

INTELLECTUAL CAPITAL AS A GENERATOR OF INNOVATION IN COMPANIES: A SYSTEMATIC REVIEW

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Abstract

Purpose: In this study, a meticulous summary of all the main investigations in response to the link between intellectual capital and innovation is achieved.

Methodology: A meta-analysis technique was implemented to establish the data in context and to determine the proposed research utility, this approach enables systematic review sources of information correlated with two variables predicted research associate intellectual capital and innovation.

Main findings: The results of the systematic review reveal that intellectual capital is a generator of innovation in corporations.

Implications: This paper will provide support to investigators who are intended to work in this area.

Novelty: This article sheds some light and gives future researchers answer to questions like what are the signifiers in which works are involved with? What theories are established in this area and data selection mechanisms chosen by scientists in the field?

Keywords: *Intellectual Capital, Innovation, Systematic Review, Innovative Companies, Human Capital, Knowledge.*

INTRODUCTION

The relationship between intellectual capital and the capacity for innovation of companies plays a decisive role in the current knowledge economy, given that a company will manage to remain competitive, only if it succeeds in placing innovative products and services on the market for its customers.

Given the diversity and complexity of the intellectual capital, also known as intangibles, it has been divided into several components. One of the classifications generally accepted by various authors establishes three components of intellectual capital: human capital, structural capital and relational capital ([Sveiby, 1997](#), [Bontis 2002](#), [\[Meritum\], 2002](#)).

Human capital is related to the knowledge, skills, and attitudes of the personnel of a company ([Subramaniam and Youndt, 2005](#)). On the other hand, structural capital is related to the processes, systems technology that support the activities of human capital. Finally, relational capital includes the relationships established by the company with suppliers, partners, customers, and alliances, among others ([De Castro and López, 2008](#)).

Innovation, as an engine of economic growth for companies ([Rose, Shipp, Lal, and Stone, 2009](#)), seeks to generate new products or services that are attractive to the customer. For more than five decades, different models of innovation have been developed. The choice of one of these models will depend on organizational needs and objectives. Hardly a company will generate innovation if it does not recognize intellectual capital as the fundamental component of the organization.

Knowledge is one of the main elements that encourages innovation and is an essential part of human intellectual capital (IC). The management of this capital is based on the intellectualities, the experience, the talent, the communication skills and the skills that it possesses and that are developed in the human resource of the organizations. In this sense, the organization becomes, in turn, a producer of knowledge and encourages behavior or culture of collaboration, initiative, and commitment, which will be basic ingredients for the creation of innovative strategies to form sustainable competitive advantages. Several authors have worked with the binomial knowledge-innovation ([Zerenler, Burak and Sezgin, 2008](#); [Wu & Sivalogathan, 2013](#); [Hoarau, Hindertje and Kline, 2014](#)), others have focused on monitoring only one variable: intellectual capital, to indicate methods of capital valuation within organizations ([Bontis, 1998](#); [Alizadeh, 2012](#)); some more studies focus on the creation of clusters as innovation strategies ([Novelli, Schmitz and Spencer, 2006](#); [Carlisle et al., 2013](#)).

THE OBJECTIVE OF THE STUDY

The objective of this article is to identify the association between intellectual capital and innovation in companies, through literature review.

To analyze the aforementioned literature, systematic reviews can be used, understood as the revision of a question formulated clearly by means of systematic and clear procedures to identify, select and critically evaluate relevant research on

such question, as well as to gather and examine data from the studies involved in the review (Marín, Tobías and Seoane, 2006, cited in [Sánchez-Meca and Botella, 2010](#)). The systematic reviews arise as an attempt to overcome the limitations of traditional reviews, characterized by being qualitative and lacking an adequate systematization.

Thus, a qualitative systemic review is presented that aims to identify common features and differences between the different articles reviewed (studies that seek to investigate the intellectual capital-innovation relationship) in relation to their approach, objectives, theories, method, data collection instrument and results obtained.

LITERATURE REVIEW

The Literature review work goes beyond reading an article or extracting definitions or certain data, it is an act of analysis and evaluation of the information, of the validity of the sources, of the attachment to a standardized structure of writing that allows locating data more quickly and efficiently.

We structure the article in five sections. We link the first section to intellectual capital and innovation, origin, definitions, components, management models, status and trends in intellectual capital and innovation research. The second section deals with models and theories developed in intellectual capital and innovation. The third section outlines the method to carry out this work. The fourth section presents the results of empirical studies conducted on the intellectual capital-innovation relationship in companies. In the fifth section, we present the conclusions and references.

DEFINITION OF KEY CONCEPTS AND SCOPE OF THE REVIEW

The present research is a systematic review of articles published in a collection of journals on the intellectual capital-innovation correlation. The concept definition used in this study is presented in the subsections.

