

Big Data-enabled Customer Relationship Management: A holistic approach

Abstract: This paper aims to figure out the potential impact of Big Data (BD) on Critical Success Factors (CSFs) of Customer Relationship Management (CRM). In fact, while some authors have posited a relationship between BD and CRM, literature lacks works that go into the heart of the matter. Through an extensive up-to-date in-depth literature review about CRM, twenty (20) CSFs were singled out from 104 selected papers, and organized within an ad-hoc classification framework. The consistency of the classification was checked by means of a content analysis. Evidences were discussed and linked to the BD literature, and five propositions about how BD could affect CRM CSFs were formalized. Our results suggest that BD-enabled CRM initiatives could require several changes in the pertinent CSFs. In order to get rid of the hype effect surrounding BD, we suggest to adopt an explorative approach towards them by defining a mandatory business direction through sound business cases and pilot tests. From a general standpoint, BD could be framed as an enabling factor of well-known projects, like CRM initiatives, in order to reap the benefits from the new technologies by addressing the efforts through already acknowledged management paths.

1 Introduction

Big Data (BD) is considered as a potential enabling factor of business process innovation (Fosso Wamba, Akter, Edwards, Chopin, & Gnanzou, 2015; Loebbecke & Picot, 2015) and as a possible new form of value creation, although the mechanisms of such creation are still unclear (George, Haas, & Pentland, 2014). In fact, these innovations are potentially triggered by the current increased data availability in terms of volumes, variety, and velocity, which are data characteristics typically associated with the concept of BD. BD and BD analytics are transforming customer-facing industries (Fosso Wamba, Akter, & Bonicoli, 2013), which are increasingly collecting large amounts of customer data, like customers' shopping behaviour, for enabling a real-time decision making (Barton & Court, 2012; Bean & Kiron, 2013; Davenport, Barth, & Bean, 2012). Companies are coping with customer data spread among an increasing number of data sources, often external or not structured. They are figuring out the potential value of data for generating insights on customers, but they are still struggling to integrate the information stemming from the innovative data sources into the Customer Relationship Management (CRM) decisions (Phillips-Wren & Hoskisson, 2015). Despite this difficulty, some, albeit few, firms have already been able to overcome such a hindrance concretely for CRM purposes: for instance, Sears Holding has been employing BD, gathered from several data warehouses related to its brands, for offering more timely, sharp, and granular personalized promotions (McAfee & Brynjolfsson, 2012); Caesars Entertainment utilizes data from its Total Reward loyalty program, real-time play, and web clickstreams for targeting customers with real-time offers through mobile devices, for improving customer understanding, and for reducing the waiting time for playing for both regular and occasional customers (Davenport and Dyché, 2013). One of the most recent challenges for CRM is to attempt to harness new heterogeneous data sources for developing innovative value propositions, for instance by drawing customer data from social networks (Acker, Gröne, Akkad, Pötscher, & Yazbek, 2011; Diffley & McCole, 2015; Faasse, Helms, & Spruit, 2011; Greenberg, 2010; Sigala, 2011; Trainor, Andzulis, Rapp, & Agnihotri, 2014).

Nonetheless, the exploitation of BD sources in firms could require relevant changes of management factors concerning both the pertinent business practices and the Information and Communication Technology (ICT) portfolio (Dutta & Bose, 2015). To our best knowledge, current scientific literature misses works dealing with how BD could affect development and management of CRM. In particular, this work is an endeavour to figure out how BD may reshape Critical Success Factors (CSFs) of CRM initiatives. Despite a wealth of knowledge about CRM CSFs, literature still lacks works that investigate the relationship between these factors and a potential BD exploitation. Managers and practitioners might benefit from further insight concerning this relationship: it could clear up the current hype that portrays BD, improving its understanding, and it may provide clues on how to potentially generate competitive advantage by means of BD-enabled CRM.

Thus, the objective of this paper is to provide a first answer to the following research question: "*How could Big Data affect Critical Success Factors of Customer Relationship Management initiatives from a holistic perspective?*". Given this purpose, we developed a classification framework for steering a thorough literature review about CRM CSFs, and for classifying its results. Twenty CSFs were identified, and the consistency of

the classification was checked through a content analysis. Finally, on the basis of the CSFs, we formulated five propositions about how BD could affect CRM. Both the literature review and the propositions enrich the corresponding research streams, and are an attempt to fill up the literature gaps. In addition, they contribute to pave the way for a concrete exploitation of BD, particularly in the CRM context.

The paper consists of five sections: after the introduction, Section 2 presents a critical overview about BD, CRM, and the link among them, based on the Resource-Based View; section 3 describes the methodological steps; section 4 presents the results from the literature review and the consistency check, and the propositions about the potential influence of BD on CRM CSFs we derived; finally, conclusions and future developments are in section 5.

2 Theoretical background

According to the Resource-Based View (RBV), firm's resources are the ultimate antecedent to firm performance (Wernerfelt, 1984). Barney (1991) highlights that resources in the RBV (I) are distributed heterogeneously across the firm, and (II) their transfer among firms has always a cost. Despite these assumptions, academics have debated which resources truly enable the achievement of competitive advantage, and different definitions of *resource* in the RBV have been proposed, *i.e.* competencies (Prahalad & Hamel, 1990), skills (Grant, 1991), physical assets (Litz, 1996), assets (Ross, Beath, & Goodhue, 1996). Wade & Hulland (2004, p. 109) propose a more comprehensive definition, that is, "*resources [are ...] assets and capabilities that are available and useful in detecting and responding to market opportunities or threats*": assets, both tangible and intangible, are everything a firm can use in producing and / or offering goods or services to a market, while capabilities are repeatable patterns of actions in using the assets (Sanchez, Heene, & Thomas, 1996).

Both knowledge assets (Bharadwaj, 2000) and technology assets, including databases (Ross et al., 1996) and systems for managing stakeholder relationships (Benjamin & Levinson, 1993), are framed as resources in the RBV (Wade & Hulland, 2004). Thus, it is licit to assume that the current enhanced availability of data could be considered as an improved resource in attaining competitive advantage, as well as capabilities for developing knowledge in managing customer relationships.

Accordingly, in the following subsections we present a critical overview about BD, we analyse the different perspective of CRM, and we point out the relationship among the two topics.

2.1 Big Data under a critical lens

The spending guide by the International Data Corporation (IDC, 2015) suggests that the worldwide revenues from BD and business analytics could grow approximately from \$122 billion in 2015 to \$187 billion in 2019. Large and very large companies will likely play a major role in this expenditure, which should be mostly accounted for service-related costs. In accordance with this trend, the BD phenomenon seems to be an imperative. Yet, its univocal definition is a still unsolved issue. Several academics rely on the paradigm of the Vs by McAfee & Brynjolfsson (2012), which depicts BD as a data set, akin to a data asset, characterized by (I) a huge – but not strictly-defined – Volume, (II) Velocity meant as speed of data creation, and / or (III) Variety in the form of data types and sources. Such a paradigm is evolving with additional Vs (Markus, 2015) like Veracity, intended as quality of data set, or Value contained within the data. Nonetheless, literature proposes other approaches in defining BD, as follows.

Wu, Zhu, Wu, & Ding (2014, p. 102) suggest a more narrow but remarkable approach to BD, claiming that its value is embedded within "*heterogeneous data types, complex intrinsic semantic associations in data, and complex relationship networks among data*". Thus, any managerial effort to exploit BD should address this multidimensional complexity, and the different Vs might represent an indirect measure of this complexity.

Differently, Fosso Wamba, Akter, Edwards, Chopin, & Gnanzou (2015, p. 235) frame BD as "*a holistic approach to manage, process and analyze 5 Vs (i.e. volume, variety, velocity, veracity and value) in order to create actionable insights for sustained value delivery, measuring performance and establishing competitive advantages*". Therefore, they stress the managerial and business process perspectives, merging them by a technologic approach for pursuing innovative insight from challenging volumes of structured and unstructured data, and for finally achieving better off competitive advantage.

Similarly, De Mauro, Greco, & Grimaldi (2016, p. 131) combine different perspectives in defining BD as "*the Information asset characterised by such a High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value*". They extend the technologic definitions of BD from a data asset to an information one: this is coherent with the need to comply with

every data quality requirement in order to elicit useful information, and not to simply explore data without a precise business goal.

Diverging from a classical gut-feeling approach, business leaders are increasingly adopting a data-driven decision making, even when the numerical evidences question their past experiences (Lavalle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011). Nevertheless, potential benefits from BD adoption are often affected by sensationalism, *e.g.* companies that took thoroughly into account BD challenges within their information strategies by 2015 will surpass unprepared competitors by 20% in all financial metrics (Beyer, 2011). In line with such considerations, several academics denoted different flaws concerning BD literature, and we arranged them as follows:

1. *Vagueness.* Current definitions of BD are depicted by hazy concepts (Fox & Do, 2013): *Big Data* is a poor term (Boyd & Crawford, 2012), and even the word *Big* is misleading (Fox & Do, 2013; George, Haas, & Pentland, 2014) as it often refers to different volume thresholds. Thence, some academics, *i.e.* George, Haas, & Pentland (2014), claim that the value of BD is in their smartness, that is, the amount of insight extractable from the new data data sources and volumes. Because of this vagueness, companies that would like to include BD technologies in their ICT portfolio "*are struggling to better understand the concept and therefore capture the business value from 'big data'*" (Fosso Wamba, Akter, Edwards, Chopin, & Gnanzou, 2015, p. 234).
2. *Lack of managerial focus.* There is no clarity on the possible relationship between BD and financial metrics (Fox & Do, 2013), or similar outcomes. Besides the shortage of any empirical acknowledgement of this relationship, one reason of the lack of clarity could be that "*most big data that received popular attention are not the output of instruments designed to produce valid and reliable data amenable for scientific analysis*" (Lazer, Kennedy, King, & Vespignani, 2014, p. 1204). Consequently, current assessments about potential returns from BD investments might be unreliable and biased, or premature at least, and further research is definitely needed.
3. *Trivial significance.* The increasing trend of data volume, variety, and velocity has always led the evolution of the ICTs, and it should not be considered as something unexpected. What is really changing is its pace, whose intensity has generated new management and data exploitation problems. The main issue is that usual statistical approaches, which rely on *p*-values to assess the significance of an outcome, become ineffective because of the huge volumes of data: due to noise accumulation, incidental endogeneity, or spurious correlations (Fan, Han, & Liu, 2014), almost everything possible phenomenon turns out to be significant (George, Haas, & Pentland, 2014). Furthermore, the data volumes we are trying to harness today "*have higher possibility of different interpretations [... and] need a more explorative and experimental approach to yield value (if any)*" (Jukić, Sharma, Nestorov, & Jukić, 2015, p. 203).

These three flaws could foster the fashion effect that affects BD, limiting the clarity about the potential role of BD and likely yielding a detrimental effect of firms' choices. In fact, the decision to proceed or not in an investment in innovative ICTs is often affected by the hype surrounding both the new technologies (Fox & Do, 2013) and the expectations towards them (*i.e.* Light & McGrath, 2010; Thompson, 2011). Managers have to strive to overtake the hype by assessing the capabilities of the new technology minimizing possible distortions and bias (Collins, Worthington, Reyes, & Romero, 2010; Zane & Reyes, 2010), and BD is no exception.

In order to align managerial efforts and BD exploitation, we deem that purely technologic approaches to BD may be misleading. Undoubtedly, BD involves the use of technologies but, if a firm aims to rely on an advanced data-driven decision making, not only on a strategic level but also on a tactical and operational one, a holistic approach to the generation, collection, and harnessing of the new data sources could be more suitable. Thus, in our opinion, the BD definition by Fosso Wamba and colleagues may be the most appropriate for attempting to adopt a more objective and managerial overture to BD initiatives, and for providing guidance in developing this paper.

2.2 The different perspectives of Customer Relationship Management

CRM was commonly contextualized within technology solutions and was described as akin to an information-enabled form of relationship marketing (Ryals & Payne, 2001). Fayerman (2002) distinguishes (I) Operational CRM, which manages current customers' interactions, (II) Analytical CRM, which fosters decision-making by analysing and re-arranging customer data, and (III) Collaborative CRM, which aims to an improved customer experience by leveraging inter-departmental teamwork and communication within a

firm. Greenberg (2003) distances himself from pure technological approaches, and propose that "*CRM is a philosophy and a business strategy supported by a system and a technology designed to improve human interactions in a business environment*".

Scientific literature has suggested further different interpretations of CRM's nature. On the basis of an extensive review, Zablah, Bellenger, & Johnston (2004a) define five major perspectives on CRM:

- *CRM as a process*. CRM is a macro-process that encompasses all the activities for pursuing a long-term, profitable, and mutually beneficial customer relationships; from a narrower perspective, it is a process limited to the management of customer interactions to establish and maintain durable worthwhile relationships.
- *CRM as a strategy*. Firms should design and prioritize the investment of resources on relationship building and maintenance in line with the customer's lifetime value.
- *CRM as a philosophy*. Customer loyalty, and thus profitability, requires a continuous understanding of customers' evolving needs for the best value delivering.
- *CRM as a capability*. The potential, additional competitive advantage that CRM can provide is tied to the capacity of gathering knowledge on current and prospective customers, and to act upon it, for instance by proactively reshaping customer interactions.
- *CRM as a technology*. Technologies for managing knowledge and interaction, linking front- and back-office functions, play a non-negligible role in firms' relationship management efforts.

