Chapter 6

# Business Intelligence: An Innovative Technological Way to Influence Corporate Entrepreneurship

Reyes Giménez-Figueroa, Rodrigo Martín-Rojas and Víctor Jesús García-Morales

Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/intechopen.70538

**Abstract**

Adaptation to dynamism and complex environments in today's Knowledge Society is key for firms to survive and improve their positions. This paper applies business intelligence (BI) to the firm to shape its organizational design and improve its performance. The paper also relates business intelligence to organizational performance management through organizational learning (OL), knowledge management (KM) and the technological competencies of the company's employees and managers. Theoretical study of the main current research serves as the basis for the development of several propositions to fill the gaps in knowledge of business intelligence. Finally, the paper presents conclusions about application of business intelligence in firms.

**Keywords:** business intelligence, corporate entrepreneurship, knowledge management, organizational learning, technological capabilities, organizational performance

## 1. Introduction

The current environment is very hostile and dynamic for firms. Firms have numerous competitors struggling to achieve strong market positions. Organizations are therefore looking for tools to strengthen their customer outreach as well as innovative organizational designs to obtain more benefits [1].

Firms must thus continually update their knowledge on change occurring within firm, through initiatives such as information mobility or cloud computing. Such initiatives enable employees and managers to have constant connection with each other and with stakeholders and full access to all information obtained directly by the company to make better decisions [2].

These initiatives are producing innovative forms of entrepreneurship in firms, modifying their organizational design to obtain higher revenues. Our chapter focuses on the potential of business intelligence (BI) to improve corporate entrepreneurship (CE) by allowing firms to acquire knowledge that enables better decision making.

Given the importance BI is achieving in today's society and the limited scholarly literature connecting BI directly to business management, this study will focus on: (1) determining guidelines for artificial intelligence that relate it to BI; (2) presenting some BI tools that improve entrepreneurship; and (3) developing a series of propositions to improve business performance through innovative CE obtained with the aid of BI and its influence on each of the concepts analyzed in this study.

BI originates in the application of new technologies to business [1, 3, 4]. Together, business applications and technological infrastructure have produced the concept of technological entrepreneurship [5]. Technological entrepreneurship is part of CE, specifically, the part involving technological and process-innovative activities. We can thus view technological entrepreneurship as an innovative form of entrepreneurship that plays an important role in developed economies, as well as in the performance and revitalization of economies [5].

This paper develops the concept of technological entrepreneurship as an innovative form of CE. We venture to combine the concepts of "innovation" and "entrepreneurship" to define innovative CE. The OSLO Manual OECD [6] defines innovation as the implementation of a new or significantly improved product (good or service) or process, a new marketing method or a new organizational method in business practices, workplace organization or external relations." Entrepreneurs "are those business persons and owners who seek to generate value through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets" [7]. Combining entrepreneurship and innovation generates innovative entrepreneurship that materializes in innovative CE in the company as a whole: new firms based on new innovative ideas ([8], p. 2). Innovative entrepreneurship is the key to economic well-being and growth [9].

To achieve these goals, the first section establishes the theoretical framework. This section provides a brief description of BI, which is based fundamentally on artificial intelligence algorithms, neural networks and the research propositions developed from them. The methodology section then explains the analytical procedure used. Finally, the results and conclusions section presents the most significant conclusions, implications, limitations and lines for future research derived from this chapter.

## 2. Theoretical framework

The BI construct is a compound of several components of the firm. To involve every employee of the organization in the BI, this study focuses on three of these components at each level of the organizational hierarchy: operations, lower managers, and top managers.

http://dx.doi.org/10.5772/intechopen.70538

Since BI is increasingly important to the decision making and changes that firms undertake to surpass competitors and gain competitive advantages, BI can be seen as an innovative form of entrepreneurship.

We will thus study BI as a promoter of knowledge management (KM hereafter), organizational learning (OL here after) and technological capabilities (TC hereafter) within the firm. We will then relate these three distinctive concepts of contemporary firms to CE to determine the latter's influence on organizational performance and possible new designs that originate in BI.

### 2.1. The concept of business intelligence

BI is an interactive process for exploring and analyzing structured information on an area (usually stored in a "data warehouse") to discover tendencies or patterns from which to derive ideas and conclusions [10, 11]. To perform a rigorous study, one must take into account that the data alone do not provide any information. The following pyramid shows the stages of data transformation that must occur for decision making and the relative value of these stages to the firm (**Figure 1**).

At the lowest level are the data, which taken alone are useless to the firm. The next level, information, is of some importance because it involves processed data. The highest level, knowledge, represents the goal to be achieved following analysis of the data and their transformation into information [3, 4, 10]. Using knowledge analysis, firms can anticipate future events to make more accurate decisions and compete with other organizations. The steps to be followed are thus: data, information, knowledge, and finally assimilated knowledge [13]. The process by which data are transformed into knowledge is shaped by the data sources. It is important to remember that transformation of data into information and then knowledge to be applied to a business plan or strategy [11] is determined by artificial intelligence through intelligent agents [4, 14, 15].