1. Intellectual capital

Intellectual capital definitions thrive. This interpretation of abundance represents diverse viewpoints. It reproduces the variety of factors contributing to this investigation theme, their chief disciplinary area and their diverse concerns in focusing on the question of managing, calculating and appreciating intellectual capital ([Mention, 2011](#)). Yet, unanimity occurs on the reality that intellectual capital is a multifaceted notion involving a mixture of human, structural and relational resources ([Meritum, 2002](#)). IC is more than the totality of these resources, which powerfully tangled. Intellectual capital holds all intangibles generating upcoming paybacks. IC is frequently used as a synonym of intangible assets, intellectual property, intangible values, Knowledge among others. [Edvinsson and Malone \(1998\)](#) conducted the first study on intellectual capital in Skandia. The study included two types of capital in its annual report: human capital and structural capital. The fact of calling it capital is due to its economic roots. [Alcaniz, Gomez-Bezares, and Roslender \(2011\)](#) identified that the notion of intellectual capital has appeared from different perspectives: economic, strategic, accounting, finance, human resources, information systems and marketing among others, according to the study by [Rahmani, Saudah and Salmiah \(2013\)](#). Consequently, there are different definitions for the concept of Intellectual Capital (see table 1), moreover, there is no single and uniformly accepted definition.

Table 1: Definitions of intellectual capital

Authors	Definition
Edvinsson and Malone (1998)	The knowledge quarantine demanded practice, organizational technology, and communications with consumers in addition to expert competencies that require a competitive position.
Bradley (1997)	The capacity to convert knowledge and intangible resources into wealth-creating abilities for companies and countries.
Stewart (1997)	The knowledge, information, intellectual property, and experience that can be used to create new wealth.
Sveiby (1997)	The combination of intangible assets that generate growth, renewal, efficiency, and stability in the organization.
Lev (2001)	Represents the main relationships, generating intangible assets, between innovation, organizational practices, and human resources.
Kristandl and Bontis (2007)	Strategic organizational sources that grant it to produce continuous value, but that are not accessible to many firms. They generate potential forthcoming profits that

cannot be held and that are not imitating by contestants. They are not interchangeable because of their organizational nature.

[Bueno \(2008\)](#)

Growth of knowledge that forms value or intellectual wealth owned by a company consisted of a collection of intangible resources that when placed into operation, giving to a certain strategy, in consolidation with substantial capital is apt to produce value and fundamental techniques in the market.

Source: [Bueno, Salmador y Merino, 2008](#).

Stewart redefined the standards and priorities of modern business, arguing that the most central assets the corporations possess today are not material goods, equipment, financial capital, or market share but are the intangibles resources: patents, knowledge of workers, customer information and experience that companies have in their institutional memory.

Thomas A. [Stewart](#) reveals, in his 2001 book “The Wealth of Knowledge: Intellectual Capital and the Twenty-first Century Organization” that today’s businesses applying the theory of intellectual capital in daily actions raise firms to progress in the market. The mentioned paradigms, and the human and organizational characteristics that shape them, form the basis on which all contemporary knowledge-intensive corporations must rely on it if they want to maintain high standards in an exceedingly competitive international market. Intellectual Capital Theory is a modern distinguished theory that not only induced great consideration but guarantees to gain interest results.

[Edvinsson \(2013\)](#) believes that the new awareness of Intellectual Capital could be called Intellectual Capital systems science. This new science would focus on a systematic interdisciplinary study to identify intellectual resources, maintain, share and use for the greater good, at the individual, organizational, social and global levels.

[Dumay \(2013a\)](#) suggests that Intellectual Capital research should be approached in a transdisciplinary manner, from areas such as psychology, information technology, engineering, among others, to propose different ways of acting in practice and extend the limits of Intellectual Capital, and not only focus on the accounting and management disciplines.

2. Innovation

In this section, the background, definitions, types, and description of the main innovation models that have been developed to promote the economic development of companies will be addressed.

Speaking of innovation evokes the appointment of [Joseph A. Schumpeter](#) who promoted the term more than a hundred years ago in his book "[The theory of economic development](#)" (1912), where he proposes five types of innovations:

- A. Introduction of new goods or goods of a new quality.
- B. Introduction of a new production method already existing in a sector, which does not derive from any scientific discovery.
- C. Opening of a new market.
- D. Development of new raw material supply sources.
- E. Establishment of new market structures in a specific industry.

[Schumpeter \(1942\)](#) redefines innovation with a term more attached to the circumstances of crisis and postwar in his book "Capitalism, socialism and democracy", where he determines that innovation fosters economic development through a dynamic process, defined as destruction creative, in which new technologies replace old ones. Likewise, it identifies two types of innovations: radical and incremental. Radical innovations give rise to sudden and important changes, while incremental innovations continually feed the process of change.