Building on the insight stemming from these five perspectives, Zablah, Bellenger, & Johnston (2004a) contend that the process approach is the most comprehensive one, and they conceptualize CRM as "*an ongoing process that involves the development and leveraging of market intelligence for the purpose of building and maintaining a profit-maximizing portfolio of customer relationships*" (p. 480). Within this process view, CRM technological tools are part of the resources in input to the CRM process.

Payne & Frow (2005) adopt three different CRM perspectives, which can be depicted as a continuum. On one side, CRM can be defined (perspective 1) *narrowly and tactically* as the implementation of a specific technology solution, for instance a Sales Force Automation project. On the other opposite side, CRM is defined (perspective 3) *broadly and strategically* as a holistic approach to a prioritized management of customer relationships for creating shareholder value. Between these two standpoints, CRM can also be framed (perspective 2) as a wide range of integrated customer-oriented technology solutions.

Payne and Frow bolster that organisations should conceptualize CRM as a strategy (perspective 3) whose purpose is to achieve shareholder value by building up and maintaining a profitable, long-term relationship with key customers, notable customer segments and, in a broad meaning, key stakeholders. Through several kinds of data and data sources, CRM aims to create value together with the customers, merging relationship marketing strategies and Information Technology (IT) in a cross-functional integration of processes, operations, and human resources. Yet, the definition by Zablah and colleagues is sharper, and it better defines the role of technology and knowledge in leveraging the management of customer relationships. Thus, we preferred it for the further development of our work.

2.3 The relationship between Big Data and Customer Relationship Management

The link between BD and the CRM process has already been hypothesized in literature and, in order to explain it, we took into consideration the CRM process by Reinartz, Krafft, & Hoyer (2004). By stressing the relevance of focusing on a single view of the customer, coordinating information during time in a multi-channel perspective, Reinartz and colleagues suggest that the CRM process has three primary dimensions – relationship initiation, maintenance, and termination – divided in a total of nine subdimensions: as shown in fig. 1, some applications of BD, prospective or already developed, could be applied to most of them.

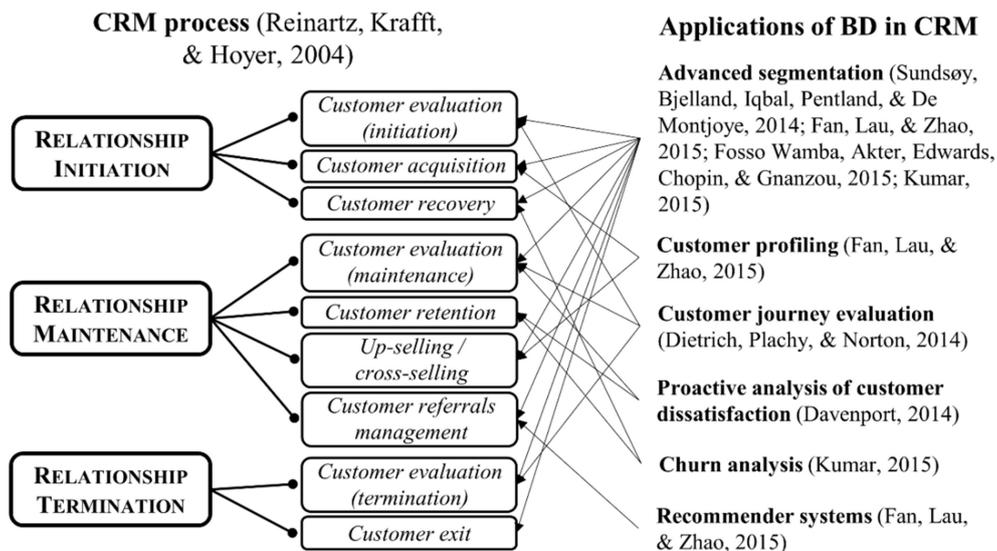


Figure 1. Potential impact of BD on CRM subdimensions

BD allows firms to develop advanced segmentation, *e.g.* micro-segmentations in real time (Fosso Wamba, Akter, Edwards, Chopin, & Gnanzou, 2015), which could be exploited to refine all the CRM activities. Clustering and classification techniques in BD environment present new specific challenges, but may help to identify groups of customers that react to the same market stimuli and to single out fine-grained profiles of individual customers (Fan, Lau, & Zhao, 2015). The development of BD-enabled advanced segmentation may draw from customer's behaviour, like experiences, sentiments, or attitudes, collected from behavioural data sources or inferred by means of advanced analytics (Kumar, 2015): in this regard, machine learning has shown excellent performances in BD-enabled customer segmentation (Sundsøy, Bjelland, Iqbal, Pentland, & De Montjoye, 2014). BD in CRM includes more specific activities, like analysis of the whole path that a customer follows from the initiation to the termination of its relationship with the firm (Dietrich, Plachy, & Norton, 2014), proactive customer retention exploiting predictive churn modelling (Kumar, 2015), foresight of signs of customer dissatisfaction that might lead to attrition (Davenport, 2014), exploitation of wider log data for more tailored recommender systems (Fan, Lau, & Zhao, 2015).

The adoption of BD in CRM initiatives is not limited to the utilization of huge volumes of structured data. In fact, the link between BD and CRM has been evolving and strengthening with the introduction of social media, which enable a better off collection of semi- and un-structured data for developing insight on prospects and current customers, on-going market trends, and possible unforeseen patterns among data (Torre-Bastida, Villar-Rodriguez, Gil-Lopez, & Del Ser, 2015). Mohan, Choi, & Min (2008) introduced the *Social CRM* concept, also known as CRM 2.0, described as the combination of the Web 2.0 paradigm and social networking with the CRM systems. *Social CRM* implies bidirectional dynamic interactions with customers by means of different online channels. The innovative insight obtainable from these interactions is "*based on customer data, customer personal profiles on the web and the social characteristics associated with them, and customer participation in the activity*" (Greenberg, 2010, p. 414). *Social CRM* is not applicable if customer management using CRM has not been already developed in the firm (Faasse, Helms, & Spruit, 2011), and it definitely benefits from BD: for instance, for commercial recommendations, automated categorisation and routing of customer interactions, predictive models of trend and clustering of customers (Orenga-Roglá & Chalmeta, 2016), advanced segmentation, monitoring of customers' portfolio (Marshall, Mueck, & Shockley, 2015).

According to the definitions we chose for BD and CRM, the utilization of BD in CRM consists in applying a holistic approach in managing a process whose inputs include ICTs.

3 Objective and methodology

The goal of this paper is to provide a first answer to the following research question: "*How could Big Data affect Critical Success Factors of Customer Relationship Management initiatives from a holistic perspective?*".

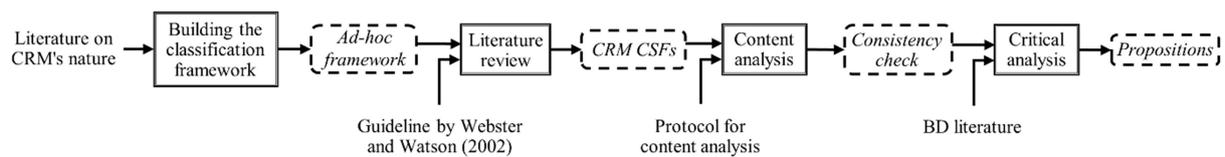


Figure 2. Methodology

In line with the research question, we followed the methodology in figure 2: the squared rectangles are the four main steps, while the dotted rounded rectangles are the main outputs. First, we structured an ad-hoc classification framework, consisting of five macro-categories, for leading the identification of the most critical areas in CRM. Second, a multi-staged in-depth literature review about CRM was performed, allowing the extraction of twenty CSFs from 104 selected papers, and the CSFs were discussed and arranged on the basis of the classification framework we developed. Third, the consistency between the selected papers and the formulation of the macro-categories which they were assigned to was positively assessed by building, analysing, and discussing ten word-trees – a form of content analysis – through NVivo 11 Pro. Fourth, in coherence with the outcomes of the previous steps, five theoretical propositions concerning the potential effect of BD on the twenty CRM CSFs were critically formulated.

The following sub-sections detail the four-step methodology we adopted: building of the classification framework, development of the literature review, content analysis, and formulation of the propositions.

3.1 Classification framework

In order to set a theoretical foundation for singling out CRM CSFs in the literature, we structured an ad-hoc review and classification framework. As a review should be concept-centric (Webster & Watson, 2002), the concept leading the building of our framework was the identification of the critical areas of CRM, with the purpose of addressing the elicitation of the CSFs in developing and managing CRM initiatives. The framework consists of five macro-categories – strategy, technology, data and insight, project, and organization – and it was developed drawing upon the five CRM perspectives depicted by Zablah, Bellenger, & Johnston (2004a).

The categories were used as main concepts for leading the subsequent literature review, similarly to the concept matrix suggested by Webster and Watson (2002), and for classifying its results. As follows, we describe the rationale underpinning the framework.

While contending that the process perspective is the most suitable one for conceptualizing the CRM phenomenon, Zablah, Bellenger, & Johnston (2004a) claim that the other perspectives they propose provide useful insights in refining the nature of the CRM process, and in defining its inputs and outputs. The CRM's intended purpose is the rational use of limited resources for enabling the building of a profit-maximizing portfolio of customer relationships. This output is attainable through appropriate inputs, which are represented by the other four CRM perspectives.

1. The strategic perspective aims to steer CRM to a greater organisational profitability by keeping into account both customer's needs and firm's capabilities. The allocation of resources for relationship building and maintenance must be consistent customers' lifetime value (Ryals, 2003) and with the type of customer, which could also lead to the decision of not to establish any kind of relationship (Verhoef & Donkers, 2001).
2. The philosophical perspective connotes the need for customer centricity as one of the pivotal organizational resources for CRM. Organizational change is inevitable in CRM initiatives, and it involves new processes and procedures to be implemented, as well as behavioural changes in employees (Shum, Bove, & Auh, 2008), company-wide cross-functional Business Process Reengineering (BPR) (Chen & Popovich, 2003), and changes in the organizational structure (Beldi, Cheffi, & Dey, 2010).
3. The technological perspective suggests that CRM tools are a fundamental input to the CRM process to improve building, dissemination, and application of customer intelligence across different touch-points. In fact, CRM success seems to be heavily influenced by the alignment between technology, on one side, and processes and employees, on the other side (Chen & Popovich, 2003; Zablah, Bellenger, & Johnston, 2004b).
4. The capability perspective proposes that firms have to possess a set of synergistic resources – that is, capabilities – for enabling firms to develop knowledge on customers and prospects, and to act upon it. Accordingly, Zablah, Bellenger, & Johnston (2004a) include Knowledge Management (KM) as a

major sub-process of the CRM macro-process, and they define it as the set of activities for creating and leveraging the market intelligence towards building and management of a profit-maximizing portfolio of customer relationships. In order to pinpoint the pertinent information management activities, firms should utilize appropriate IT tools and applications (Payne and Frow, 2005).

The CRM approach by Zablah, Bellenger, & Johnston (2004a) entails, obviously, the formal adoption of a CRM process by the firm. CRM initiatives usually require the development of a CRM project upstream, which can be really challenging, with a failure rate between 35 and 75% (Zablah, Bellenger, & Johnston, 2004b). Successful CRM initiatives rely on employee engagement (Payne and Frow, 2005) and on efficient project and change management (Bygstad, 2003; Mendoza, Marius, Pérez, & Grimán, 2007), and a project perspective on CRM could be a key to success (Beldi, Cheggi, & Dey, 2010). Thus, we claim that a project standpoint should be considered in our framework.

In light of the above considerations, figure 3 summarises the theoretical foundation for defining the macro-categories of the review and classification framework. The project perspective and its arrow are dotted in order to highlight that they intervene upstream in developing the CRM process only.

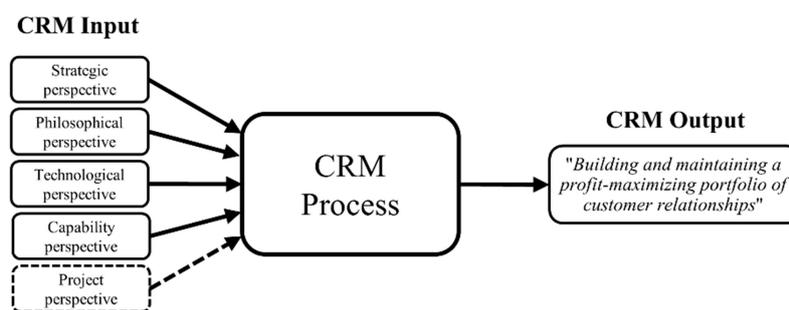


Figure 3. Theoretical basis for the review and classification framework

According to figure 3, we propose a possible framework, consisting of five categories, for eliciting and classifying the CSFs of CRM initiatives. The perspective which each category stems from is highlighted between round brackets.

1. *Strategic planning of CRM* (Strategic perspective). CRM needs for a strategic orientation that should be framed within the company's overall strategies. Its mid- and long-term impacts may imply relevant effects that should be carefully evaluated.
2. *Infrastructure for IT in CRM* (Technological perspective). A diversified ICT portfolio should be able to support the CRM process with appropriate hardware and software resources. Then, the pertinent requirements are fundamental for a smooth value co-creation with the customer.
3. *Insight and data management in CRM* (Capability perspective). Effective CRM should be based upon the benefits from a useful gathering and exploitation of both customer data and upon all the insight extractable from them. Thus, data should be specifically arranged and managed within a formal process, and these activities should be supported by means of suitable technologies.
4. *CRM project* (Project perspective). A project management approach may facilitate the formal institutionalization of a CRM process within a firm. Whether a CRM initiative includes the implementation of a CRM system, the potential hindrances to success may become tougher because of the introduction of the pervasive new Information System (IS) and, then, a warier approach is needed.
5. *CRM and organizational impact* (Philosophical perspective). CRM exerts a strong impact on both other business processes and the organizational structure. With the purpose to steer the full exploitation of the potential benefits linked to the value co-creation with the customers, a critical redesign of the information and process flows and of the interfaces that link business processes and that connect employees / teams could be fundamental.