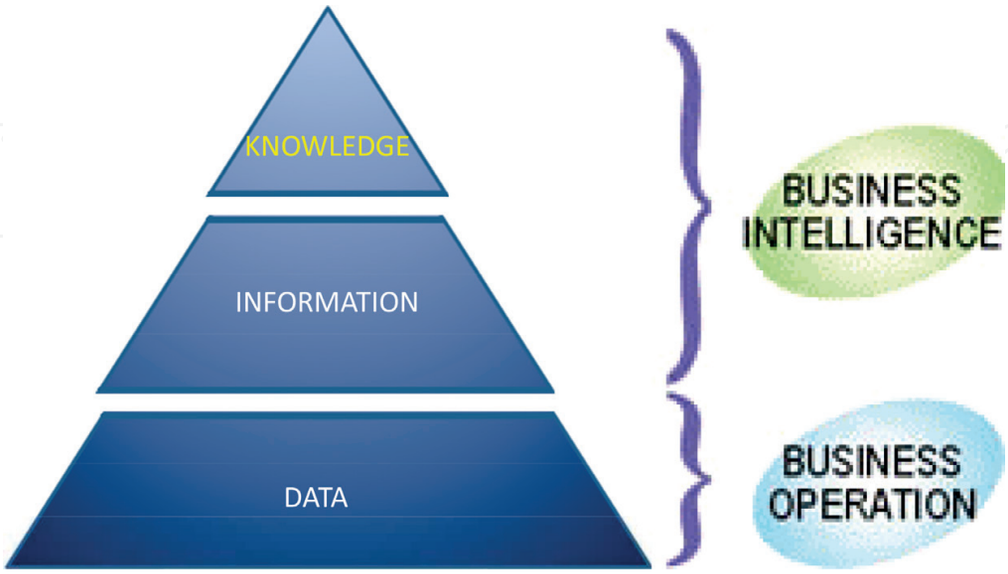


**Figure 1.** Transformation of data for decision-making. Source: Davenport and Prusak [12].

An intelligent agent is defined as "any system located in an environment that can perceive the surrounding medium and act based on that medium using a series of actuators, i.e., elements that react to the perception of a change to perform an action" ([16], p. 14). As intelligent agents have received much study in relation to KM and twenty first century decision-making technology [17], we can relate artificial intelligence as a form of innovation in entrepreneurship through technology.

Having analyzed the intelligent agents, we stress that they form part of artificial intelligence [18], the capability of machines to perform actions by simulating intelligent behavior, based on experience and study of the environment [14, 16]. If we consider artificial intelligence as a fundamental component of BI [17, 19], both enable the materialization of firms' practical data as knowledge, favoring the firm's entrepreneurship and development [20, 21].

BI is thus increasingly crucial in making good decisions to respond to the rapid and substantial changes occurring in firms [19]. Because BI originates in the firm's technology, we can speak of BI as a form of innovative or technological entrepreneurship in the firm.

### 2.2. Business components of BI

BI can materialize in several components of the firm [19]. We study three of these, one for each level of the business hierarchy pyramid [22]. Our goal is to show that BI affects all parts of the organization (**Figure 2**). We choose the components most influential in the business world for improving firms' decision-making and efficiency, as well as the components that are enabling the greatest development of artificial intelligence and thus of BI [19]. At the bottom of the pyramid, we find employees' decisions and a series of tools used for them, such as enterprise resource planning (ERP) and customer relations management (CRM), tailored applications, data warehouses, and data mining—the tools discussed in this study. At the middle level of the pyramid, we find the analysts, who also possess a series of tools, such as the decision support system (DSS), which we will explain here, and the executive information system (EIS). Finally, at the tip of the pyramid, we find the top management, who use the balanced scorecard (BS).

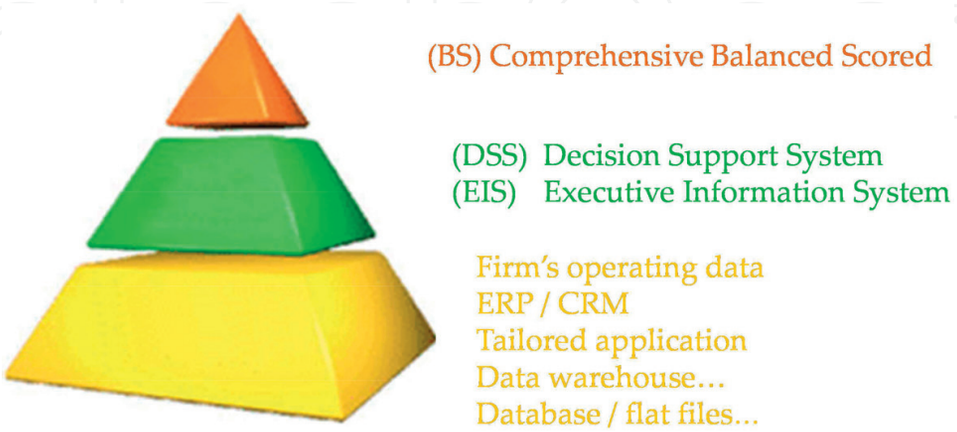


**Figure 2.** Pyramid of BI tools based on level in firm. Source: Sinnexus [19].

#### *2.2.1. Balanced scorecard (BS)*

Since the BS is at the tip of the pyramid, this BI tool can be used to monitor the evolution of the firm's procedures, analysis and activities strategically, with focus on the different areas of the firm [23]. As defined by Kaplan and Norton [23] is a revolutionary tool to mobilize people to fulfill the company's mission by channeling the energies, abilities and specific knowledge held by people throughout the organization toward achieving long-term strategic goals. It thus enables both direction of both current and future performance.

Organizations decide which dashboard to use based on financial indicators (income and expenses), nonfinancial or intangible assets, learning development, relations with stakeholders, capabilities or competencies, etc.

#### *2.2.2. Decision support system*

The DSS is a BI tool that has a series of reports that can be navigated, managed, and structured to lead to analysis of the firm's data. DSS has a set of important characteristics: dynamic, flexible, interactive reports that change as the firm's data change; no need for technical knowledge; quick response; integration of all systems/departments in the company; availability of the right information to each user according to profile; and availability of historic information.

#### *2.2.3. Data mining*

Data mining emerged to explore large quantities of data with the help of statistical techniques and a series of search algorithms based on neural networks of artificial intelligence.

Since data mining searches for patterns in data, this tool will achieve more extensive information on customers, thereby reducing marketing costs and achieving retention of current customers. Further, such detailed information into account enables more accurate decision-making.

### 2.3. Influence of BI on KM and OL based on technology and TC

#### *2.3.1. Knowledge management*

According to Nonaka and Takeuchi [24], knowledge can be viewed in two ways. When viewed as static (stock), knowledge is usually called intellectual capital. A dynamic view of knowledge stresses knowledge flows composed of OL and KM. The field of knowledge as static has received extensive study over the years [12, 24, 25], but the dynamic view has not been treated in depth. This study thus focuses on knowledge as dynamic, since firms are continually changing and knowledge must be dynamic to enable them to face events that arise and demand OL processes in the firm.

KM and OL provide a dynamic image of intellectual capital reconceived knowledge flows [26].