[Peter Drucker \(1985\)](#) describes innovation as an exact gadget of entrepreneurship. [Christensen \(1997\)](#) states that innovation is identified as the key to companies to raise and withstand high profitability.

“An innovation is 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” [Oslo Manual \(OECD, 2005\)](#).

Two aspects of innovation identified by literature, as process and as an outcome ([Crossan&Apaydin, 2010](#)). Innovation as a process is engaged in the “how” investigation, whereas innovation as an outcome relates to the “what” angle. Innovation

concentrates on the type (product, process, marketing, managerial), the magnitude (radical or incremental), and the referent (firm, market, industry) addressed to measure the novelty degree.

3. Analysis of definitions

After reviewing the references of the definitions of the variables, we drew a definition analysis table up that included the names of the authors and the year of definition publication. Common characteristics and elements analyzed and separated each of them. In order to write a summary and examine the evolution and approaches of the statements of the variables, a reading, and revision of the common elements was carried out, in such a manner that the definitions planned with the same logic were marked with a color; For example, those of innovation that refer to the invention of machinery, those that are aimed at innovation in processes, those that allude to ideas, the creation of new businesses types or those described in the introduction of incremental and radical changes.

With this table, it was possible to establish that the term intellectual capital emerged in the early nineties of the twentieth century in the United States and Sweden, mainly, and that measures the value of a knowledge of the company in its different areas: people (human intelligence), the organization (the company's know-how, patents, and brands) and the market (satisfaction of a client portfolio). The origin of the term intellectual capital is distinguished from three main areas: the one that arises from the knowledge management as part of the tacit resources (Dierickx and Cool, 1989 (cited in [Alizadeh, 2012](#)); [Stewart, 1997](#); [Hall, 1992](#); [Klein and Prusak, 1994](#); [Nonaka and Takeuchi, 1995](#); [Sveiby, 1997](#); [Klein, 1998](#); [Ulrich, 1998](#); [Edvinsson and Malone, 1998](#)), that of the accounting-financial sphere, as an indispensable item in the financial statements ([Brooking, 1997](#); [Roos et al., 1997](#); [Edvinsson and Malone, 1998](#); Seetharaman, 2002 (cited in [Alizadeh, 2012](#)), and a more recent vision that takes up the origin of knowledge aimed at the competitive advantages contribution ([Youndt, Subramaniam and Snell, 2004](#); [Chen, Cheng and Hwang, 2005](#); [Viedma, 2007](#)).

We can conclude that intellectual capital is an intangible asset of organizations that includes knowledge, skills, experiences, data, intellectual property, databases, procedures, organizational culture, among others, and can be classified as human, relational, structural and social, through whose management can generate innovation and maintainable competitive advantages that impact on performance for the employee, the company and society.

For its part, the term innovation has been used in different social and economic fields as a guarantee of competitiveness in companies; [Medina and Espinosa \(1994\)](#) indicate that it comes from the Latin innovatio (action and effect of innovating), and innovate innovare (change or alter things by incorporating something new).

At the end of the 18th century, with the birth of industrial production, innovation focused on the creation of machines. At the beginning of the twentieth century, with the work of [Schumpeter \(1939\)](#), the act of innovating was incorporated, not only referring to machinery, but to most processes. In the eighties and nineties, above all, the concept extended to incorporate the ideas applied to the processes and as a means and opportunity for the creation of new businesses. Examples are “[Van de Ven \(1986\)](#), [Tushman and Nadler \(1986\)](#), [Damanpour \(1990\)](#), [Damanpour and Gopalakrishnan \(1997\)](#), [Chen and Tsou \(2007\)](#)”.