3.2 Literature review

By taking into account the review principles by Webster and Watson (2002), a multi-staged in-depth literature review for identifying the CSFs in developing and managing CRM initiatives was carried out in six main steps: (I) identification of keywords and search strings; (II) definition of the time window; (III)

selection of the citation database(s); (IV) selection of the disciplines / topics; (V) refinement of the results through a multi-staged skimming process; (VI) review of the relevant papers.

Table 1 shows the protocol that led the first four steps of our literature review. The exclusion of *CSFs* from the keywords allowed us to take into consideration a wider set papers for the identification of the factors.

Table 1. Protocol for the literature review

PARAMETER	DETAIL	JUSTIFICATION
KEYWORDS	"Customer Relationship Management" in Title, Abstract, and Keywords OR CRM in Title OR CRM in Keywords.	In order to provide the widest possible results, we preferred to explore the whole CRM topic and to proceed with a reasoned extraction of explicit and implicit CSFs from the papers. Thus, although the purpose of the review was to identify the CSFs, the keyword <i>CSF</i> was not considered.
TIME WINDOW	Jan 2003 ÷ Feb 2016	Logical continuity with the CRM review by Ngai (2005), whose time window is 1992-2002.
TYPE OF ARTICLE	Journal (J), reviews, Conference (C)	Journals are recognized as the best scientific source; according to Webster and Watson (2002), selected conference proceedings should be examined, especially those with a reputation for quality.
SOURCES	Scopus	Elsevier Scopus is recognized as the largest abstract and citation database of peer-reviewed literature. In addition, it was preferred to ISI Web of Science (WoS) for its better flexibility. All the main results of the query were found on WoS too, through similar queries.
DISCIPLINES	Business, Management and Accounting; Computer Science, Engineering; Social Sciences; Decision Sciences; Economics, Econometrics and Finance.	Disciplines were selected according to their fit with the research objective.
RESULTS OF THE QUERY		J papers: 2459; C papers: 1811

The fifth step of the review – refinement of the results through a multi-staged skimming process – was decomposed in three phases (table 2). First, title, abstract, and keywords of each paper were carefully read. Conference papers were further skimmed by considering only those belonging to the Association of Information Systems, which are known for their quality: ICIS, ECIS, AMCIS, and ACIS. Second, introduction, objectives, methodology, and results of the papers that passed the first selection were examined. The two first skimming phases led to a restricted pool of 232 journal papers and 6 conference papers, which were clustered in line with the year of publication, and prioritized according to citations and impact factor. Finally, in the third skimming phase, the full-body of the retained papers was deeply analysed, leading to the final pool of papers.

Table 2. Phases for skimming the papers

SKIMMING PHASE	CRITERIA FOR FIT EVALUATION	NUMBER OF RETAINED PAPERS PER STEP
PHASE 1	J: title, abstract, and keywords C: belonging to the selected conferences (constraint); title, abstract, and keywords.	J: 444 out of 2459 (18%) C: 29 out of 1811 (16%)
PHASE 2	J and C: introduction, objectives, methodology, results.	J: 232 out of 444 (52%) C: 6 out of 29 (21%)
PHASE 3	J and C: full-body of the paper.	J: 104 out of 232 (45%) C: 1 out of 6 (17%)

Thus, the authors were randomly divided into two couples: each couple independently identified the CSFs within the retained papers, and univocally assigned them to the appropriate category of the classification framework. Finally, the results were compared and critically discussed until convergence.

3.3 Content analysis

After the CSFs classification, the coherence between the selected papers and the five macro-categories was assessed through NVivo 11 Pro, a software package for content analysis¹, by building and analysing word trees. A word tree is a visualization and information-retrieval technique belonging to the wider category of

¹ See www.qsrinternational.com/what-is-nvivo for further information.

Keyword-In-Context techniques, and it "*enables rapid querying and exploitation of bodies of text*" (Wattenberg & Viégas, 2008, p. 1221). Keyword-In-Context techniques are known for facilitating the development of categories (Krippendorff, 2004), which is our case.

The word trees were developed by singling out and analysing the co-occurrences of specific keywords, chosen jointly by the authors according to the definition of the five CRM macro-categories, within the selected papers. These co-occurrences can witness a logical alignment between the text of the retained works, which the CSFs were extracted from, and the conceptualization of the CRM categories, which the CSFs were assigned to. If such an alignment exists within the body of papers, the coherence check may be appreciably positive, strengthening the link between the papers and the classification framework.

Within the NVivo environment, the *word tree* function explores how specific keywords develop within a text. Its output is a word tree, that is, a graphical outcome that recalls the shape of a tree: the top of the tree is the keyword, and the branches and the leaves are those parts of the in-text sentences that precede or follow the keyword. This function requires two inputs: *text* and *keywords*. *Text* is the textual object to analyse, that is, the selected papers, and it must be arranged in one or more logical nodes. A logical node is a cluster which the text should be assigned to. We created five logical nodes, one for each macro-category, and we assigned the papers according to the table A.1 in appendix A, which contains the references of our review for each macro-category. A *keyword* is a word that the software can find and analyse within the text. By combining the keywords through the Boolean logic, the software can highlight their co-occurrences in the body of the text if they are distant each other no more than *n* words: then, *n* is a proximity threshold, and it can be set by the user.

Table 3 explains the protocol we developed for the *word tree* analysis.

Table 3. Protocol for the *word tree* analysis

PARAMETER	DETAIL	JUSTIFICATION
KEYWORDS	<ul style="list-style-type: none"> Strategic planning of CRM: <i>strategy, needs</i> (requirements); Infrastructure for IT in CRM: <i>technology, value</i> (performance); Insight and data management in CRM: <i>knowledge</i> (insight), <i>integration</i>; CRM project: <i>management, resources</i>; CRM and organizational impact: <i>structure, processes</i> (interface); 	<p>Since the number papers in input is high, and in order to obtain more compact, manageable, and understandable results, we chose no more than two keywords for each logical node. They were formulated in coherence with the definition of the five macro-categories. Keywords between round brackets were dropped and replaced due to their low frequency within the papers, or because they led to unclear results.</p> <p>Each couple of keywords was combined through the AND Boolean operator with the purpose of investigating their coupled occurrence.</p>
PAPERS IN INPUT	See table A.1 in appendix A	The selected papers for each CSF are the outcome of the literature review.
PARTS LEFT OUT	<ul style="list-style-type: none"> Title, abstract, keywords; References; Appendices; Footnotes and headnotes; Tables combining numbers and keywords; 	Some parts of the papers were excluded from the query in order to focus only on the body of the text, and to find only the most meaningful relationships among the keywords.
PROXIMITY THRESHOLD	Thirty (30) words	The threshold was chosen for trying to consider those cases in which the two keywords occur separately in consecutive sentences. Thirty was considered as adequate because, usually, scientific papers do not include very long sentences.
CRITERIA FOR REDUCING REDUNDANCIES	<p>We excluded the occurrences of the keywords:</p> <ul style="list-style-type: none"> Between square brackets; Within bullet lists, if alone or in short sentences; Preceded or followed by numbers or references; Used with other meanings, for instance <i>needs</i> as a verb and not as a noun; 	Given the huge amount of text in input, the resulting word trees could be too much big, and not easily understandable, if not trimmed. In order to facilitate their representation and interpretation, they were rationalized according to these four criteria, which were chosen for keeping those branches that can convey the most understandable meaning.

3.4 Formulation of the propositions

Key evidences stemming from the previous steps were analysed in light of the existing BD literature. Thus, with the purpose of explaining the possible impact of BD on CRM CSFs, five theoretical propositions were formulated and discussed. For a matter of logical development of the paper, the number of the propositions

was aligned to the number of the CRM macro-categories, which in turn stemmed from the five CRM inputs, and their formulation was derived from a critical analysis of the relationship between each CSF and BD literature.

In order to derive the propositions from the literature review, the authors were randomly divided in two couples, avoiding the same coupling of the step 2. Each couple independently reviewed the evidences concerning the twenty CSFs, and sketched out their possible link with BD literature. Results from the two teams were compared and refined until convergence, and the five propositions were jointly developed and discussed until reaching consensus.

4 Results and discussion

In the first part of this section, we expound the results of the literature review and their classification within the framework. In the second part, we describe the outcome of the content analysis. Finally, we derive the propositions about the potential impact of BD on CRM CSFs.

4.1 Results from the literature review

Twenty (20) CSFs were singled out from the 104 journal papers and assigned to the most pertinent macro-category of the classification framework (fig. 4) on the basis of the fit between their definition and the formulation provided for each category. All the references for each CSF are in Table A.1 in Appendix A. Figure 5 shows the temporal distribution of the body of the selected papers.

Table 4 describes the results of the review in a matrix structure: its rows identify the CSFs arranged in the same order as in figure 4; the first column provides a conceptualisation for each CSF; instead, the second column describes the main evidences for each success factor from the retained papers.

As an additional result, our review shows that scientific literature has neglected, and maybe underestimated, the relationship between BD and CSFs of CRM and of other business processes. In fact, although the BD concept in its current meaning has started to spread some years ago (*i.e.* see Jacobs, 2009), only two papers (Malthouse, Haenlein, Skiera, Wege, & Zhang, 2013; Woodcock, Green, & Starkey, 2011) link CRM CSFs to the possible exploitation un-structured and semi-structured data for value co-creation, specifically in terms of social media data, whilst the explicit relationship between CSFs of classical CRM and BD was not considered. The reason may be twofold: on one side, the hype effect may have disguised BD as a mandatory investment, regardless of the additional criticalities it may add to the business processes; on the other side, to our best knowledge, most papers hypothesize several benefits and constraints concerning BD, but very few tries to explore the risks linked to such initiatives.