To gain a position among the best firms, it is important to know how to manage knowledge. From the dynamic perspective, a good definition of KM is "the firm's capability to foster and drive all of its competencies and capabilities" [26]. Bueno Campos ([27], p. 17) defines it as "the function that plans, coordinates and controls knowledge flows that occur in the firm relative to its activities and environment in order to create certain essential competencies."

The firm must manage and strengthen its knowledge, strengthening that knowledge both in its different phases of acquisition, storage, transfer and use, and in the process by which the firm generates new knowledge (socialization, externalization, combination and internalization) [24]. Further, since this type of BI is having dramatic and increasing impact on knowledge in firms, development of BI may well provide more efficient KM.

The tools mentioned above (data mining, DSS and BS) have been studied as developers of knowledge, since they are responsible for converting data into information and performing the analysis that will transform this information into knowledge for proper decision-making. BI thus promotes KM.

Through artificial intelligence, intelligent systems and finally data, BI facilitates KM. Knowledge acquisition also becomes more fluid through BI tools, which store, manage and analyze knowledge, as for example through document management or web content analysis. We thus formulate the following hypothesis:

P1: BI motivates the development of KM.

*2.3.2. Organizational learning*

OL is the capability "within an organization to maintain or improve performance based on experience" ([28], p. 363). It is a process whereby members in an organization are stimulated to strive continually for new approaches and to acquire as well as to share knowledge that emerges from interactions with environments [29, 30]. OL is thus the process of increasing the knowledge created by individuals in an organized way and transforming it into part of the organization's knowledge system [28].

OL complements the flow phase of KM. "It not only occurs over a period of time and among different levels of the firm (individual, group, organizational and interorganizational) but also creates tension between assimilation of new knowledge (feed-forward) and exploitation of what has already been learned (feedback)" ([31], p. 532).

In the case of technology-based firms or firms that foster development of BI, fostering OL is necessary to maintain a balance between activities of exploitation (feedback) and exploration (feedforward). Achieving this balance is quite complicated, however, as investment is difficult and learning involves imbalances [32].

Artificial intelligence, and consequently BI, are increasingly changing the way firms work. BI makes firms more efficient in terms of connections among employees [33] and exploitation of ongoing ways of training to control new data (BS, DSS or data mining). An educational system or OL program for the entire production staff is thus necessary to exploit BI [34, 35].

BI attempts to use the information achieved by technology applications in the firm to enable interoperability and organization of the flow of knowledge among applications. This means that BI attempts to enable communication not only among the different applications in the firm but also with customers, partners, or suppliers, such that these other parties can form part of the business system and improve its knowledge through OL processes motivated by the firm.

In conclusion, OL is indispensable in firms and closely related to entrepreneurship [29, 36, 37], since BI permits tools such as data mining or data warehousing that encourage learning for all personnel in the organization as a flow process/system.

Taking into account the information gathered here on OL and its relationship to BI, we propose the following proposition:

P2: BI motivates the development of OL.

*2.3.3. Technological capabilities*

Due to environmental dynamicity, we must define dynamic capabilities before we discuss TC. The term "dynamic capability" was coined by Teece et al. ([38], p. 510) as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments."

TC are dynamic capabilities, and they grant a competitive advantage because firms are also inherently changing [37–39]. It is primarily in the field of innovation and technology that TC are especially motivated by BI.

If we focus on the field of technology, having examined the relationship between BI and technological knowledge, we can affirm that BI enables discovery and anticipation of trends when making decisions about change and technology based on the information explored and analyzed in the firm.

Westphal et al. [40], p. 5, thus define TC as "the ability to make effective use of technological knowledge." As seen above, BI in firms increases technological knowledge. BI thus fosters the development of TC in the firm.

According to Martín-Rojas et al. [37], TC enable firms to have greater competitive advantage due to rapid adaptation to changing opportunities. Further, firms are more efficient when they acquire TC [36, 37, 41]. Therefore, BI through the firm's development of TC will improve business performance.

The technological integration currently underway in society is creating greater development of TC in individuals [42] and allowing them to juggle several things at once [43]. For instance, the Smartphones gadget requires specific capacities in order to perform various tasks in parallel.

The ability to perform various activities in parallel on the same device is being fostered inherently and with increasing frequency. Further, business performance will develop to solve problems in companies using a single device. It is thus advisable for firms to have specific devices to improve their activities and train personnel with incremental TC [34] in order to control data integration within the firm.

Data integration enables the firm to share information among the different applications. To do so, however, employees must possess TC, since the data must be identified and metadata models built that require highly advanced knowledge to use that many people cannot use. Once the models are built, data can be transmitted through the database systems to grow the firm [44].

In conclusion, the relationship between BI and TC is quite close, since BI will only function correctly if one realizes that it manages changing data and requires workers to have the TC necessary to adapt to this change. That is, if the firm does not have specific TC, it will not be able to adapt effectively to BI.

This adaptation shows that the firm's TC are especially important when competing with different firms, making it necessary to innovate in and improve employees' technological knowledge continually to accelerate the process of developing their TC and motivating the idea of BI with a more positive and significant effect.

P3: BI motivates the development of TC.

### 2.4. Influence of KM, OL and TC on innovative entrepreneurship

As discussed above, in technology firms, where turbulence is practically an imperative, knowledge becomes indispensable for increasing the firm's innovation capability [45]. That is, knowledge requires a form of innovative entrepreneurship.

Organizations' members must acquire greater intellectual integration of knowledge through advanced training programmes and further training to respond innovatively to the entrepreneurial needs of their market [20]. For example, in a study of TFT-LCD firms, Hu [46] explains how good knowledge management in all its phases enables the firm to undertake small innovations that make better products for the market. This knowledge is not easy to acquire; entrepreneurs must invest tremendous effort. If they do not do make this effort, however, they will miss true innovations that permit them to face new challenges the firm confronts. If the firm is unable to dedicate time and resources to good KM, a competitive break will occur, with loss of current market position [47]. In firms that face a turbulent market and are in continuous change, such as technology-intensive industries where BI is becoming a key to their development, KM is especially important. It ensures the effective development of innovative entrepreneurship [46], which allows modification of the systems and processes of business development that lead to strategic flexibility, faster learning and more efficient adaptation to market opportunities [47].