4. Characteristics of intellectual capital and innovation

Regarding the determination of the traits that characterize intellectual capital and innovation, among the authors who cite knowledge and intellectual capital as a source of sustainable competitive advantage are [Estrada and Dutrénit \(2007\)](#); [Rivas and Flores \(2007\)](#) (cited in [Ochoa, Prieto, and Santidrián \(2012\)](#)). The latter also points out that intellectual capital is a generator of innovation for competitiveness; thus, knowledge is the key component in competitive advantage because, as an asset, it keeps some properties that make an organization indefectible. [Nagles \(2007\)](#) adds that the use of intellectual capital allows solving problems, making decisions, adding value to products and services, enriching jobs and empowering employees to ensure the capacities creation that allows them to exploit the company's resources. On the other hand, [Darceles \(2007\)](#) directs the intellectual capital to the use of creativity to generate innovations, in this way the variables and approaches of his research work are linked. According to [Ochoa, Prieto, and Santidrián \(2012\)](#); [Estrada and Dutrénit \(2007\)](#) and [Alizadeh \(2012\)](#) the intellectual capital characterized as a set of intangible resources, or intellectual resources destined to create value, unique, difficult to imitate, tacit and complex nature. Several authors characterize intellectual capital as a fundamental part of the company's book value ([Brooking, 1997](#); [Roos et al., 1997](#); [Edvinsson and Malone, 1998](#); [Alizadeh, 2012](#)), highlighting that intangible assets must be present in the accounting reports of the organizations, so the key factor is to identify and quantify the intellectual capital. Regarding the innovation variable, it stated that its adoption is gradual, although sometimes disrupts disruptively in organizations, improving products, processes, strategies, ideas, technology, practices in supplies, among other things. Innovation is characterized by its capacity to generate ingenious, profitable and creative solutions, in order to meet the needs of a market. Innovating then becomes a fundamental factor for the competitiveness of companies ([Richards, 2011](#)).

Innovation is not the driving action, but the result of applying a process ([Hoarau and Kline, 2014](#)), in this case, intellectual capital management. As [Nagles \(2007\)](#) points out, developing innovation is a process focused on value creation. From this

point of view, innovation comprises four elements: production of new knowledge, organization of the same, its adaptation and innovation. Also, innovation is gradual, so continuous improvements are often defined as incremental innovations and technological revolutions as radical innovations ([Hoarau and Kline, 2014](#); [Schumpeter, 1939](#) (cited in [Carlisle et al., 2013](#))).

Although there are no distinctive and determinant characteristics (since the innovations are multiple, of different magnitude and of a different order), it can be specified that it is an exploitation of resources, which is handled in processes, which can be of a technological purpose in the sense generic word, which is done incrementally and seeks to improve the ways of carrying out an activity or create new products and services for the demands of a society.

5. Components of the variables

The elements that make up intellectual capital range from the intellect to the processes and relationships with external entities. However, [Perozo \(2004\)](#), [González \(2002\)](#), [Dárceles \(2007\)](#), [Estrada and Dutrénit \(2007\)](#) and [Madrigal \(2009\)](#) tend to privilege the human component as indispensable to the intellectual capital.

[Marulanda and López \(2013\)](#) indicate other components of intellectual capital: human resources, relationships, physical infrastructure, practices and routines, and intellectual property.

[Edvinsson and Malone \(2006\)](#); [Estrada and Dutrénit \(2007\)](#); [Bontis, Chua, and Richardson \(2000\)](#); [Madrigal \(2009\)](#) shows that intellectual capital is formed by human capital, structural capital and relational capital.

For [Amaya, Iriarte and Perozo \(2006\)](#) the intellectual capital components are a network of human resources, information, as well as computer and telematic. In turn, [Funes and Hernández \(2001\)](#) include several perspectives to indicate their components or types. For example, they cite [Brooking \(1997\)](#), who divides a company's intellectual capital into four categories of intangibles: a) market assets, b) intellectual property assets, c) assets focused on the individual, and d) infrastructure assets.

With a properly accounting approach to the intellectual capital, [Alizadeh \(2012\)](#) divides assets into two categories: physical and financial assets and intangible assets (intellectual property, copyright, patents, and goodwill), that is, what is properly indicates as intellectual capital.

Authors suchlike [Hoarau and Kline \(2014\)](#) indicate five categories of innovations: 1) in products, 2) in processes, 3) in management, 4) in marketing, and 5) innovations. [Schumpeter \(1939\)](#) incorporates innovation on purchases and supplies an introduction into new markets. The Organization for Economic Cooperation and Development, in its Oslo Manual (2006, cited in [Mercado, Demunerand Fierro, 2012](#)), incorporates, in addition to the innovation of products, processes and organization, innovation in marketing.

Hjalager (2002, quoted in [Novelli, Schmitz and Spencer, 2006](#)), subdivides innovation into product innovations and processes, but incorporates a new vision, with innovations in information management, administrative and institutional innovations.

As can be seen, the components of innovation are varied, but most agree in arguing the preponderance of innovations in products (whether goods or services), in processes, in organizational systems, in marketing strategies and, in general, in any type that generates value for organizations.

ANALYSIS OF MODELS APPLIED TO THE VARIABLES AND THEORIES OF INTELLECTUAL CAPITAL AND INNOVATION

This section introduces and analyzes the models applied and theories linked to intellectual capital and innovation. In this current stage, we have presented the most significant models and theories in the field. The studies for each intellectual capital, innovation, models and theories are explained based on the literature.