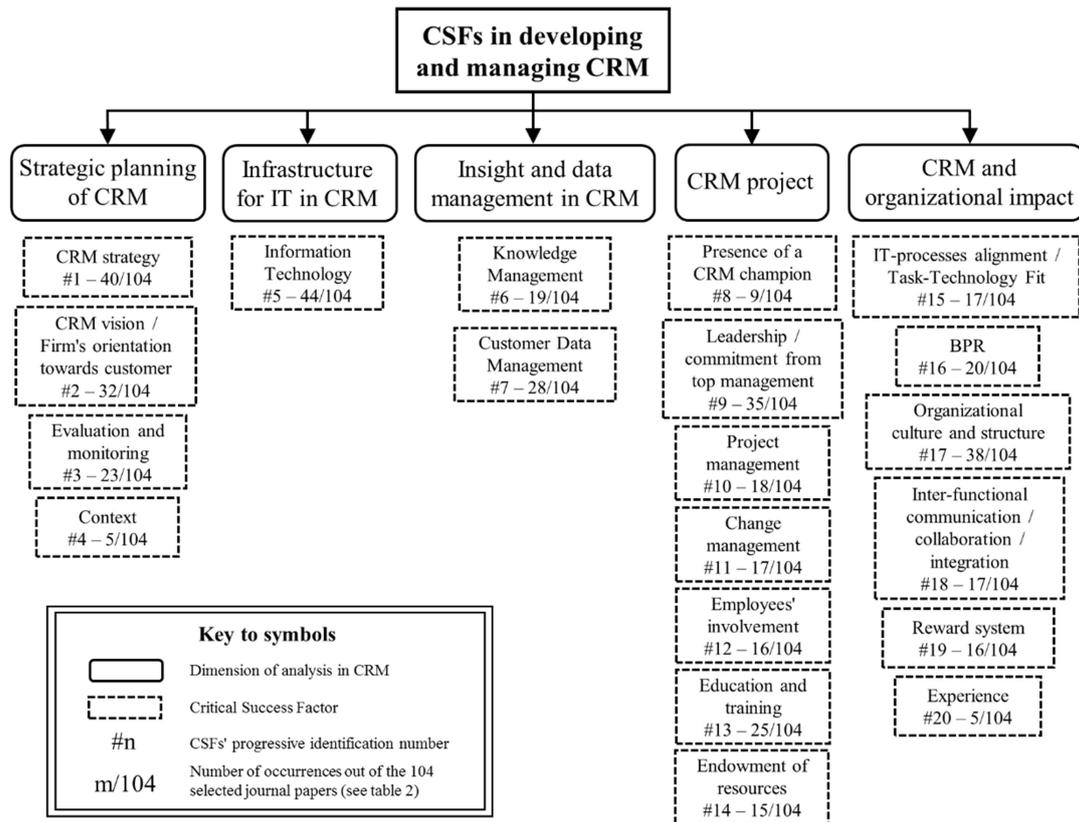


Figure 4. The identified CRM CSFs organized within the classification framework

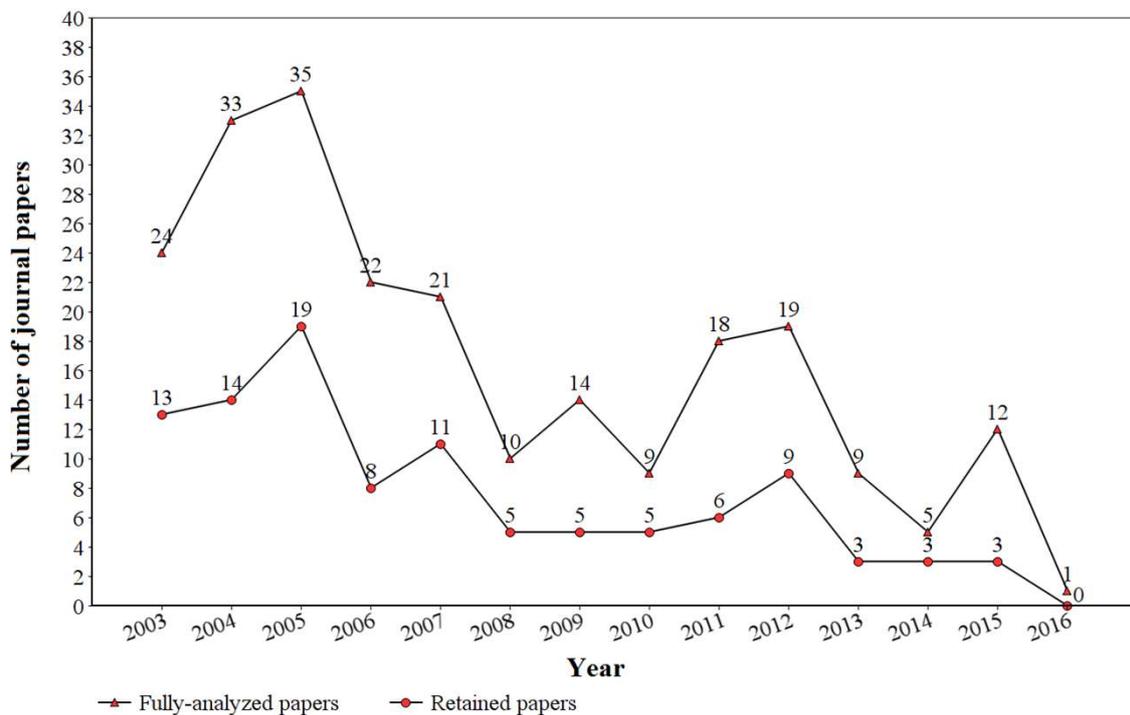


Figure 5. Number and temporal distribution of the selected journal papers

Table 4. Definition and discussion of the CRM CSFs

Definition	Relevant findings
CRM strategy	Evaluation and prioritization of customer life-time value is the most cited strategy (e.g. Padmanabhan & Tuzhilin, 2003; Kale, 2004; Zablah et al., 2004a; Landry et al., 2005). Payne & Frow (2004) suggest to structure CRM strategy as a holistic approach in creating shareholder value by managing customer relationship through a multi-channel integration. Several authors (e.g. Mendoza et al., 2007; Dimitriadis & Stevens, 2008) agree on such a holistic integration.
CRM vision / Firm's orientation towards customer	The orientation towards customers should aim to a long-term development of the relationships (Zablah et al. 2004b). As part of customer-centric marketing (Sin et al., 2005), customer relationships orientation affects positively the process of customer interaction and customer information management for value creation (Jayachandran et al., 2005).
Evaluation and monitoring	Evaluation and monitoring of CRM processes and performances, including shareholder results (Payne and Frow, 2005), require a feedback logic (e.g. Curry & Kkolou, 2004; Da Silva & Rahimi, 2007). Additional specific metrics for benchmarking (e.g. Eid, 2007; Vazifehdust et al., 2012) and for <i>Social CRM</i> (e.g. Woodcock et al., 2011; Malthouse et al., 2013) should be developed, if relevant.
Context	Success of CRM initiatives also relies on the development of the infrastructures of the country which the firm works in (Sharma & Iyer, 2007). Moreover, not all industries and markets are suitable for close and profitable long-term relationships (Steel et al., 2013).
Information Technology	Adequate technology is the most cited CSF in our review (figure 4). Integration among all the different ISs is strongly recommended (Salomann et al., 2005; Mendoza et al., 2007). According to Becker et al. (2009), technological implementations for acquisition, storage, accessibility and analysis of customer information is positively associated with the performance in CRM initiation, maintenance and retention.
Knowledge management	King & Burgess (2008) hypothesize that a successful CRM implementation should increase KM capabilities. Notwithstanding, findings by Garrido-Moreno & Padilla-Meléndez (2011) show that KM may have only an indirect effect on CRM success, affecting it through organizational variables.
Customer data management	The most widespread requirement about CRM data is the integration of customer data into a single cross-functional database (e.g. Payne & Frow, 2005; Tanner et al., 2005; Anderson et al., 2007). In addition, the relevance of data quality must not be neglected (Roh et al., 2005; Dimitriadis & Stevens, 2008).
Presence of a CRM champion	The role of a champion should not be limited to attract resources but has to include a continuous commitment (Kim, 2004). An executive champion should also connect CRM strategy to the company's strategic business plan. CRM project championship could be supported by an appropriate team (Steel et al., 2013).
Leadership/ commitment from top management	Managers could develop a close relationship between the firm and its customers through an orientation towards employees (Plakoyiannaki et al., 2008). Therefore, the satisfaction of external customers could be achieved by satisfying internal customers in a CRM perspective. Top management commitment should include a smooth communication of CRM business objectives (Garrido-Moreno & Padilla-Meléndez, 2001).
Project management	Given, their wide impact, CRM projects require a thorough justification. Since classical appraisal techniques are outdated for this kind of projects (Wilson et al., 2007), Maklan et al. (2005) recommend to use real option within the business case for CRM investments. The team that plans and executes the project should have multidisciplinary skills (i.e. Mendoza et al., 2007), including knowledge about organizational processes (Da Silva and Rahimi, 2007).

Change management	Management of organizational transition, in terms of business processes, values and beliefs, corporate strategy according to the customer-centric orientation	Often, managers in a firm perceive the need for change but they do not invest resources for managing it (Chalmeta, 2006). In CRM implementations, top management should also encourage and motivate employees to share knowledge for, from, and about customers (Salomann et al., 2005).
Employees' involvement	Active participation of the employees in the whole CRM initiative	CRM programs require an "active participation of all employees stemming from employee motivation and task interdependencies" (Campbell, 2003, p. 380). Thus, organization-wide commitment (<i>i.e.</i> Kim, 2004; Zablah et al., 2004b) and employees' empowerment (Vazifehdust et al., 2012) are needed.
Education and training	Development of CRM-specific skills and knowledge for creating customer awareness and yielding value through CRM processes	Training programs should also include routines for identifying, creating and maintaining customer relationships (Saini et al., 2010). Cross-training among firm departments is relevant in order "to enhance employees' understanding and appreciation of other functional areas" (Campbell, 2003).
Endowment of resources	Tangible and intangible resources that are needed for supporting and developing the CRM initiatives	On the basis of our review, adequate financial commitment (<i>e.g.</i> Zablah et al., 2004a; Anderson et al., 2007) is the most cited resources requirement. Specific skills are also needed, for instance IT skills (<i>e.g.</i> Roh et al., 2005; Saini et al., 2010), staff social and communication skills (Sigala, 2005), skills in data analysis (Malthouse et al., 2013).
IT-processes alignment / Task-Technology Fit	Strategic alignment between CRM processes and pertinent tasks, and the technology supporting them	Findings by Raman et al. (2006) show that the fit between tasks performed by individuals and the technology that supports those tasks – that is Task-Technology Fit (TTF) by Goodhue & Thompson (1995) – may be a key organizational capability for transforming CRM tools into advantage-producing resource.
BPR	Redesign of existing business processes in order to achieve integration between them and the CRM strategy and process	According to Sen and Sinha (2011), IT alignment in CRM is dynamic and evolves during time because IT infrastructure in CRM involves both On-Line Transaction Processing (OLTP) and On-Line Analytical Processing, while most IT alignment literature focuses on OLTP systems only. "BPR can help firms to change their business processes from production-orientated to customer-oriented practices and thinking" (Chang, 2007, p. 505). Mishra & Mishra (2009) suggest to take into account a redesign of all the customer interaction points too.
Organizational culture and structure	Customer-centric redesign of organizational structure and culture towards creation and management of long-term customer relationships	The customer-focused structure should be flexible (Yim et al., 2004) and should consider a power redistribution for matching the new CRM processes (Chang, 2007). CRM practices should address organizational learning culture (Curry & Kkolou, 2004; Nguyen & Mutum, 2012) but without conflicting with the established culture (Mishra & Mishra, 2009).
Inter-functional collaboration / communication / integration	Active customer-centric cross-functional interaction	Interdepartmental two-way communication and collaboration towards CRM objectives (Garrido-Moreno & Padilla-Meléndez, 2011) foster customer-centric orientation of the firm. Departments and functions should work in an integrated way in a CRM perspective (Mendoza et al., 2007), sharing customer information and discussing about customer needs (Chang, 2007).
Reward system	Redesign of reward and incentive system to foster employees to share customer knowledge, to engage them in CRM activities, and to steer activities towards CRM objectives	Reward policy has to be consistent with CRM philosophy (Zablah et al., 2004b). The management must send "clear, unambiguous signals to employees regarding the reward system structure to achieve optimal results", combining individual and team evaluations (Cooper et al., 2008).
Experience	Previous experience in CRM and in processes affecting it	Findings by Garrido-Moreno and Padilla-Meléndez, 2011) show that previous CRM experience has a direct effect on subsequent CRM success. Similarly, according to Hart et al. (2004), using CRM tools and having experience in the corresponding strategy improve the ability of the firm in achieving effective results from that strategy.
	A moderate level of brick-and-mortar experience of firms before their online entry (approximately 12 years) and a moderate online experience compared to the first entrant in the industry (approximately 4.5 years) maximize customer satisfaction returns on CRM investments (Srinivasan & Moorman, 2005).	

4.2 Outcome of the content analysis

The output of the analysis consisted of ten word-trees (see figures from B.1 to B.10 in Appendix B), one for each keyword. Figures B.1-10 show their trimmed version, for a matter of both compactness and understandability. Given a main keyword in the middle of a word tree, blue underlined terms are the nearest occurrences of the second corresponding keyword that, according to the protocol in table 3, refers to the same logical node: for instance, figure B.1 concerns the keyword *Strategy* belonging to the *Strategic planning of CRM* logical node, and the blue word is *Needs*, which is the second keyword belonging to the same node. Instead, black underlined words are the nearest occurrences of the same keyword, *i.e.* figure B.2 is focused on the keyword *Needs*, and the same word occurs two times more in the same word tree. All the keywords have numerous branches, which means that their frequency within the corresponding papers is high. In detail, we discuss the results for each macro-category, as follows:

- *Strategic planning of CRM* (figures B.1 and B.2). This is the only case in which the co-occurrence of the two keywords does not show a high frequency within the proximity threshold. This is unexpected because the frequency of the two separate keywords does not seem low, and *strategy* and *needs* should be naturally linked because, usually, customer needs play a central role in CRM strategies (figure B.2). The reason for their distance within the papers may be that the selected scientific papers consider this link implicitly, and, according to figure B.1, they concern more focused aspects like the need of a cross-functional approach, information sharing, multi-channel strategy, integration, and so on, which are in line with the need for a long-term strategic orientation.
- *Infrastructure for IT in CRM* (figures B.3 and B.4). The branches show a strong logical relationship between technology and superior value creation for the customer and for the firm (figure B.4). Even though the words *hardware* and *software* are part of the definition of this macro-category, they do not occur in figure B.3. Despite this, the term *infrastructure* is quite recurrent within the papers, and it covers both of them, implicitly.
- *Insight and data management in CRM* (figures B.5 and B.6). The two word-trees point out a sound link between *knowledge* and *integration* in the papers. In line with the definition of the macro-category, *integration* is meant as "specific arrangements and management" of the data, which knowledge should be extracted from.
- *CRM project*. Given their general nature, *management* and *resources* show a huge frequency that led to numerous branches (figures B.7 and B.8). Yet, figure B.7 suggests that CRM requires a formal management of several aspects that are part of the project management: resource management, project championship, support from top management, involvement. In addition, the heterogeneity of the resources involved in CRM, like human, financial, tangible, intangible (figure B.8), is consistent with a holistic management of the CRM project complexity.
- *CRM and organizational impact*. Figures B.9 and B.10 contain explicit statements about the need for changes in both business processes and organizational structure in order to challenge a CRM initiative, or to pursue the customer orientation.

Globally, all the ten word-trees show that the content of the retained papers is consistent with the definition of the pertinent macro-categories. Therefore, it is licit to assume that the coherence check was positive, enhancing the soundness of both the literature review and the classification within the framework.

4.3 Big Data-enabled Customer Relationship Management

Drawing upon the evidences from the literature review and the content analysis, we formally elicited five propositions about the potential impact of a BD approach on the five categories of CRM CSFs. The propositions were developed by addressing the relationship with the corresponding CSFs, which were highlighted by their progressive number (see figure 4) between square brackets.

