazi, A., Raj, R.G., Tahir, M., Cambria, E. and Syed, K.B.S. 2014. Enhancing business intelligence by means of suggestive reviews. *The Scientific World Journal*, 2014.
- Ram, J., Zhang, C. and Koronios, A. 2016. The Implications of Big Data Analytics on Business Intelligence: A Qualitative Study in China. *Procedia Computer Science*, 87, 221-226.
- Ranjan, J. 2009. Business intelligence: Concepts, components, techniques and benefits. *Journal of Theoretical and Applied Information Technology*, 9(1), 60-70.
- Ranjan, R., Vyas, D. and Guntoju, D. P. 2014. Balancing the trade-off between privacy and profitability in Social Media using NMSANT. In: *Proceedings of Advance Computing Conference (IACC)*, 2014 IEEE International, pp. 477-483, IEEE.
- Rosemann, M., Eggert, M., Voigt, M. and Beverungen, D. 2012. Leveraging social network data for analytical CRM strategies: the introduction of social BI. In: *Proceedings of the 20th European Conference on Information Systems (ECIS) 2012*, AIS Electronic Library (AISeL).
- Ruhi, U. 2014. Social Media Analytics as a business intelligence practice: current landscape & future prospects. *Journal of Internet Social Networking & Virtual Communities*, 2014.

- Rui, H., & Whinston, A. 2011. Designing a social-broadcasting-based business intelligence system. *ACM Transactions on Management Information Systems (TMIS)*, 2(4), 22.
- Sathyanarayana, P., Tran, P.N.K., Meredith, R. and O'Donnell, P. A. 2012. Towards a Protocol to Measure the Social Media Affordances of Web Sites and Business Intelligence Systems. *DSS*, pp. 317-322.
- Seebach, C., Beck, R. and Denisova, O. 2012. Sensing Social Media for Corporate Reputation Management: a Business Agility Perspective. *ECIS*, p. 140.
- Shroff, G., Agarwal, P. and Dey, L. 2011. Enterprise information fusion for real-time business intelligence. In: *Proceedings of the 14th International Conference, Information Fusion (FUSION)*, pp. 1-8, IEEE.
- Sigman, B. P., Garr, W., Pongsajapan, R., Selvanadin, M., McWilliams, M. and Bolling, K. 2016. Visualization of Twitter Data in the Classroom. *Decision Sciences Journal of Innovative Education*, 14(4), 362-381.
- Sijtsma, B., Qvarfordt, P. and Chen, F. 2016. Tweetviz: Visualizing Tweets for Business Intelligence. In: *Proceedings of the 39th International ACM SIGIR conference on Research and Development in Information Retrieval*, July 2016, pp. 1153-1156, ACM.
- Sleem-Amer, M., Bigorgne, I., Brizard, S., Dos Santos, L.D.P., El Bouhairi, Y., Goujon, B. and Varga, L. 2012. Intelligent semantic search engines for opinion and sentiment mining. *Next Generation Search Engines: Advanced Models for Information Retrieval*, pp. 191-215, IGI Global.
- Tayouri, D. 2015. *The Human Factor in the Social Media Security-Combining Education and Technology to Reduce Social Engineering Risks and Damages*. Procedia Manufacturing, 3, 1096-1100.
- Tziralis, G., Vagenas, G., & Ponis, S. 2009. Prediction markets, an emerging Web 2.0 business model: towards the competitive intelligent enterprise. In *Web 2.0* (pp. 1-21). Springer, Boston, MA.
- Wen, C., Teng, Z., Chen, J., Wu, Y., Gong, R. and Pu, J. 2016. socialRadius: Visual Exploration of User Check-in Behavior Based on Social Media Data. In: *Proceedings of the International Conference on Cooperative Design*, October 2016, Visualization and Engineering, pp. 300-308, Springer International Publishing.
- Wongthongtham, P., & Abu-Salih, B. 2015. Ontology and trust based data warehouse in new generation of business intelligence: State-of-the-art, challenges, and opportunities. In *Industrial Informatics (INDIN), 2015 IEEE 13th International Conference on* (pp. 476-483). IEEE.
- Wu, Y., Liu, S., Yan, K., Liu, M. and Wu, F. 2014. Opinionflow: Visual analysis of opinion diffusion on social media. *IEEE Transactions on Visualization and Computer Graphics*, 20(12), 1763-1772.
- Yang, C. S. and Shih, H. P. 2012. A Rule-Based Approach for Effective Sentiment Analysis. *PACIS*, p. 181).
- Yang, C.S. and Chang, P.C. 2015. Mining Social Media for Enhancing Personalized Document Clustering. In: *Proceedings of the International Conference on HCI in Business*, pp. 185-196, Springer International Publishing.
- Yang, C.S. and Chen, L.C. 2014. Personalized Recommendation in Social Media: a Profile Expansion Approach. *PACIS*, p. 68.
- Zeng, D., Chen, H., Lusch, R. and Li, S.H. 2010. Social media analytics and intelligence. *IEEE Intelligent Systems*, 25(6), 13-16.
- Zhang, Z., Guo, C. and Goes, P. 2013. Product comparison networks for competitive analysis of online word-of-mouth. *ACM Transactions on Management Information Systems (TMIS)*, 3(4), 20.
- Zhang, Z., Li, X. and Chen, Y. 2012. Deciphering word-of-mouth in social media: Text-based metrics of consumer reviews. *ACM Transactions on Management Information Systems (TMIS)*, 3(1), 5.
- Zimmerman, C., & Vatrappu, R. 2015. The Social Newsroom: Visual Analytics for Social Business Intelligence. In: *Proceedings of the International Conference on Design Science Research in Information Systems*, pp. 386-390, Springer International Publishing.
- Zimmerman, C.J., Wessels, H.T. and Vatrappu, R. 2015. Building a social newsroom: Visual analytics for social business intelligence. In: *Proceedings of the IEEE 19th International Conference, Enterprise Distributed Object Computing Workshop (EDOCW)*, pp. 160-163, IEEE.

Copyright of Journal of Intelligence Studies in Business is the property of Adhou Communications AB and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.