1. Analysis of models applied to the variables

There are multiple models and theories in the study of the variables of intellectual capital and innovation. The models most cited for the study of intellectual capital are Kaplan and Norton's balanced scorecard (1996), the Canadian Imperial Bank of Davenport and Prusak (1998), López's digital citizenship (2010), the management integral of the knowledge of Wiig (1993), the participative knowledge management of [Holsapple and Joshi \(2002\)](#), the intelligent knowledge designed by Del Moral et al. (2007), the knowledge management of [Nonaka and Takeuchi \(1995\)](#), the Skandia, the KMAT and the model from the University of West [Ontario, Bontis \(1998\)](#). Other models more focused on innovation are knowledge management as a source of innovation, proposed by [Nagles \(2007\)](#), the Intertwining Model or interlaced model, and that of the triple helix, outlined.

2. Analysis of theories of intellectual capital and innovation

More than a model of analysis, this section will present the main theoretical perspectives that accompany work in the field of intellectual capital research and innovation.

The theory of resources and capabilities (Grant, 1991, cited by [González, 2002](#)), [Estrada and Dutrénit \(2007\)](#), [Ochoa, Prieto, and Santidrián \(2012\)](#); [Mercado, Demuner, and Fierro \(2012\)](#). All these authors comment that the resources and capacities that a company possesses and controls will shape and delimit the strategic alternatives. This theory explains the importance of intangible resources, scarce, difficult to imitate and irreplaceable.

In the theory of intellectual capital ([Edvinsson and Malone, 1998](#)), used as a basis by [Ochoa, Prieto, and Santidrián \(2012\)](#) and by [Bontis, Chua and Richardson \(2000\)](#), three types of intangible resources linked to the competitive advantage of the signature. That is, it deals exclusively with the knowledge that is created and accumulated in the three capital components of the company: people (human capital), social relations (social capital) and systems and processes (organizational or relational capital).

For its part, the theory of dynamic capabilities ([Teece, 1998](#)), also exposed by [Ochoa, Prieto, and Santidrián \(2012\)](#), shows the ability of the company to integrate, build and restructuring internal and external capabilities in the direction of environmental changes rapid. The dynamic term refers to the capacity to reintroduce abilities, including the achievement of congruence with varying business environments.

The theory of stakeholders Clarkson (1995) cited by [Ochoa, Prieto, and Santidrián, \(2012\)](#); [Chen \(2014\)](#), and [Hoarau and Kline \(2014\)](#). In this case, the stakeholders are people or groups that have (or can demand) property rights, as well as interests incorporation and its activities and classify the stakeholders as primary (shareholders, investors, workers, customers, suppliers, and community) and secondary (those that are influenced by the corporation but do not engage in transactions with it, such as environmentalists, media representatives or client advocates).

The theory of the agency, cited by [Ochoa, Prieto, and Santidrián \(2012\)](#), is based on two approaches: the normative and the positive. The first includes the intangibles within the contracts, while the second establishes that the intellectual capital information systems are valuable instruments to encourage the efficient use of knowledge within the company and provide relevant information for decision making.

More than a theory, the focus on clusters is the most demanded in the works on innovation. Authors such as "[Novelli & Schmitz and Spencer \(2006\)](#), [Richards \(2011\)](#), [Jin&Weber and Bauer \(2012\)](#), [Yeoh, Othman and Ahmad \(2013\)](#), [Arsezen-Otamis and Yuzbasioglu \(2013\)](#), [Carlisle et al. \(2013\)](#), [Joukes & Lourenço-Gomes and Marta-Costa \(2013\)](#), [Viladrich and Baron-Faust \(2014\)](#), [Hoarau and Kline \(2014\)](#), [Thomas and Wood \(2014\)](#)" use it as a base and focus of their research work.

For long, positive functioning has been attributed to certain externalities that favor innovation. Generally, this phenomenon is known as a cluster and refers to concentrations of companies in certain geographical locations. The success of a cluster lies largely in the balance between competition and the cooperation of the agents involved in it.

METHOD

We apply the systematic literature review method. According to [Mulrow \(1994\)](#) "systematic review has been argued to provide the most efficient and high-quality method for identifying and evaluating extensive literature". The systematic reviews, and especially the Meta-analysis, are scientific investigations whose purpose is to integrate into an objective and systemic way the results of the empirical studies on a determined research problem, to establish the state-of-the-art in a precise field of study. They are developed in stages such as 1) formulation of the problem, 2) definition of inclusion criteria and search of the studies, 3) codification of the characteristics of the studies that can moderate the results, 4) calculation of the size of the effect, 5) techniques of statistical analysis and interpretation, and 6) publication ([Sánchez-Meca and Botella, 2010](#)).