4.3.1 Strategic planning of Customer Relationship Management

A successful CRM initiative, aiming to value co-creation with customers [#2], requires a multi-channel holistic approach that should be integrated with the overall corporate strategy, and that should fit the market and geographical context [#4]. E-commerce systems collect less structured data (Chen, Chiang, & Storey, 2012) that, in the last few years, have become a competitive variable which cannot be neglected within a CRM strategy. Yet, we deem that any decision to harness BD sources should neither pertain to circumstances nor be occasional: a sound comprehension of the benefits and of what it is possible to achieve or not by means of BD in CRM must be embedded within the overall marketing strategy [#1]. This strategy design is mandatory in order to ascertain the right and reasonable expectations, and to clear out myths about what BD

could allow to achieve. In fact, a decision-making based only upon data might be a nonsense (Harford, 2014): efforts in doing analytics without a strategic business direction are likely to stall, and the inevitable outcomes could be squandered resources, and scepticism about the investment (Lavalle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011).

In addition, managers should strive to assess BD initiatives, and their usefulness, by setting appropriate metrics [#3] (Phillips-Wren, Iyer, Kulkarni, & Ariyachandra, 2015). The reason underpinning this requirement is that current measurement limitations entail difficulties in distinguishing returns to emerging data technologies from returns to traditional database systems (Tambe, 2014).

Accordingly, we state:

Proposition 1: *"CRM strategies should be enriched with a BD-led business direction, if applicable and relevant to the addressed market, in order to bridle the new data".*

4.3.2 Infrastructure for IT in Customer Relationship Management

Our literature review points out that *technological readiness* and *integration among different ISs* are two of the most widespread IT requirements in CRM implementations. In fact, IT is an acknowledged enabler of CRM processes, and this includes BD technologies. Thus, any BD-enabled initiative that aims to extract additional value from new data sources should not neglect [#5]:

- Systems integration; advanced visualization functions for singling out patterns within BD databases (Dutta & Bose, 2015);
- Coexistence of BD solutions with legacy analytics and warehousing technologies (Davenport & Dyché, 2013), which should be kept, and not removed, for supporting and fuelling the new ones (Lavalle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011);
- Check for issues like local optimums, transmission costs, and privacy concerns in aggregating distributed data sources for a centralized mining (Wu, Zhu, Wu, & Ding, 2014);

Then, we formulate:

Proposition 2: *"BD-enabled CRM should rely on a synergy between the additional BD technologies, with advanced data visualisation capabilities, and the existing analytics and data warehouses".*

4.3.3 Insight and data management in Customer Relationship Management

Like every data intensive process, CRM requires both integration / centralization of all the customer data into a *golden record*, that is, a single and univocal database, and appropriate collection, management, and exploitation of all the profitable information pulled out from such database. Nonetheless, an important caveat is that semi-structured and unstructured data, like those from social media, could definitely worsen data quality, and this could jeopardize the Veracity of the 5 Vs paradigm. Moreover, *"currently there is no acknowledged and efficient data model to handle Big Data"* since traditional data models are not able to manage the increased complexity (Wu, Zhu, Wu, & Ding, 2014). Data should be managed in order to pursue an alignment between the structure of the data source and the form of the new obtainable insight, privileging an effective visualisation for fostering information diffusion within the firm.

In line with propositions 1 and 2, we state [#6, 7]:

Proposition 3: *"Traditional customer data warehouses must fuel and be integrated with emergent BD warehousing technologies".*

4.3.4 Customer Relationship Management project

The decision to embed a BD initiative in a traditional CRM project may increase the overall management complexity because of severe issues in evaluating the potential benefits and the competitive value of the enhanced data availability, from both a tangible and intangible point of view. In order to mitigate these problems, an initial proof of concept for investigating, eliciting, and illustrating the benefits of the BD involvement before applying the new solutions to the current or reengineered business processes (Davenport & Dyché, 2013) may be a wary and necessary approach [#10]. The proof of concept should be part of a wider business case, which has to include structured statements about how BD should or could be harnessed. This suggestion is coherent with the necessity of designing and developing a pilot test of the important strategic assumptions in CRM projects, prompted by Curry & Kkolou (2004). Such tests should be performed by a cross-functional supporting team, which will likely uphold the whole BD-enabled CRM project, and that should possibly include data modelers and scientists [#13, 14] (Dutta & Bose, 2015).

Since an interdepartmental critical review of customer needs within a firm is relevant to CRM success (Chang, 2007), in our opinion the diffusion of the BD solutions should be fostered among all the departments of the company that wants to implement the new technologies [#12], and the needed project champion [#8] should endorse and facilitate this process. So, in line with Dutta & Bose (2015), we deem that stimulating prospective user acceptance towards the BD solutions is doubtlessly important, and it should be planned among the upstream CRM activities [#11].

In addition, firms that aim to deploy CRM initiatives that involve BD will struggle to attract and acquire the appropriate skills to take advantage of the BD tools, for instance advanced skills in extracting, structuring, and modelling data [#14]. BD scientists should also possess visual and verbal skills for explaining BD outcomes to executives (Davenport & Dyché, 2013), and a background in marketing (Leeflang, Verhoef, Dahlström, & Freundt, 2014) for supporting the development of successful fact-based marketing propositions (Verhoef & Lemon, 2013).

Thus, we state:

Proposition 4: *"BD-enabled CRM projects have to include a business case and pilot tests for dissipating the uncertainty around concrete objectives and potential benefits of the initiative".*

4.3.5 Customer Relationship Management and organizational impact

CRM needs for an organizational culture that is fit for the customer orientation. The decision to rely also on BD sources and tools in CRM requires further changes in both culture and incentive system. In fact, employees at all the levels in the firm should shift to a data-driven approach for harnessing the new data sources [#9, 17], and they should be incentivized to accept and to utilize the new tools [#19] (Dutta & Bose, 2015). These requirements are needed for achieving the best consistency with the way BD will be used in redefining the value propositions, and to obtain the desired benefits. Consequently, the typical BPR for CRM should be oriented towards an intensive use of BD analytics [#16] (Dutta & Bose, 2015; Tambe, 2014). The re-engineered processes should show a satisfactory fit with the already existing technologies and the new ones [#15], and previous experience in CRM initiatives [#20] could help in attaining the best fit.

A BD-oriented change management program should frame and underpin the required organizational and process redesign. For instance, according to the well-known ADKAR framework for change management, people involved in BD-enabled CRM should be: informed (Awareness) about the benefits of the initiative and all the other contents of the business case; motivated (Desire) to be involved in the change to a data-driven approach to CRM; skilled (Knowledge and Ability) for coping with the change starting from the "old" gut-feeling decision making; and active (Reinforcement) in supporting and strengthening the change. With the purpose of pursuing the needed holistic customer orientation, change management activities have to include a worthwhile inter-functional communication, collaboration, and integration [#18] that should continue and evolve even beyond the end of the CRM project, matching the overall CRM strategic and operational needs.

In order to cope with the heterogeneity of the data sources, it could be preferable to appoint a single leader that should be responsible for building up and managing all the analytic capabilities, in example a Chief Analytics Officer or a similar role [#17]. He should be supported by a staff that should encompass both conventional quantitative analysts and data scientists (Davenport & Dyché, 2013).

Therefore, we state:

Proposition 5: *"Organizational and process redesign in BD-enabled CRM should aim to a pervasive management and exploitation of all the kinds of data across the firm. The continuous inter-functional dialogue in a CRM perspective must facilitate the required change management and the attainment of the best fit between old and new technologies and the reengineered processes".*

5 Conclusions

This work is a first answer the research question *"How could Big Data affect Critical Success Factors of Customer Relationship Management initiatives from a holistic perspective?"*. In the following sub-sections, we discuss scientific and managerial implications of our findings, limitations of this work, and suggestions for potential future research.

5.1 Scholarly implications

From a scientific standpoint, this is a first attempt to explore the consistency between BD and CRM initiatives, a topic that is currently underestimated and underexplored. On the basis of the four

methodological steps, we deem that the exploitation of BD in CRM may not imply the introduction of new CSFs, but it will likely affect both formulation and management of the known ones, as hypothesized in the five propositions.

This work provides three contributions. First, scientific literature could benefit from our in-depth up-to-date review about CRM CSFs: past reviews (*i.e.* Croteau & Li, 2003; Mendoza, Marius, Pérez, & Grimán, 2007) are still valuable contributions, obviously, but they could lack the more comprehensive point of view stemming from over 10 additional years of academic research. Furthermore, to our best knowledge, no other review analysed a number of papers comparable to the body of works we considered. Second, the five propositions we formulated formally integrate the CRM and BD streams. In fact, although such streams offer a wealth of works, literature still lacks contributions dealing with how BD and CRM might interplay directly, trying to strip these opportunities of the fashion effect that imbue them: almost all the contributions that address the BD topic from a non-technical perspective (*i.e.* Fan, Lau, & Zhao, 2015; Rust & Huang, 2014) are not focused on CRM, and they only provide very limited insights about it. Third, in line with the previous contributions, and by building upon the process view of CRM, this paper lays the foundations for a new roadmap of research in CRM, that is, the BD-enabled CRM.

By contextualizing BD in the CRM process view we adopted, BD should not be considered as a completely new paradigm, but as a holistic management approach to CRM – a point of view that is consistent with the more general perspective on BD by Fosso Wamba, Akter, Edwards, Chopin, & Gnanzou (2015) – and its new technologies should be stripped of the fashion effect and should be objectively treated as innovative ICTs. Extending such considerations to a broader point of view, ICTs are a well-known enabling factor of other several relevant processes or projects, besides CRM. Consequently, by drawing upon the wide body of knowledge about such projects, and by framing BD as an enabling factor of these initiatives, it could be possible to understand how to concretely harness the potential of BD within a diversified ICT portfolio in an explorative way, and how its holistic impact could affect business practises with customers in a firm.

5.2 Managerial implications

From a practitioner perspective, by drawing upon those enabling factors that CRM and BD could likely share, the answer to our research question might pinpoint a potential way to harness BD, that is, the BD-enabled CRM. Unfortunately, the BD environment may be still surrounded by hype, and this could hamper identification and achievement of potential benefits stemming from BD initiatives. In this perspective, investments in pilot tests within the business processes of the firm may be even more valuable, for two reasons: for figuring out the needed changes, according to our propositions; and for taking distance from the fashion effect of BD by contextualizing these initiatives in a more tangible environment, clarifying the BD real potential. The decision to manage a BD-oriented initiative could make sense only if there is an unambiguous and holistic business direction underpinning it. Without it, the project will likely result in an escalation that can multiply doubts and uncertainties about such initiatives, and that will waste resources. Therefore, we strongly advise against plunging into a sea of data in order to find out something that, currently, is neither defined nor definable without a business case and aware pilot tests.

Notwithstanding, the concept of BD has spread fast, and firms should carefully figure out if they want and are able to keep the pace with it, and they should clarify the consequences, both positive and negative, of framing BD within their processes and strategies. For instance, according to Tambe (2014), investments in traditional database systems may remain more effective if managers do not want to face risks and costs for attracting the BD expertise. Waiting can be a reasonable strategy, keeping in mind that both costs of acquiring the needed skills, and the benefits achievable through a BD project should decrease over time.

5.3 Limitations and suggestions for further research

As is often the case, also this work suffers from some limitations. First, although it relies on a sound scientific base, this manuscript is conceptual in nature: a BD-enabled approach would require a further refinement and conceptualization of how BD could directly or indirectly affect the CRM inputs and outputs explicitly, for instance by formulating specific hypotheses. Second, the word tree methodology we used for the content analysis is still little applied for scientific purposes, and literature does not provide any guideline for its development. Thus, if on one side the word tree protocol we built might be considered as a reference for future applications, since it relies on both common sense and a reasonable logic, on the other side it should be extended and formalized for strengthening its validity.

Despite these limitations, this work sketches out the BD-enabled CRM concept that could be worth of further research. Therefore, as BD literature strongly lacks empirical works, we suggest three possible future

developments. First, it would be interesting to assess the effect of BD initiatives on CRM CSFs through a case study approach that, according to Yin (2014), would be a suitable exploratory research method in this context. Second, the insights emerging from one or more exploratory case studies could support formulation and test of specific hypotheses, laid on the propositions we presented, about the relationship between BD initiatives and CRM enabling factors to be tested. Alternatively, a third potential development is to replicate and extend this study into other contexts, different from the CRM one, in order to evaluate the generalizability of our statements about BD, and to evaluate if similar conclusions may be drawn.