KM thus enables acquisition, assimilation and use of new knowledge that improve the innovative entrepreneurship of the firm's personnel and of the firm in itself, improving the business results to the extent that the knowledge becomes more intensive and is developed better to improve the dynamic business process [48]. Knowledge is thus a strategic source of the organization's innovative entrepreneurship. The greater and more strategic the knowledge, the better the proactive innovative actions and search for new ideas in the firm resulting from its members' greater consciousness of the importance of innovation [49].

In sum, efficient KM in the firm promotes innovative entrepreneurship through change or flexibility of previously established models or the creation of new models that foster

performance and business effectiveness [50]. Such innovative entrepreneurship combines new knowledge obtained from applying BI in the firm to enable it to reflect innovative results materialized in processes or systems [51, 52].

P4. KM of technology encourages CE.

OL is needed throughout this process, since involving users as part of the comprehensive innovation process necessitates more planning than may be realized at the outset [34]. Thus, models of OL have been applied fruitfully to specific aspects of the innovative process [53, 54]. The most innovative organizations have effective learning systems, in which knowledge is managed efficiently and one learns to maintain today's competitive advantage while preparing for tomorrow. Such innovation requires high capability for learning and effective KM [55].

Entrepreneurs must learn these aspects of entrepreneurship, including use of technological knowledge to prepare for the competitive global market and the challenge of managing a business in its different dimensions, and to guarantee the solidity of the structural conditions for its development [56].

Nevertheless, the higher the degree of innovation, the greater the OL required [57]. More innovative products or services require a higher degree of OL [57, 58]. In dynamic and competitive environments such as BI businesses, the process of OL is even more essential as a mechanism to encourage innovative CE [5]. Furthermore, OL models are usually appropriate for the study of CE [29].

Moreover, CE requires an OL framework that involves searching for innovative activities, such as investing resources obtained through BI in exploration of alternative possibilities, attempting to understand the relationship between organizational characteristics and outcomes, and determining the viability of organizational change [9, 29, 32, 54].

OL also enables development of CE in technological organizations by enhancing the development of technological variables throughout the firm as a coordinating management process. The firm can thus become a cognitive entity in which new abilities, competencies and knowledge have been developed [29, 38, 59]. In addition, Simsek et al. [60] consider OL as a central mechanism likely to grant the firm an adaptive advantage via CE. All of this evidence suggests the following proposition:

P5. Technology-based learning encourages CE.

Business models are currently changing firms' way of acting in society by using web tools, specifically through web applications such as "Google." Applications have been developed because the firm's personnel have better TC or have acquired more technological knowledge, motivated fundamentally by the development of BI [4, 37, 43].

TC represents "the organization's expertise in mobilizing various scientific and technical resources through a series of routines and procedures which allow new products and production processes to be developed and designed" ([61], p. 508). They "reflect the firm's ability to make certain physical products or processes which enable the firm to serve a particular customer group" ([62], p. 520).

These TCs permit exploitation of technological opportunities for development of CE and generation of innovative competitive advantage in the firm [37, 61, 63].

In firms' focus on BI, industrial application of technology requires new capabilities in process technologies [64], which can compensate for average or potentially below-average technological know-how when firms seek to innovate technologically. Integration of business applications is thus a serious matter, as it integrates the levels of the firm's information system [2]. That is, TC enables the firm to integrate technological knowledge within and across its boundaries, an important determinant of heterogeneous competency [65]. It also encourages innovation capability [66] and CE [21, 37, 67].

Technological innovation systems thus increase the firm's TC, since they provide innovative ways to speed up the problem-solving process, with key elements such as technological infrastructure or TC [68] and CE [37].

Findings also show that TC including capabilities for exploring or exploiting technological opportunities, core technology capability, and autonomy of R&D decisions are particularly important to the firm's innovation capability in highly competitive industries, where technological knowledge is extremely important and BI application is becoming inherent [69, 70].

Given the current environmental dynamicity and uncertainty, firms with higher levels of information processing, communication and knowledge transfer are more likely to develop CE as an innovative way of doing, as these processes will result in more successful technological innovation than firms in these environments with lower levels of cooperative resources [65, 71]. All in all, we propose that:

P6. TC encourage CE.

### 2.5. Influence of innovative entrepreneurship on organizational performance

Numerous studies identify a positive relationship between innovative entrepreneurial activity and territorial growth [72–74].

CE is a strategic variable in successful organizations [5, 75, 76], and it is positively related to the firm's growth and profitability [21, 77]. Organizations that engage in entrepreneurial activities achieve higher levels of growth and profitability than organizations that do not [75].

As a result, firms that exhibit CE are typically viewed as dynamic, flexible entities preparing or prepared to take advantage of new business opportunities when they arise [63, 78].

Nowadays, firms that exploit BI as a way of achieving better market positions have a strong incentive to be first innovators when the first-mover advantage is significant [11, 14, 32, 79]. Once an innovation is made, the entrepreneur must bring the innovation to the market in the shortest possible time, as the innovator's position of monopoly might otherwise be quickly eroded by imitators or superior innovations [80].

Innovative companies frequently develop strong, positive market reputations that ensure customer loyalty, enable them to exploit an additional basis for competitive advantage, or result in

http://dx.doi.org/10.5772/intechopen.70538

first-mover advantages that translate into superior firm performance. Such characteristics may well enable entrepreneurial firms to take advantage of the effects of learning and experience curves to improve their product, process or market strategies and achieve better organizational performance [81]. These entrepreneurial firms are willing to deviate from prior routines, strategies, business models and operating environments to embrace new resource combinations that hold promise as potential enablers of innovation [78], such as exploitation of BI in firms.