The review approach is a multi-step process consisting of the keywords identification, mainly resulting from previous works. However, this approach produced many disturbances amidst the recovered headings; it was judged appropriate as the exclusive use of the "Article titles, abstracts and keywords" search choice clearly brought to a disregard of related contributions. The systematic review approach is usually applied in medical sciences and have newly raised in the management literature ([Denyer& Neely, 2004](#)). They vary from classical narrative reviews by following a replicable and rigorous scientific process. Therefore, this method minimizes bias and subjectivity. Systematic literature reviews aim to detect key scientific contributions to a domain and present the findings.

With these criteria of the procedure ([Sánchez-Meca and Botella, 2010](#)) the following systematic revision of literature elaborated, which seeks to be a guide that supports subsequent systemic reviews, even if it does not have an updated registry protocol that covers the analysis work.

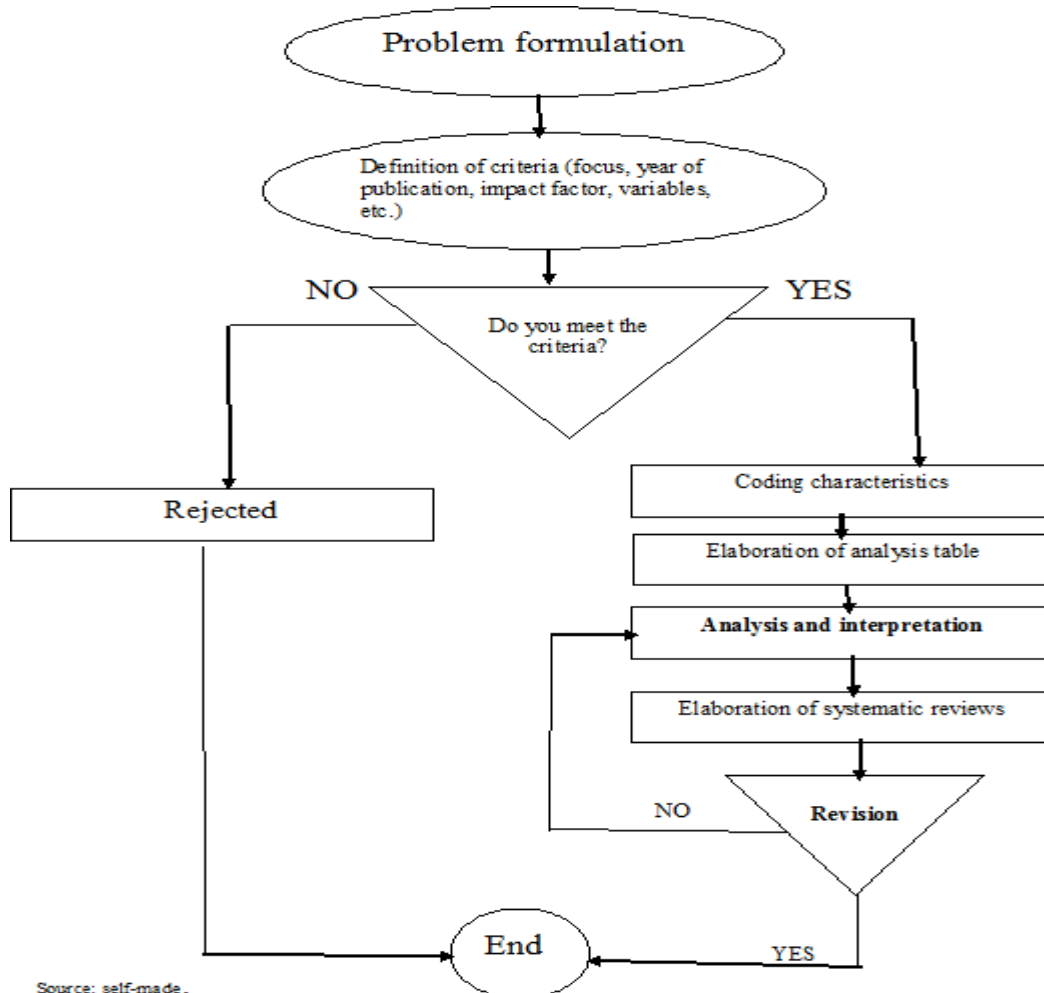


Figure 1. Procedure for the preparation of systematic reviews

Through the above procedure, the component checklists provided by the method, Strengthening the Reporting of Observational Studies in Epidemiology (Vandenbroucke, et al., 2009), and the statement Preferred Reporting Items for Systematic reviews and meta-analyses (prism) (Urrútia and Bonfill, 2010) for the analysis of systemic reviews and meta-analyses. This paper aims to analyze applied research on the variables intellectual capital and innovation to determine the common features and relationship between the different variables, analysis of definitions, characteristics, theories and models that support them, objectives pursued, methods used for research, data collection instruments and results obtained.