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Appendix A

Table A.1 References of the literature review

Dimension of classification	References
CSF (citations out of total retained papers)	
Strategic planning of CRM	
CRM strategy (40)	Ahearne et al. (2012); Allen & Mcmenamin (2003); Anderson et al. (2007); Batenburg &

<i>CRM vision / Firm's orientation towards customer</i> (32)	Versendaal (2007); Bohling et al. (2006); Boulding et al. (2005); Bygstad (2003); Chalmeta (2006); Diffley & McCole (2015); Dimitriadis & Stevens (2008); Eichorn (2004); Eid (2007); Finnegan & Currie (2010); Frow et al. (2011); Kale (2004); Keramati et al. (2012); Kim (2004); Kivetz & Simonson (2003); Landry et al. (2005); Lee & Park (2005); Mendoza et al. (2007); Nguyen & Mutum (2012); Nguyen et al. (2007); Padmanabhan & Tuzhilin (2003); Pan & Lee (2003); Payne & Frow (2004, 2005); Peelen et al. (2009); Rapp et al. (2010); Rigby & Ledingham (2004); Roh et al. (2005); Ryals (2005); Sin et al. (2005); Steel et al. (2013); Tamošiūniene & Jasilioniene (2007); Tanner et al. (2005); Vazifehdust et al. (2012); Verhoef (2003); Woodcock et al. (2011); Zablah et al. (2004a);
<i>Evaluation and monitoring</i> (23)	Boulding et al. (2005); Chalmeta (2006); Chang (2007); Coltman (2007); Da Silva & Rahimi (2007); Eid (2007); Garrido-Moreno et al. (2015); Garrido-Moreno & Padilla-Meléndez (2011); Jan & Abdullah (2014); Javalgi et al. (2005); Jayachandran et al. (2005); Kale (2004); Keramati et al. (2012); King & Burgess (2008); Lüneborg & Nielsen (2003); Nguyen & Mutum (2012); Pan & Lee (2003); Peelen et al. (2009); Raman et al. (2006); Rapp et al. (2010); Reinartz et al. (2004); Sen & Sinha (2011); Shang & Lin (2010); Sin et al. (2005); Steel et al. (2013); Teo et al. (2006); Trainor et al. (2014); Vazifehdust et al. (2012); Wang & Feng (2012); Woodcock et al. (2011); Zablah et al. (2004a, 2004b);
<i>Context</i> (5)	Anderson et al. (2007); Boulding et al. (2005); Chalmeta (2006); Cooper et al. (2008); Curry & Kkolou (2004); Da Silva & Rahimi (2007); Eid (2007); Frow et al. (2011); Garrido-Moreno & Padilla-Meléndez (2011); Keramati et al. (2012); Malthouse et al. (2013); Mendoza et al. (2007); Mishra & Mishra (2009); Nguyen et al. (2007); Pan & Lee (2003); Payne & Frow (2005); Peelen et al. (2009); Rigby & Ledingham (2004); Shanks et al. (2009); Vazifehdust et al. (2012); Woodcock et al. (2011); Zablah et al. (2004a, 2004b);
Infrastructure for IT in CRM	
<i>Information Technology</i> (44)	Ahn et al. (2003); Anderson et al. (2007); Avlonitis & Panagopoulos (2005); Becker et al. (2009); Chang (2007); Croteau & Li (2003); Curry & Kkolou (2004); Da Silva & Rahimi (2007); Eid (2007); Ferguson et al. (2004); Garrido-Moreno et al. (2014, 2015); Garrido-Moreno & Padilla-Meléndez (2011); Harrigan et al. (2011); Hasanian et al. (2015); Jan & Abdullah (2014); Javalgi et al. (2005); Keramati et al. (2012); Kim & Pan (2006); Kim (2004); King & Burgess (2008); Landry et al. (2005); Lindgreen & Antiocho (2005); Mack et al. (2005); Malthouse et al. (2013); Mendoza et al. (2007); Mishra & Mishra (2009); Osarenkhoe & Bennani (2007); Pan & Lee (2003); Payne & Frow (2005); Rapp et al. (2010); Roh et al. (2005); Salomann et al. (2005); Shum et al. (2008); Sin et al. (2005); Teo et al. (2006); Trainor et al. (2014); Tuzhilin (2012); Vazifehdust et al. (2012); Vella & Caruana (2012); Wang & Feng (2012); Woodcock et al. (2011); Yim et al. (2004); Zablah et al. (2004a);
Insight and data management in CRM	
<i>Knowledge management</i> (19)	Croteau & Li (2003); Arnett and Badrinarayanan (2005); du Plessis & Boon (2004); Garrido-Moreno et al. (2014, 2015); Garrido-Moreno & Padilla-Meléndez (2011); Hasanian et al. (2015); Jordan (2003); King & Burgess (2008); Lin et al. (2006); Osarenkhoe & Bennani (2007); Salomann et al. (2005); Shang & Lin (2010); Sin et al. (2005); Tanner et al. (2005); Vazifehdust et al. (2012); Xu & Walton (2005); Yim et al. (2004); Zablah et al. (2004a);
<i>Customer data management</i> (28)	Anderson et al. (2007); Campbell (2003); Chalmeta (2006); Chang (2007); Dimitriadis & Stevens (2008); Eichorn (2004); Frow et al. (2011); Harrigan et al. (2011); Jan & Abdullah (2014); Kale (2004); Keramati et al. (2012); Kim (2004); Landry et al. (2005); Lindgreen & Antiocho (2005); Mendoza et al. (2007); Mishra & Mishra (2009); Öztaysi et al. (2011); Padmanabhan & Tuzhilin (2003); Pan & Lee (2003); Payne & Frow (2005); Roh et al. (2005); Salomann et al. (2005); Sin et al. (2005); Tanner et al. (2005); Teo et al. (2006); Tuzhilin (2012); Vazifehdust et al. (2012); Zablah et al. (2004b);
CRM project	
<i>Presence of a CRM champion</i> (9)	Allen & Mcmenamin (2003); Garrido-Moreno et al. (2014); Kim & Pan (2006); Kim (2004); Saini et al. (2010); Steel et al. (2013); Teo et al. (2006); Vazifehdust et al. (2012); Zablah et al. (2004b);
<i>Leadership / commitment from top management</i> (35)	Allen & Mcmenamin (2003); Bohling et al. (2006); Campbell (2003); Chalmeta (2006); Chang (2007); Croteau & Li (2003); Curry & Kkolou (2004); Da Silva & Rahimi (2007); Eid (2007); Garrido-Moreno et al. (2014, 2015); Garrido-Moreno & Padilla-Meléndez (2011); Kale (2004); Keramati et al. (2012); Kim & Pan (2006); King & Burgess (2008); Malthouse et al. (2013); Mendoza et al. (2007); Mishra & Mishra (2009); Osarenkhoe & Bennani (2007); Pan & Lee (2003); Papadopoulos et al. (2012); Peelen et al. (2009); Plakoyiannaki et al. (2008); Rigby & Ledingham (2004); Roh et al. (2005); Saini et al. (2010); Sen & Sinha (2011); Shum et al. (2008); Tamošiūniene & Jasilioniene (2007); Teo et al. (2006); Vazifehdust et al. (2012); Woodcock et al. (2011); Xu & Walton (2005); Zablah et al. (2004b);
<i>Project management</i> (18)	Anderson et al. (2007); Bohling et al. (2006); Bygstad (2003); Chalmeta (2006); Curry & Kkolou (2004); Da Silva & Rahimi (2007); Dimitriadis & Stevens (2008); Eid (2007); Kim

	& Pan (2006); Kim (2004); Maklan et al. (2005); Mendoza et al. (2007); Mishra & Mishra (2009); Papadopoulos et al. (2012); Plouffe et al. (2004); Rahimi & Berman (2009); Wilson et al. (2007); Zablah et al. (2004b);
<i>Change management</i> (17)	Bohling et al. (2006); Bygstad (2003); Chalmeta (2006); Dimitriadis & Stevens (2008); Eid (2007); Kale (2004); Keramati et al. (2012); Kim & Pan (2006); Kim (2004); Landry et al. (2005); Mishra & Mishra (2009); Rigby & Ledingham (2004); Salomann et al. (2005); Sen & Sinha (2011); Tamošiūniene & Jasilioniene (2007); Woodcock et al. (2011); Zablah et al. (2004b);
<i>Employees' involvement</i> (16)	Bygstad (2003); Campbell (2003); Chalmeta (2006); Chang (2007); Garrido-Moreno et al. (2014, 2015); Kim & Pan (2006); Kim (2004); Mendoza et al. (2007); Mishra & Mishra (2009); Pass et al. (2004); Shang & Lin (2010); Shum et al. (2008); Vazifehdust et al. (2012); Yim et al. (2004); Zablah et al. (2004b);
<i>Education and training</i> (25)	Campbell (2003); Chalmeta (2006); Chang (2007); Curry & Kkolou (2004); Dimitriadis & Stevens (2008); Eid (2007); Garrido-Moreno et al. (2014, 2015); Garrido-Moreno & Padilla-Meléndez (2011); Kale (2004); Kim et al. (2010); Kim (2004); Landry et al. (2005); Lindgreen & Antiooco (2005); Osarenkhoe & Bennani (2007); Papadopoulos et al. (2012); Raman et al. (2006); Saini et al. (2010); Shang & Lin (2010); Shum et al. (2008); Sigala (2005); Vazifehdust et al. (2012); Woodcock et al. (2011); Yim et al. (2004); Zablah et al. (2004b);
<i>Endowment of resources</i> (15)	Anderson et al. (2007); Curry & Kkolou (2004); Da Silva & Rahimi (2007); Diffley & McCole (2015); Keramati et al. (2012); Kim & Pan (2006); Malthouse et al. (2013); Papadopoulos et al. (2012); Roh et al. (2005); Saini et al. (2010); Sigala (2005); Sin et al. (2005); Vazifehdust et al. (2012); Zablah et al. (2004a, 2004b);
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CRM and organizational impact	
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<i>IT-processes alignment / Task-Technology Fit</i> (17)	Allen & Mcmenamin (2003); Brohman et al. (2003); Campbell (2003); Javalgi et al. (2005); Kim (2004); Nguyen & Mutum (2012); Pan & Lee (2003); Papadopoulos et al. (2012); Raman et al. (2006); Rapp et al. (2010); Rigby & Ledingham (2004); Roh et al. (2005); Sen & Sinha (2011); Shanks et al. (2009); Tamošiūniene & Jasilioniene (2007); Woodcock et al. (2011); Zablah et al. (2004b);
<i>BPR</i> (20)	Allen & Mcmenamin (2003); Bohling et al. (2006); Boulding et al. (2005); Bygstad (2003); Chalmeta (2006); Chang (2007); Dimitriadis & Stevens (2008); Ferguson et al. (2004); Kale (2004); King & Burgess (2008); Landry et al. (2005); Lindgreen & Antiooco (2005); Mishra & Mishra (2009); Raman et al. (2006); Ramaseshan et al. (2006); Ramaseshan et al. (2006); Rigby & Ledingham (2004); Tamošiūniene & Jasilioniene (2007); Teo et al. (2006); Trainor et al. (2014); Zablah et al. (2004b);
<i>Organizational culture and structure</i> (38)	Becker et al. (2009); Bygstad (2003); Chang (2007); Curry & Kkolou (2004); Diffley & McCole (2015); Dimitriadis & Stevens (2008); Eichorn (2004); Eid (2007); Garrido-Moreno & Padilla-Meléndez (2011); Hart et al. (2004); Hasanian et al. (2015); Iriana et al. (2013); Jayachandran et al. (2005); Keramati et al. (2012); King & Burgess (2008); Mack et al. (2005); Malthouse et al. (2013); Mishra & Mishra (2009); Nguyen & Mutum (2012); Raman et al. (2006); Ramaseshan et al. (2006); Reinartz et al. (2004); Roh et al. (2005); Shang & Lin (2010); Shum et al. (2008); Sigala (2005); Sin et al. (2005); Steel et al. (2013); Tamošiūniene & Jasilioniene (2007); Tanner et al. (2005); Trainor et al. (2014); Vazifehdust et al. (2012); Wang & Feng (2012); Wilcox & Gurău (2003); Woodcock et al. (2011); Xu & Walton (2005); Yim et al. (2004);
<i>Inter-functional collaboration / communication / integration</i> (17)	Boulding et al. (2005); Bygstad (2003); Campbell (2003); Chang (2007); Cooper et al. (2008); Curry & Kkolou (2004); Da Silva & Rahimi (2007); Arnett & Badrinarayanan (2005); Eichorn (2004); Garrido-Moreno & Padilla-Meléndez (2011); King & Burgess (2008); Mack et al. (2005); Mendoza et al. (2007); Osarenkhoe & Bennani (2007); Shum et al. (2008); Yim et al. (2004); Zablah et al. (2004b);
<i>Reward system</i> (16)	Campbell (2003); Chang (2007); Cooper et al. (2008); Dimitriadis & Stevens (2008); Garrido-Moreno et al. (2014, 2015); Garrido-Moreno & Padilla-Meléndez (2011); Keramati et al. (2012); Kim et al. (2010); Landry et al. (2005); Reinartz et al. (2004); Shang & Lin (2010); Sigala (2005); Wang & Feng (2012); Yim et al. (2004); Zablah et al. (2004b);
<i>Experience</i> (5)	Allen & Mcmenamin (2003); Garrido-Moreno & Padilla-Meléndez (2011); Hart et al. (2004); Srinivasan & Moorman (2005); Steel et al. (2013);
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Appendix B