In the case of technological organizations, various current studies indicate a positive relationship between CE and organizational performance [5, 8, 9, 36, 37, 73, 82, 83]. These studies show that entrepreneurship aims to stimulate the emergence of productive entrepreneurial undertakings. Research also demonstrates that positive economic performance in high-tech or ICT companies depends on innovative entrepreneurship capital. Alternately, companies may license use of their technology to other companies in the industry to create new business and enhance their revenue and profits [69]. Since these technological opportunities in an industry are positively associated with increased CE, we can expect a positive relationship between CE and performance in terms of profitability and growth, enabling proposal of the following hypothesis:

P7. CE encourages organizational performance.

## 3. Methodology

The methodology followed to perform this study is called grounded theory. It attempts to discover theories, concepts, hypotheses and propositions by starting directly from data rather from a priori assumptions drawn from other research [84]. Since grounded theory has been primarily theoretical, we performed an exhaustive search for articles specifically on BI in the field of telecommunications engineering of intelligent systems and related these studies to articles in the field of business management.

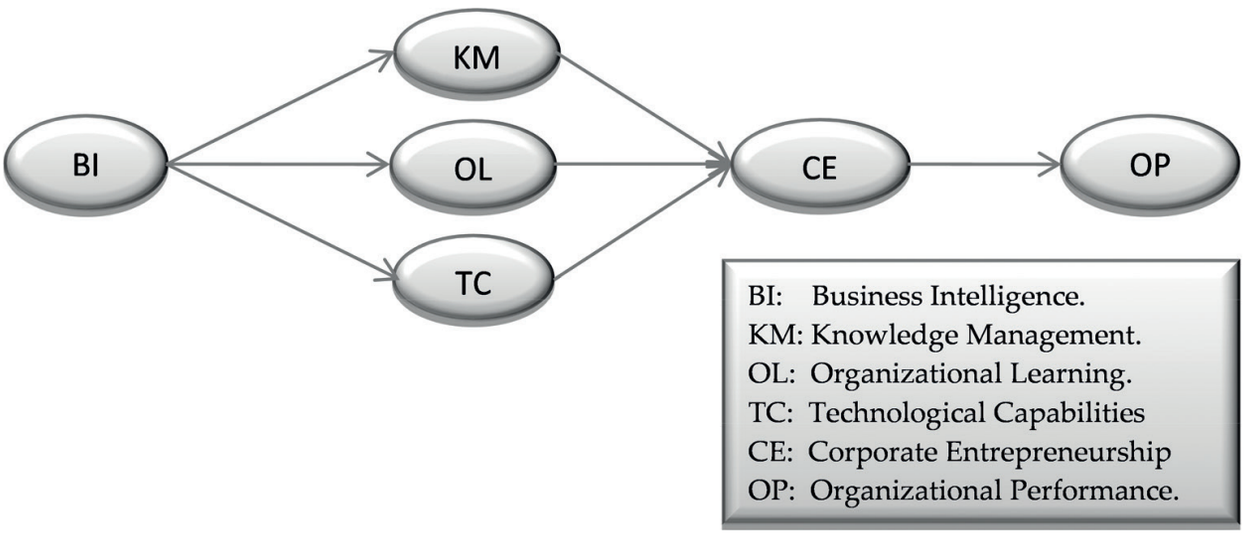


**Figure 3.** Proposed model. Source: Developed by the authors.

Further, due to the newness and minimal development of the topic, in addition to scholarly articles, we consulted numerous webpages to gather information on the new types of design firms are currently applying.

After reading and studying this information, we formulated a series of propositions that relate BI to each of the management concepts explained above (organizational learning, knowledge management and technological capabilities of the firm's employees and top managers). We will attempt to contrast these propositions empirically with theoretical development in this study to obtain results of interest for the scholarly community.

**Figure 3** represents the proposed model.

## 4. Results and conclusions

### 4.1. Results

We have achieved the study's initial goals. First, we were able to distinguish between artificial intelligence and BI, while observing that artificial intelligence is one of the main components of BI.

The second goal was to provide a series of tools (CMI, DSS and data mining) to develop BI. These tools were explained in the course of the study and are indirectly related to greater business development.

Finally, the third goal was to propose a series of propositions to improve business performance with the aid of BI. To do this, we demonstrated a series of relationships between BI and numerous specific components of business development which, when performed well, can lead to the firm's success.

To fulfill this goal and observe these relationships, it is worth stressing that:

The help of BI in the firm's knowledge management and organizational learning makes information more accurate and useful, improving business efficiency and thus business results (P1 and P2).

On the other hand, the firm's aptitudes, such as technological capabilities, are fostered by introducing BI in the firm. Aspects of the firm are changing every day, requiring the organization to adapt, and it will adapt correctly when it has sufficiently developed technological capabilities (P3).

The business structure assumes that using BI will be more effective for the businessperson and easier to install in the firm. We have thus developed other hypotheses that connect BI to business performance through the development of CE as an innovative form of entrepreneurship. CE has been encouraged, firstly, indirectly by BI through effective knowledge management within the firm or by managing the web application needed (P4); secondly, through development of organizational learning processes within the firm or technological

integration of BI (P5); and thirdly, by strengthening TC among the firm's stakeholders (P6). Finally, innovative CE has been shown to increase or improve organizational performance in the firm (P7).

### 4.2. Conclusions

In dynamic environments, dynamic capabilities rest less on existing knowledge than on faster new knowledge creation through learning [85]. Firms should stimulate the development of opportunities that combine inventions generated internally and externally through efficient knowledge transfer and protection of intellectual property, and improved protection against imitation by rivals [86]. "Firms innovate through a continuous learning process by which they generate new knowledge" ([24], p. 3).

BI thus attempts to use the information traffic achieved with firms' current technological integration to achieve interoperability and organization of the flow of information between applications. This means that BI seeks to enable communication not only among the firm's different applications but also with other stakeholders that may form part of the business system.

This study thus proposes that BI influences company performance directly and indirectly: directly because it permits innovative development of entrepreneurship dependent on task interdependence in the organization, and indirectly through effective knowledge management, efficient organizational learning processes, and increased technological capabilities in the firm. All of these improvements materialize in data, business processes and applications, which are in turn innovative forms of entrepreneurship.

If we understand that entrepreneurial activity involves innovation [72, 87], entrepreneurs become critical to the innovation process, and entrepreneurial capability is a key element in knowledge transfer during the commercialization process. Such innovative corporate entrepreneurship enhances the potential for achieving excellent performance.