In order to locate and choose the works, it is recommended to be organized from the beginning in order to keep well established the variables to be investigated, the purposes and the most adequate bases that generate updated, pertinent, reliable and high impact information. The search mechanism was more organized in the second stage; In addition to the variables studied (intellectual capital, innovation, and its relationship), possible theoretical approaches were identified (management of clusters and stakeholders). We conducted the study in more qualified databases and with studies from other countries, such as Web of Science, Elsevier, Emerald, and Google Academic, among others. The search words were intellectual capital, innovation, clusters, and stakeholders. Articles were chosen based on the year of publication (from 2005 to 2018), the keywords (knowledge management, intellectual capital, innovation, tourism innovation, clusters), the aim of the article (intellectual capital a generator of innovation in companies and as a competitive advantage) the article (applied research, essays, editor's notes, literature analysis) and, above all, with applied research, the method they had used, the results and the breadth of the bibliography.

FINDINGS

This section presents the relevant results of the research of different authors on the relationship between the different components of intellectual capital and innovation capabilities in the firm. The capacity of a company to generate innovation related to intellectual capital or its ability to use its knowledge resources (Subramaniam and Youndt, 2005). In this way, the

terms knowledge, intellectual capital, and innovation are highly related, as shown by several studies that characterize innovative companies as companies that create knowledge (for example, [Nonaka and Takeuchi, 1995](#)) other studies emphasize that new products result from incorporating the knowledge of the organization (for example, [Stewart, 1997](#)) and others describe innovation as a knowledge management process (for example, [Madhavan and Grover, 1998](#)).

Several empirical studies have been carried out to establish and measure the relationship between intellectual capital and innovation. These studies have considered several levels: company level (for example, [Ghorbani, et al., 2012](#)), a group of companies from different sectors (for example, [Dumay, Rooney and Marini, 2013](#)), a group of companies from the same industry (for example, [Wu and Sivalogathan, 2013](#)), and at the level of regions, cities or nations (for example, [Bontis, 2002](#)).

Of the total of the researches chosen, 9 were studies related to the relationship between intellectual capital and innovation. The objectives, the theories and models and the types of research and data collection instruments used were derived from them and other articles.

1. Types of Research and Data Collection Instruments

[Subramaniam and Youndt\(2005\)](#); [Zerenler, Burak, and Sezgin \(2008\)](#); [Delgado-Verde \(2011\)](#); [Santos-Rodrigues, Faria, Cranfield and Morais \(2011\)](#); [González-Loureiro and Figueroa, \(2012\)](#) and [Wu &Sivalogathan \(2013\)](#) used a questionnaire based on Likert scales, with dimensions such as organizational analysis, organizational commitment, managerial philosophy, databases, training, experience and abilities, competencies, company images, patents, innovation culture, innovative capability, intellectual capital and innovation performance, information technologies, customer capital and the growth of innovative SMEs, knowledge, management systems, reward systems, managerial institution, operation processes, organizational culture, copyrights and trademarks which allowed comparing the status of companies in a different sector. On the other side, [Dumay, Rooney, and Marini \(2013\)](#) use the interview, asking 27 Australian executive managers from leading Australian companies and the public sector . The topics included from the profile of the company and their strategies, the process of innovation, innovation practice, the stability of the business environment and the need for innovation. Yasmin Kamall Khan, Sharifah Zannierah Syed Marzuki, Azlin Shafinaz Mohd Arshad use secondary data from Business Longitudinal Database (BLD) with dimensions as a product, process, and administrative innovations, process innovation, knowledge management processes, business practices for organizing procedures, organizing work responsibilities and decision making. An interesting work that differs from the traditional methods of research on relationship between intellectual capital and innovation is that of [Mir Dost, Yuosre F. Badir, Zeeshan and Adeel \(2016\)](#), which uses a key informant technique for data collection These informants were those who measured total innovation actions and well knowledgeable about their structural policies.

[Subramaniam and Youndt \(2005\)](#) conducted a confirmatory factor analysis (CFA) of the three aspects of intellectual capital and the two innovative capabilities using LISREL 8.54.

The research of [Zerenler, Burak and Sezgin \(2008\)](#) aimed at Three of intellectual capital types, employed capital, structural capital, and customer capital, that had significant positive relationships with innovation performance. The study applied regression analysis to verify the hypotheses.

Like the previous works, [Mir Dost, Yuosre F. Badir, Zeeshan and Adeel \(2016\)](#) use multiple regression analysis to verify the hypotheses and test the effect of human, organizational and social capital on innovation generation and adoption. [Delgado-Verde \(2011\)](#) apply an exploratory factor analysis, including all items related to intellectual capital components and confirmatory factor analysis using AMOS 7.0 to analyze the secondary sources (research started from the SABI database) and the questionnaire (7-point Likert scale).