Figure B.1 Word tree of the keyword *Strategy*



Figure B.2 Word tree of the keyword *Needs*

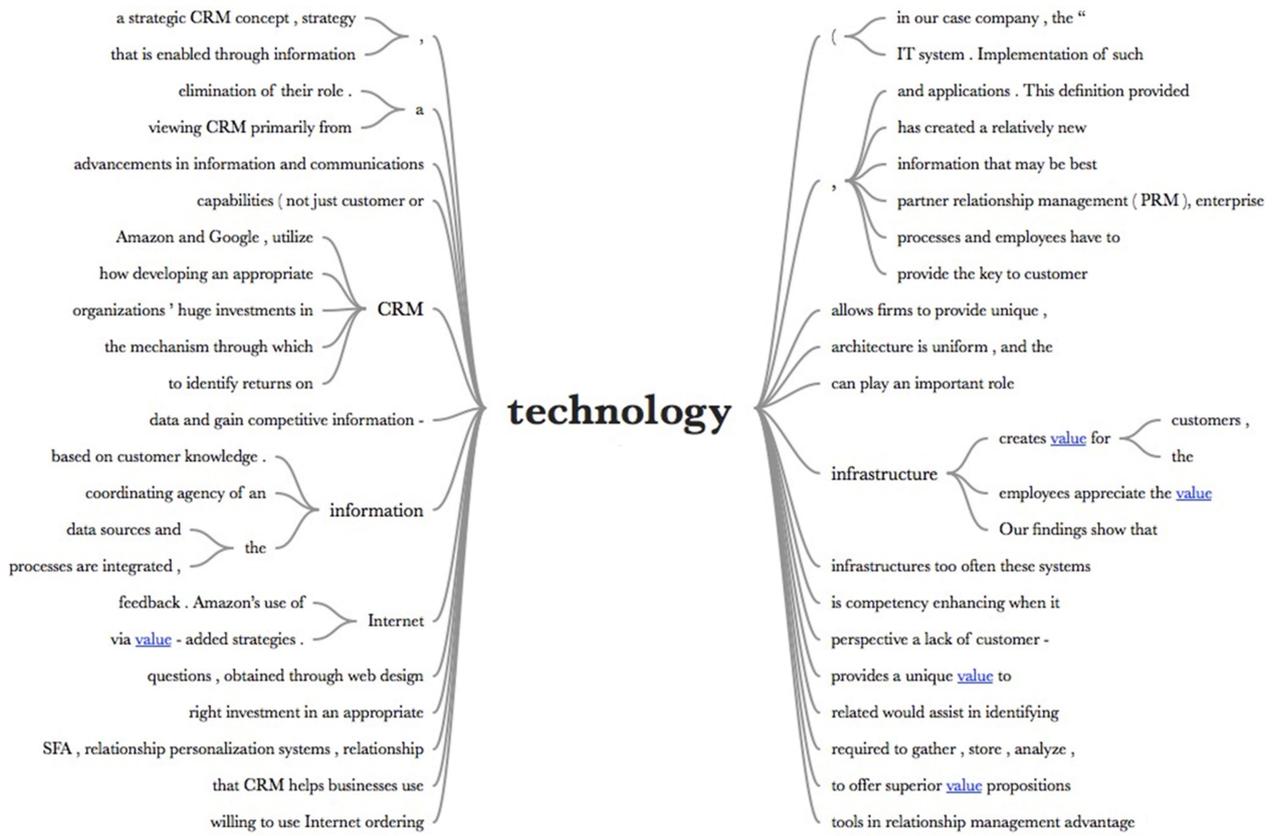


Figure B.3 Word tree of the keyword *Technology*

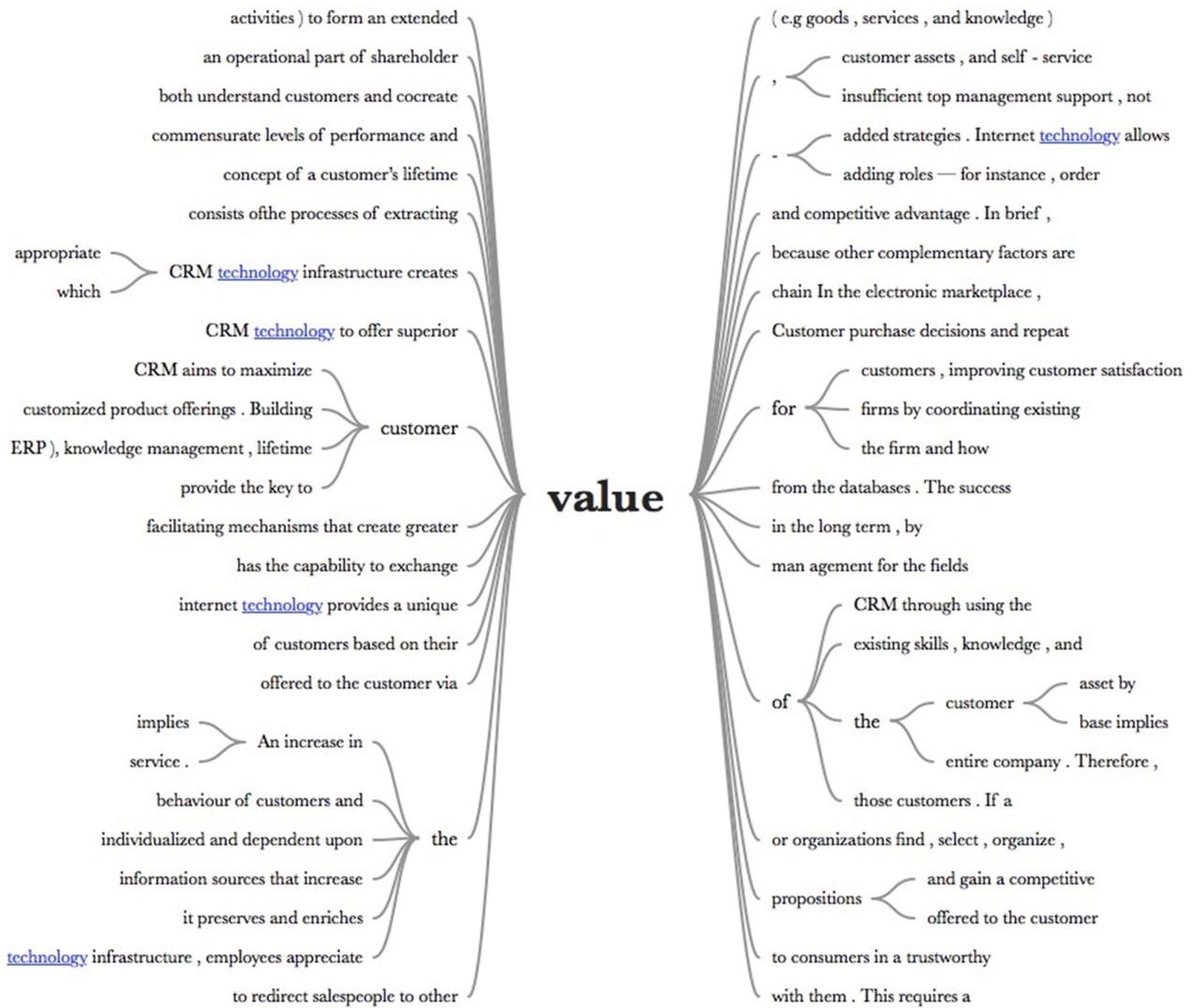


Figure B.4 Word tree of the keyword *Value*

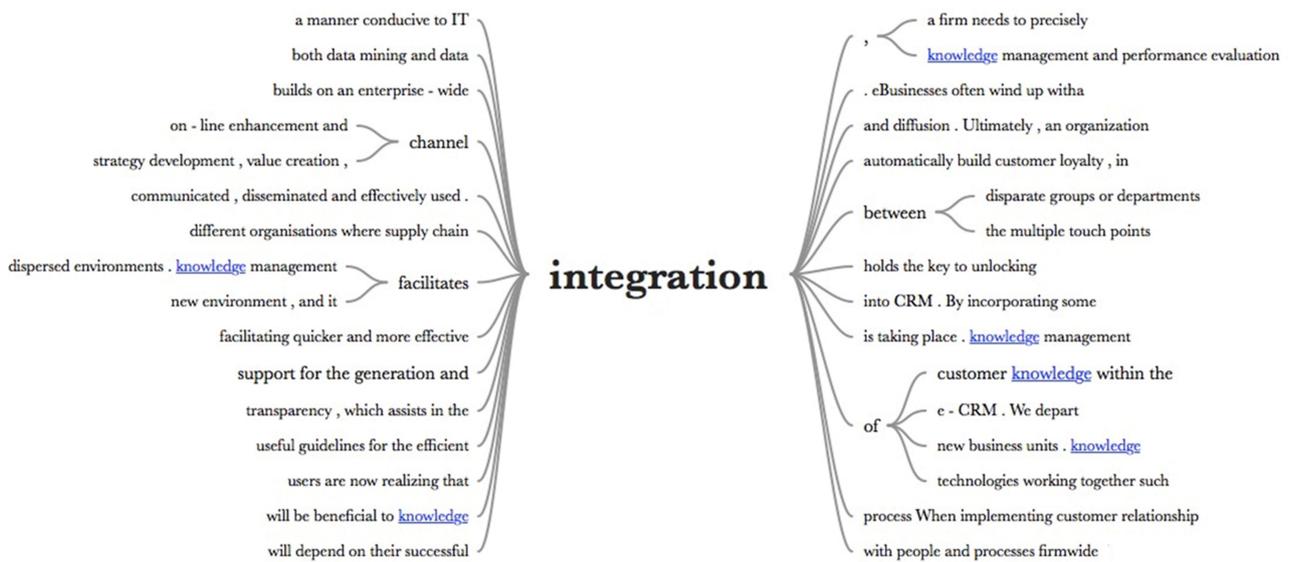


Figure B.5 Word tree of the keyword *Integration*

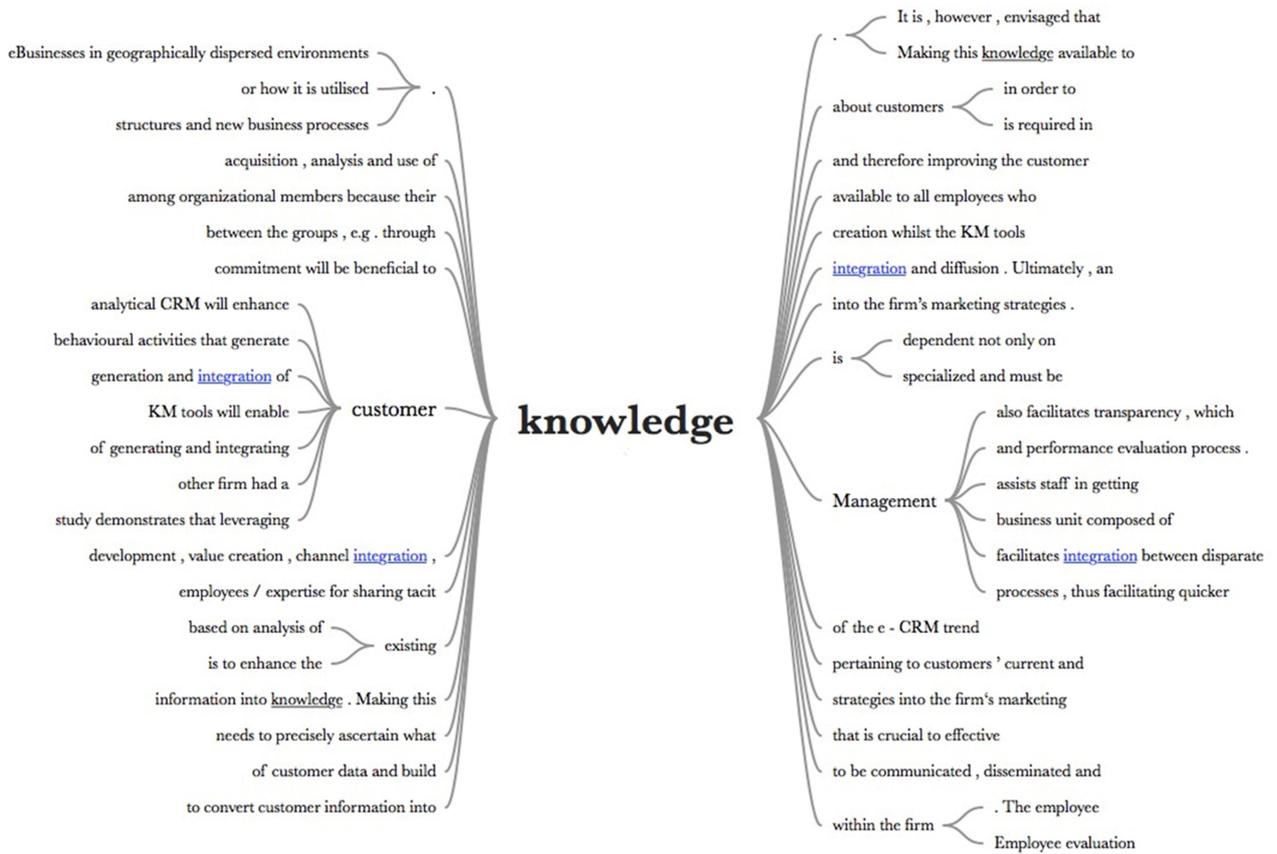