### 4.3. Implications

This study has the three main implications:

Only after firm personnel develop technological capabilities through BI will firms achieve trustworthy and efficient use of the information within the company. Furthermore, doing work on time, without mistakes and more effectively enables firms to achieve higher entrepreneurial activity.

The information analysis performed provides not only easy visualization of data within the firm, but also rapid decision-making for managers supported by well-developed CE.

Such excellent decision-making—achieved by the impact of BI on CE through organizational learning processes, effective knowledge management and strengthening of technological competencies—increases the company's organizational performance and changes its current organizational design.

Finally, BI and the different propositions that emerge from this process develop as firms continually discover business models, modifying the firm's current organizational design. For instance, dosdoce.com [88] presents some innovative business models that integrate BI: (a) *micropayments* or fractioned content, "*carrier billing*" in which the customer makes purchases through the Smartphone, charging the expense to the phone bill; (b) *Streaming/Pay per View* in the hotel sector *ByHours*; (c) subscription to journals or newspapers; (d) *Freemium-Premium, Spotify*; (e) *Open Access, Wikipedia* or Open Access articles; (f) P2P (*"peer to peer") People's University,* which undertakes to provide a series of online academic content free, charging only for registration; (g) *MOOCs* or *Massive Open Online Courses*, free online courses, and other courses available for a set price; (h) *Bundles*, or inseparable products, such as the Microsoft Office package; (i) *Crowdfunding,* or financing a business idea from an investor or collaborator like *kickstarter* or *indiegogo*; (j) *cocreation, Lego Cuusoo*, where the customer creates a LEGO product which, with sufficient support and compliance with the requirements imposed by the company, could be produced as an official LEGO product; (k) gamification, which enables one to find and evaluate game-based solutions to develop behavior in nonludic situations; (l) *Direct sale*, whether *B2C* or *B2B* models; and (n) *Self-publication,* as with *Amazon Kindle Direct Publishing*, where authors can publish free and keep copyright of their books.

### 4.4. Limitations

In addition to the problems posed by applying BI in firms (the high investment involved in introducing BI in the firm and the fact that employees are not accustomed to using the tool), it is important to mention another limitation of this study:

To study this topic, we used a grounded theory focus, for which we will attempt to achieve empirical results.

### 4.5. Future lines of research

Studies such as Gartner [89] study the business results of organizations that use BI and data analysis and conclude that these trends will evolve more in the coming years. More research on these topics is thus advisable. It is also quite likely that the concept of BI will even fuse with the Internet of Things, since BI must increasingly analyze a quantity of data about which the firm will have to obtain the necessary information and which, as we have seen, is of vital importance for the firm's organization.

In conclusion, future development of this research could perform case studies of the application of BI in the firm, as in the case of Google, or demonstrate the propositions statistically and thus perform an empirical study to confirm the hypotheses.

## Acknowledgements

We acknowledge the financial support from Excellence Research Project with reference P11-SEJ-7988 from Andalusian Regional Government.

## Author details

Reyes Giménez-Figueroa, Rodrigo Martín-Rojas* and Víctor Jesús García-Morales

*Address all correspondence to: rodrigomr@ugr.es

University of Granada, Granada, Spain

## References

[1] Curto DJ. Introducción al Business Intelligence. Barcelona: UOC; 2012

[2] Linthicum DS. Enterprise Application Integration. Canada: Addison Wesley; 1999

[3] Medina-Soto JA. Business Intelligence. Teoría y conceptos [Internet]. 2005. Available from: https://www.gestiopolis.com/business-intelligence-teoria-y-conceptos/ [Accessed: June 22, 2015].

[4] Ramos S. Curso MS Business Intelligence – Componentes de una solución de BI, SolidQ [Internet]. 2011. Available from: http://blogs.solidq.com/es/business-analytics/curso-ms-business-intelligence-componentes-de-una-solucion-de-bi-4/ [Accessed: July, 24 2015].

[5] Antoncic B, Prodan I. Alliances, corporate technological entrepreneurship and firm performance: Testing a model on manufacturing firms. Technovation. 2008;**28**:257-265

[6] OECD. Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data. 3rd ed. Paris, France: European Commission: OECD Publishing; 2005. DOI: 10.1787/9789264013100-en

[7] OECD. Innovation and Growth. Rationale for an Innovation Strategy [Internet]. 2007. Available from: http://www.oecd.org/sti/inno/39374789.pdf [Accessed: June 22, 2017]

[8] Szabo KZ, Herman E. Innovative entrepreneurship for economic development in EU. Procedia Economics and Finance. 2012;**3**:268-275

[9] Roig-Tierno N, Alcázar J, Ribeiro-Navarrete JA. Use of infrastructures to support innovative entrepreneurship and business growth. Journal of Business Research. 2015; **68**:2290-2294

[10] Bustamante AA, Galvis EA, González M, García AA, Benavides LF. Soluciones de inteligencia de negocios en la práctica: apoyo a la toma de decisiones en proyectos educativos para población infantil vulnerable en el caribe Colombiano. Revista UIS Ingenierías. 2011;**10**(2):123-135

[11] Computer hoy. "Qué son los wearables" "Cómo funcionan" [Internet]. 2014. Available from: http://computerhoy.com/noticias/hardware/que-son-wearables-como-funcionan-16575 [Accessed: August 18, 2015]

[12] Davenport TH, Prusak L. Working Knowledge. United States of America: Harvard Business Review Press; 2000

[13] Beazley H, Boenisch J, Harden D. La continuidad del conocimiento en las empresas. Bogotá: Norma; 2004

[14] Knight K, Rich E. Inteligencia Artificial. Madrid: McGraw Hill; 1994

[15] Nilsson NJ. Inteligencia artificial: Una nueva síntesis. Madrid: McGraw-Hill; 2000

[16] Hípola P, Vargas-Quesada B, Montes A. Descripción y evaluación de agentes. El profesional de la información. 1999;**8**(11):15-26

[17] Lu P, Chen S, Zheng Y. Artificial intelligence in civil engineering. Mathematical Problems in Engineering. 2012:1-22

[18] Wooldridge M, Jennings NR. Intelligent agents: Theory and practice. Knowledge Engineering Review. 1995;**10**(2):115-152

[19] Sinnexus. Sinergia e Inteligencia de Negocio S.L. Sinnexus business intelligence información estratégica [Internet]. 2007. Available from: http://www.sinnexus.com/empresa/index.aspx [Accessed: July 24, 2015]

[20] Tsai KH, Liao YC, Hsu TT. Does the use of knowledge integration mechanisms enhance product innovativeness? Industrial Marketing Management. 2015;**46**:214-223

[21] Zahra SA, Nielsen AP, Bogner WC. Corporate entrepreneurship, knowledge, and competence development. Entrepreneurship: Theory and Practice. 1999;**23**(3):169-189

[22] Mintzberg H. La estructuración de las organizaciones. 9ª ed. Barcelona: Ariel; 2009

[23] Kaplan R, Norton DP. The Balanced Scorecard. Boston: Harvard Business Review Press; 1996

[24] Nonaka I, Takeuchi H. The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. United Kingdom: Oxford University Press; 1995

[25] Winter SG. Knowledge and competence as strategic assets. In: Teece DJ editor. The Competitive Challenge: Strategies for Industrial Innovation and Renewal. Cambridge: The MIT Press; 1987. p. 159-184

[26] Bueno Campos E. Dirección estratégica basada en conocimiento: Teoría y práctica de la nueva perspectiva. Barcelona: Ariel; 2002

[27] Bueno CE. Gestión del conocimiento y capital intelectual: Experiencias en España. Madrid: IU Euroforum Escorial; 1999

[28] Dibella A, Nevis EC, Gould JM. Understanding organizational learning capability. Journal of Management Studies. 1996;**33**:361-379

[29] García-Morales VJ, Lloréns-Montes FJ, Verdú-Jover AJ. Antecedents and consequences of organizational innovation and organizational learning in entrepreneurship. Industrial Management & Data Systems. 2006;**106**(2):21-42

[30] Nonaka I, Reinmoller P, Toyama R. Integrated information technology systems for knowledge creation. In: Dierkes M, Berthoin-Antal A, Child J, Nonaka I, editors. Handbook of organizational learning and knowledge. New York: Oxford University Press; 2001. p. 827-848

[31] Crossan M, Lane H, White R. An organizational learning framework: From intuition to institution. Academy of Management Review. 1999;**24**(3):522-537

[32] Roldán JL, Cepeda-Carrión GA, Galán JL. Los sistemas de inteligencia de negocio como soporte a los procesos de toma de decisiones en las organizaciones. Papeles de Economía Española. 2012;**132**:239-260

[33] Ngai EW, Tao SS, Moon KK. Social media research: Theories, constructs, and conceptual frameworks. International Journal of Information Management. 2015;**35**(1):33-44

[34] Leonard-Barton D. The case for integrative innovation: An expert system at digital. Sloan Management Review. 1987;**29**(1):7-19

[35] Leonard-Barton D. Core capabilities and core rigidities: A paradox in managing new product development. Strategic Management Journal. 1992;**13**:111-125

[36] Martín-Rojas R, Garcia-Morales VJ, Garcia-Sanchez E. The influence on corporate entrepreneurship of technological variables. Industrial Management & Data Systems. 2011;**11**(7):984-1005

[37] Martín-Rojas R, Garcia-Morales VJ, Bolivar-Ramos MT. Influence of technological support, skills and competencies, and learning on corporate entrepreneurship in European technology firms. Technovation. 2013;**33**:417-430

[38] Teece D, Pisano G, Shuen A. Dynamic capabilities and strategic management. Strategic Management Journal. 1997;**18**:509-533

[39] Garzón MA. Modelo de capacidades dinámicas. Revista Dimensión Empresarial. 2015;**13**(1): 111-131

[40] Westphal JD, Fredickson JW. Who directs strategic change? Director experience, the selection of new CEOs, and change in corporate strategy. Strategic Management Journal. 2001;**22**:1113-1137

[41] Lall S. Technological capabilities and industrialization. World Development. 1992; **20**(2):165-186

[42] Maksymiv N. CNN Expansión [Internet]. 2010. Available from: http://www.cnnexpansion.com/tecnologia/2010/07/01/tecnologia-integradora-una-tendencia [Accessed: August 02, 2015].

[43] Martínez-López E. Integración de Aplicaciones Empresariales. Mexico: Universidad Veracruzana; 2011

[44] Pérez MA, Ortega DM, Losavio FA. Integración de Aplicaciones Empresariales. Venezuela: Universidad Central de Venezuela; 2006

[45] Martín-Castro G. Knowledge management and innovation in knowledge-based and high-tech industrial markets: The role of openness and absorptive capacity. Industrial Marketing Management. 2015;**47**:143-146

[46] Hu MC. Knowledge flows and innovation capability: The patenting trajectory of Taiwan's thin film transistor-liquid crystal display industry. Technological Forecasting and Social Change. 2008;**75**:1423-1438

[47] Ravishankar MN, Pan SL. Examining the influence of modularity and knowledge management (KM) on dynamic capabilities: Insights from a call center. International Journal of Information Management. 2013;**33**:147-159

[48] Jiménez-Jiménez D, Cegarra-Navarro J. The performance effect of organizational learning and market orientation. Industrial Marketing Management. 2007;**36**:694-708

[49] Xie X, Fang L, Zeng S, Huo J. How does knowledge inertia affect firms product innovation? Journal of Business Research. 2016;**69**(5):1615-1620

[50] Drucker PF. Innovation and Entrepreneurship. Oxford: Butterworth-Heinemann; 1997

[51] Kogut B, Zander U. Knowledge of the firm and the evolutionary theory of the multidimensional corporation. Journal of International Business Studies. 1993;**24**(4):625-645

[52] Tidd J, Bessant J. Managing Innovation. Integrating Technological, Market and Organizational Change. Chichester: Wiley; 2009

[53] Cohen WM, Levinthal DA. Absorptive capacity: A new perspective on learning and innovation. Administrative Science Quarterly. 1990;**35**:128-152