Figure B.6 Word tree of the keyword *Knowledge*

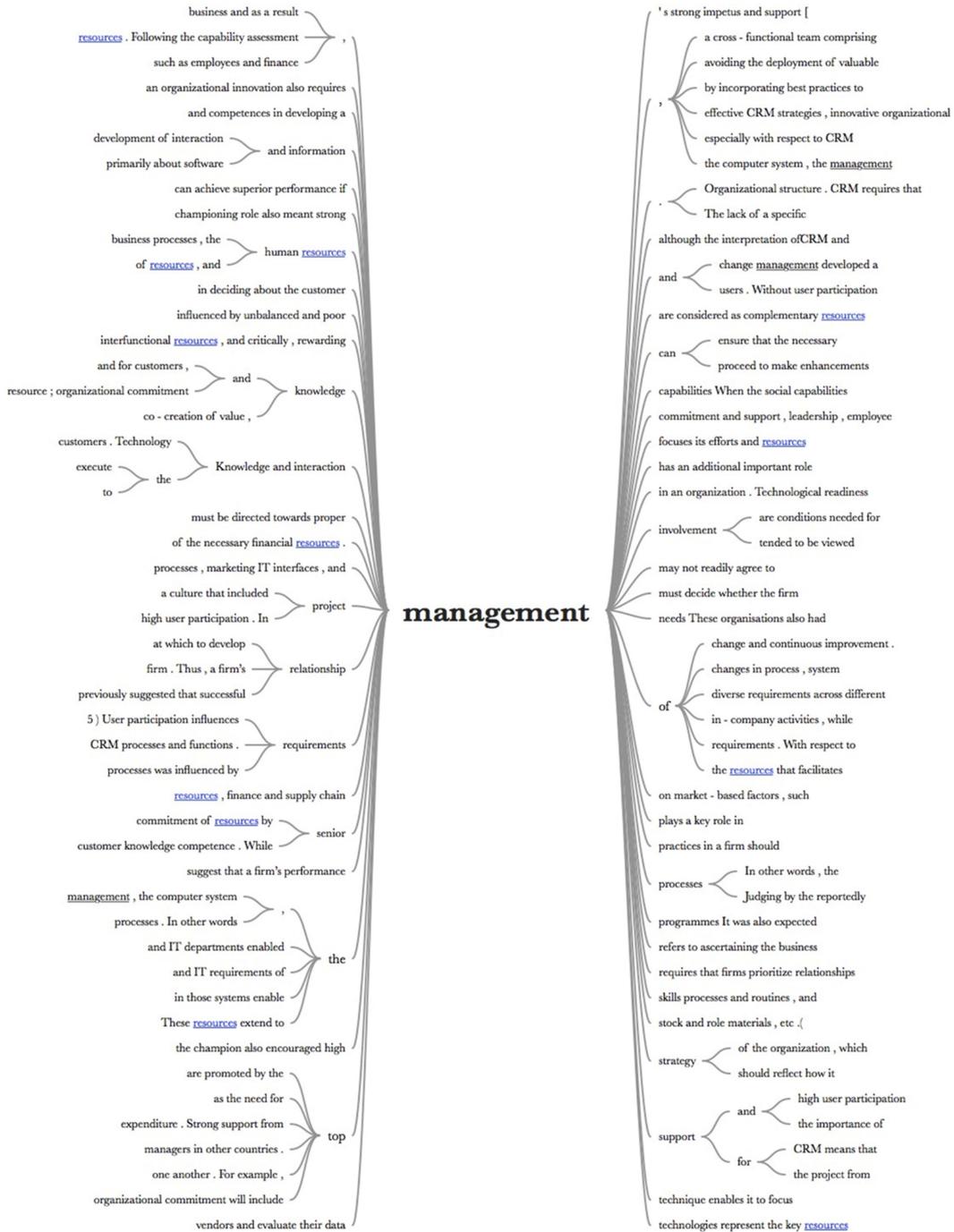


Figure B.7 Word tree of the keyword *Management*

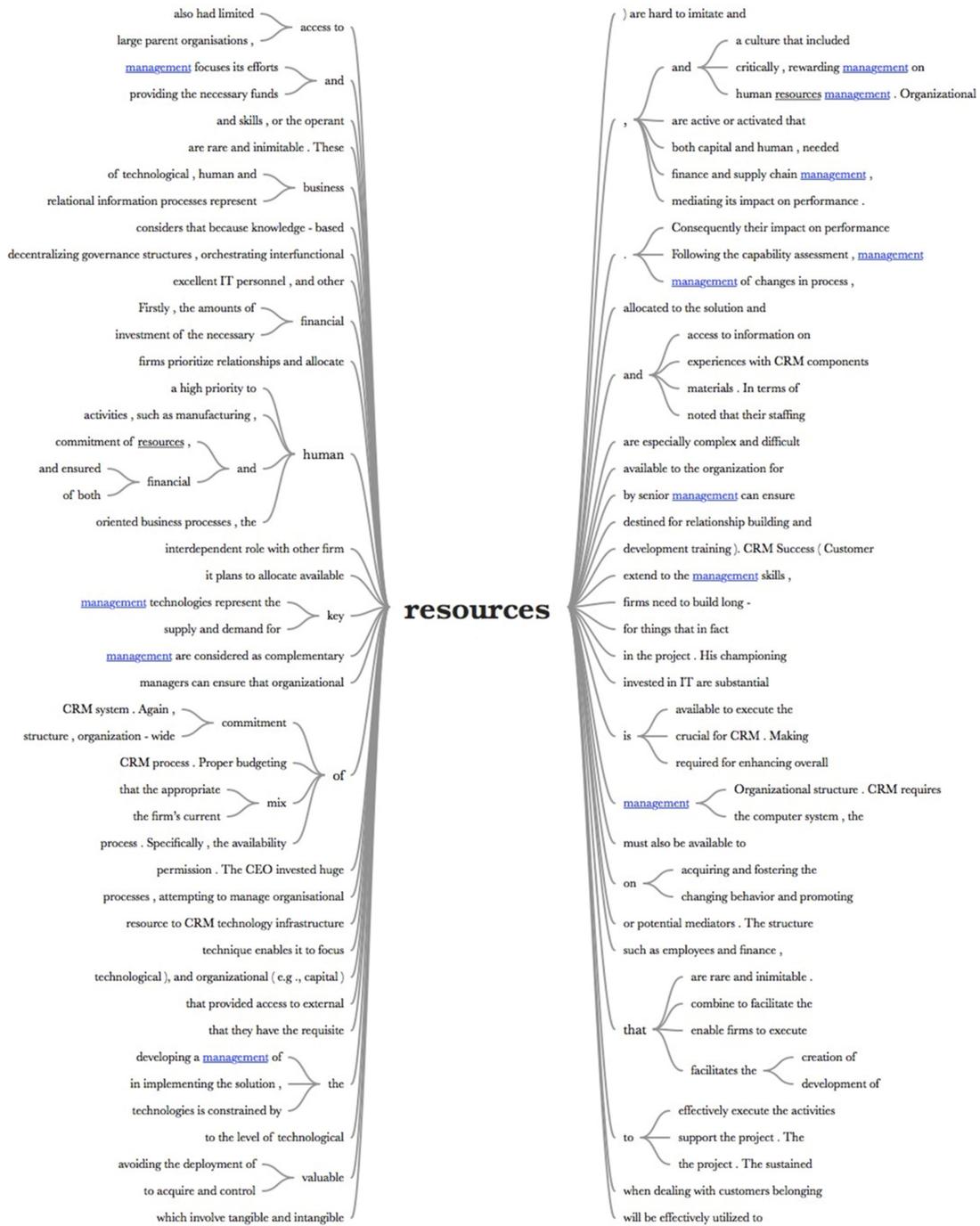


Figure B.8 Word tree of the keyword *Resources*

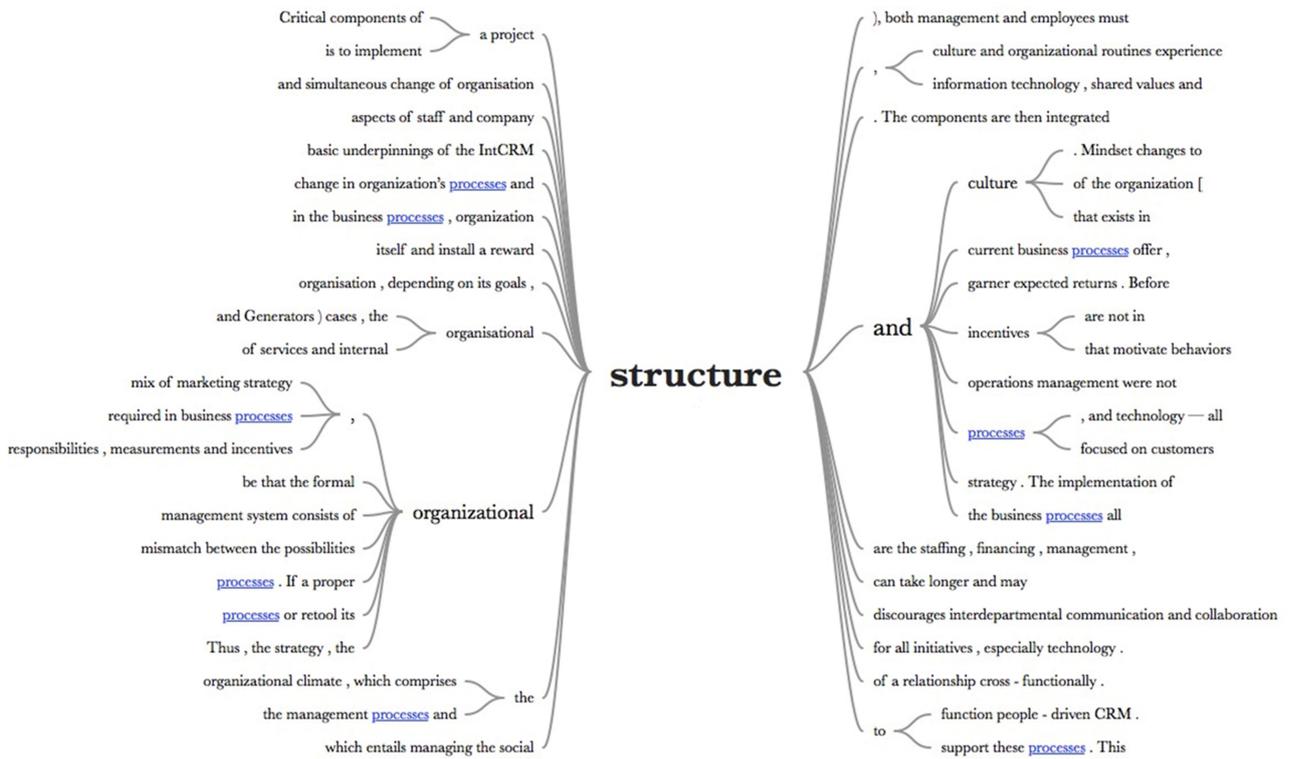


Figure B.9 Word tree of the keyword *Structure*

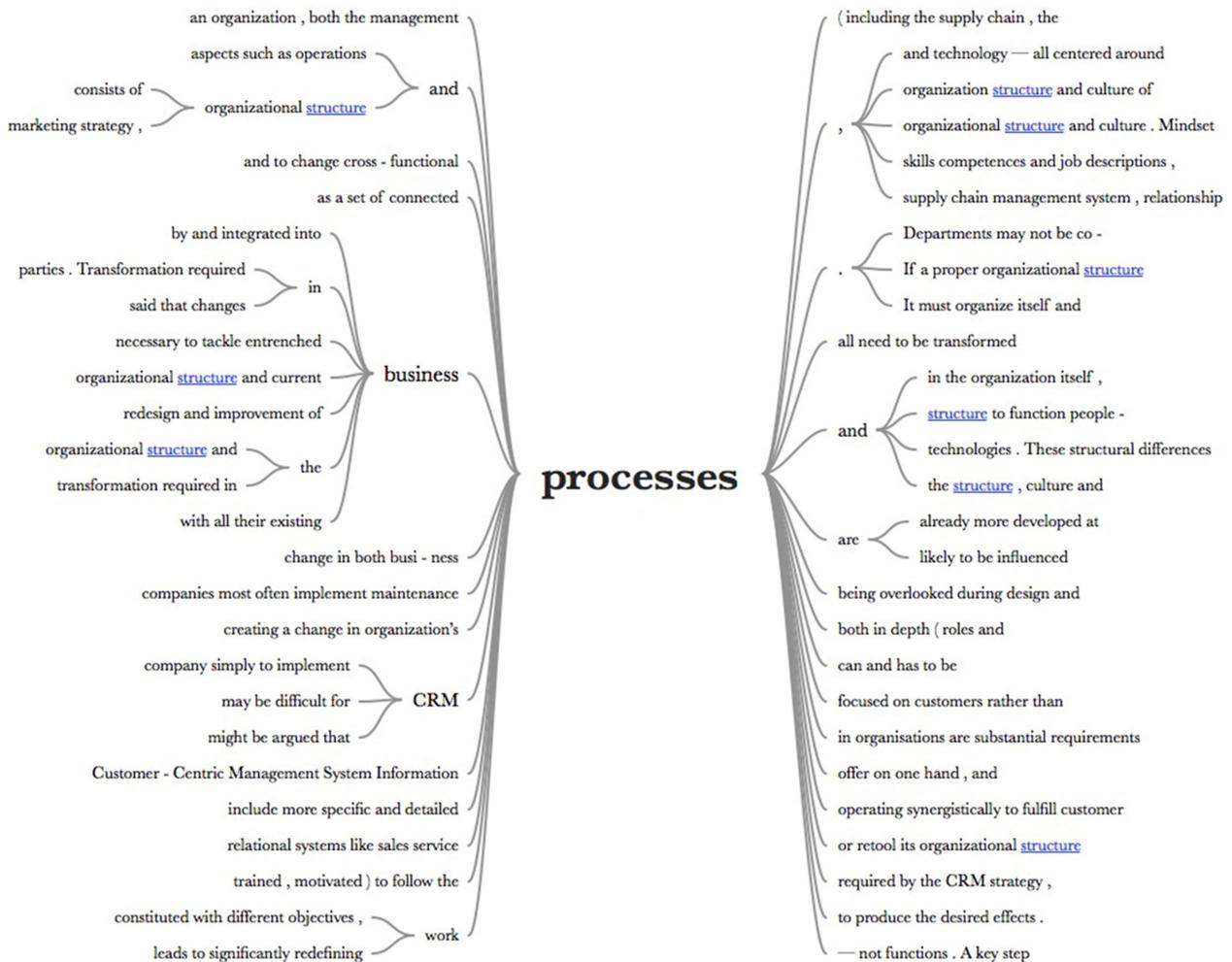


Figure B.10 Word tree of the keyword *Processes*