[54] Lant TK, Mezias SJ. Managing discontinuous change: A simulation study of organizational learning and entrepreneurship. Strategic Management Journal. 1990;**11**:147-179

[55] Thomas JB, Sussman SW, Henderson JC. Understanding: 'strategic learning': Linking organizational learning, knowledge management, and sensemaking. Organization Science. 2001;**12**:331-345

[56] Gillich GR, Amariei D, Gillich N, Amariei OI. Premio- an electronic platform for entrepreneurial training. Procedia - Social and Behavioral Sciences. 2009;**1**(1):2380-2384

[57] García-Morales VJ, Jiménez-Barrionuevo MM, Gutiérrez-Gutiérrez L. Transformational leadership influence on organizational performance through organizational learning and innovation. Journal of Business Research. 2012;**65**:1040-1050

[58] Senge PM, Roberts C, Ross RB, Smith BJ, Kleiner A. The Fifth Discipline Fieldbook. New York: Doubleday Publication; 1994

[59] Berry MJ. Technical entrepreneurship, strategic awareness and corporate transformation in small high-tech firms. Technovation. 1996;**16**(9):487-498

[60] Simsek Z, Lubatkin MH, Veiga JF, Dino RN. The role of an entrepreneurially alert information system in promoting corporate entrepreneurship. Journal of Business Research. 2009;**62**:810-817

[61] Real JC, Leal A, Roldan JL. Information technology as a determinant of organizational learning and technological distinctive competencies. Industrial Marketing Management. 2006;**35**:505-521

[62] Danneels E. Organizational antecedents of second-order competences. Strategic Management Journal. 2008;**29**:519-543

[63] Woolley J. Technology emergence through entrepreneurship across multiple industries. Strategic Entrepreneurship Journal. 2010;**4**(1):1-21

[64] Fontes M. Biotechnology entrepreneurs and technology transfer in an intermediate economy. Technological Forecasting and Social Change. 2001;**66**:59-74

[65] Henderson R, Cockburn I. Measuring competence? Exploiting firm effects in pharmaceutical research. Strategic Management Journal. 1994;**15**:63-84

[66] Linton J, Walsh S. The effect of technology on learning during the acquisition and development of competencies in technology-intensive small firms. International Journal of Entrepreneurial Behaviour and Research. 2013;**19**(2):165-186

[67] García-Morales VJ, Bolívar-Ramos MT, Martín-Rojas R. Technological variables and absorptive capacity's influence on performance through corporate entrepreneurship. Journal of Business Research. 2014;**67**(7):1468-1477

[68] Carlsson B. Technological Systems and Economic Performance: The Case of Factory Automation. Dordrecht: Kluwer; 1995

[69] Martín-Rojas R, Fernández-Pérez V, García-Sánchez E. Encouraging organizational performance through the influence of technological distinctive competencies on components of corporate entrepreneurship. International Entrepreneurship and Management Journal. 2017;**13**(2):397-426

[70] Huang KF. Technology competencies in competitive environment. Journal of Business Research. 2011;**64**:172-179

[71] Walsh S, Linton JD. The measurement of technical competencies. The Journal of High Technology Management Research. 2002;**13**(1):63-86

[72] Audretsch DB, Keilbach MC, Lehmann EE. Entrepreneurship and Economic Growth. Oxford: OxfordUniversity Press; 2006

[73] Autio E, Kenney M, Mustar P, Siegel D, Wright M. Entrepreneurial innovation: The importance of context. Research Policy. 2014;**43**(7):1097-1108

[74] Kelley DJ, Singer S, Herrington M. The Global Entrepreneurship Monitor. 2011 Global Report. London, U.K.: Global Entrepreneurship Research Association (GERA). 2012. p. 7

[75] Antoncic B, Hisrich RD. Intrapreneurship: Construct refinement and cross-cultural validation. Journal of Business Venturing. 2001;**16**(5):495-527

[76] Kanter RM. The Change Master–Innovation & Entrepreneurship in the American Corporation. New York: Simon & Schuster; 1983

[77] Covin JG, Slevin DPA. Conceptual model of entrepreneurship as firm behavior. Entrepreneurship: Theory and Practice. 1991;**16**:7-25

[78] Goodale JC, Kuratko DF, Hornsby JS, Covin JG. Operations management and corporate entrepreneurship: The moderating effect of operations control on the antecedents of corporate entrepreneurial activity in relation to innovation performance. Journal of Operations Management. 2011;**29**(1-2):116-127

[79] Yin JZ. Technological capabilities as determinants of the success of technology transfer projects. Technological Forecasting and Social Change. 1992;**42**(1):17-29

[80] Shan W. An empirical analysis of organizational strategies by entrepreneurial high-technology firms. Strategic Management Journal. 1990;**11**:129-139

[81] Zahra SA, Covin JG. Contextual influences on the corporate entrepreneurship-performance relationship: A longitudinal analysis. Journal of Business Venturing. 1995;**10**:43-58

[82] Aparicio S, Urbano D, Gómez D. The role of innovative entrepreneurship within Colombian business cycle scenarios: A system dynamics approach. Futures. 2016;**81**: 130-147

[83] Dirican C. The impacts of robotics, artificial intelligence on business and economics. Procedia – Social and Behavioral Sciences. 2015;**195**:564-573

[84] Rodríguez-Gómez G, Gil-Flores J, García-Jiménez E. Metodología de la investigación cualitativa. Granada: Aljibe; 1996

[85] Eisenhardt KM, Martin JA. Dynamic capabilities: What are they? Strategic Management Journal. 2000;**21**(11):1105-1121

[86] Teece DJ. Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. Strategic Management Journal. 2007;**28**(13):13-19

[87] Acs ZJ. How is entrepreneurship good for economic growth? Innovations: Technology, Governance, Globalization. 2006;**1**(1):97-107

[88] Dosdoce.com. Nuevos modelos de negocio en la era digital. Madrid: Liber; 2014

[89] Gartner IT Glossary [Internet]. 2012. Available from: http://www.gartner.com/it-glossary/ [Accessed: July 29, 2015]