The authors [Khan, Marzuki, Arshad \(2014\)](#) use secondary data from Business Longitudinal Database (BLD) that got from the Australian Bureau of Statistics (ABS) to conduct a statistical analysis. STATA version 10 used to analyze the data, the preliminary analysis that used to test the hypotheses was Poisson regression analysis (PRA) and the goodness-of-fit chi-squared test confirms that the data is Poisson distributed .

[González-Loureiro and Figueroa \(2012\)](#) develop and test a model for measuring and evaluating the effect of the three intellectual capital elements on the growth of innovative SMEs, the model is tested in a representative sample of innovative SMEs from Galicia.

[Santos-Rodrigues, Faria, Cranfield and Morais \(2011\)](#) conducted a survey with a questionnaire distributed to sixty-eight service directors, with Kaiser Normalization converged in 6 interactions (KMO) used for the analysis.

[Morais \(2011\) & Wu &Sivalogathan \(2013\)](#) examine theoretically and empirically the impact of intellectual capital components on the innovation capacity and the industry performance in Sri Lanka using Pearson correlation to test research hypotheses.

[Dumay, Rooney, and Marini \(2013\)](#) use a qualitative approach linking intellectual capital to innovation by developing a differentiation innovation practice theory. They implemented a grid analysis to analyze the interviews conducted with 27 Australian executive managers and chief executive officers (EMCs) across different industry sectors.

2. The intellectual capital generator of the innovation capacity of the companies

Table 2 shows the findings of the relationship between intellectual capital and innovation of some studies carried out between 2005 and 2018. This information helps to clarify the influence of intellectual capital and its components on the innovation capacity of companies, according to the analysis made.

Table 2: Results of studies conducted on the relationship between intellectual capital and innovation in companies from different sectors.

Authors	Study population	Findings
Subramaniam and Youndt (Subramaniam and Youndt, 2005).	93 public companies from different sectors with more than 100 employees.	<ul style="list-style-type: none"> - The interaction of human and social (relational) capital positively influenced the capacity for radical innovation. The social capital (relational) positively influences the capacity for both incremental and radical innovation. Human capital has a negative influence on the capacity for radical innovation - Organizational (structural) capital positively influences incremental innovation capacity -We did not find that social (relational) capital fosters the influence of organizational (structural) capital on the capacity for incremental innovation.
MuammerZerenler, SelcukBurakHasiloglu, Mete SezginTurkia (Zerenler, Burak and Sezgin, 2008).	92 managers surveyed from automotive suppliers (marketing department, R & D, or Production related to innovation).	<ul style="list-style-type: none"> - Intellectual capital components (employee, structural and customer) had a significant positive relationship with the innovation performance. -The client capital (relational capital) was the most significant on the performance of innovation, followed by capital employed (human capital) and finally, the structural capital was the least significant.
Miriam Delgado Verde (Delgado-Verde, 2011).	251 Spanish companies in the high and medium technology manufacturing sector with 50 or more employees.	<ul style="list-style-type: none"> -The human capital has a positive relationship with radical innovation. - Structured collective knowledge, represented by organizational capital and technological capital, positively influences incremental rather than radical innovation. -Relationship capital positively influences radical innovation. - Social capital seems to have a greater influence on incremental innovation than on radical innovation.

		-In the interaction of human capital and relational capital, a significant influence was found in radical innovation.
Helena Santos-Rodrigues, João Faria, Desireé Cranfield and CarmindaMorais (Santos-Rodrigues, Faria, Cranfield and Morais, 2011).	65 service directors of a hospital in the north of Portugal.	-The human capital is associated with the innovation capacity of an organization. -Structural capital is directly related to the adoption of innovation. -Structural capital is not directly related to the creation of innovation. -Relationship capital is the only capital directly associated with the construct's creation of innovation and adoption of innovation.
Miguel Gonzalez-Loureiro and Pedro Figueroa-Dorrego(González-Loureiro and Figueroa, 2012).	The limited sample of 140 SMEs and the regional scope (region of Galicia).	-Human capital is the fundamental starting point in innovative SMEs. -The main link that explains the growth of these companies is human capital and structural capital. -Low degree of the link between human capital and relational capital to explain the growth. -Internal factors play a main role in innovation processes, while relational capital (external links) could participate as a secondary role.
Dumay J., Jim Rooney and Lisa Marini (Dumay, Rooney and Marini, 2013).	Interviews with 27 Australian executive directors of companies from different industries, including the public sector.	-Manage the approach of successful and failed innovations. As well as three types of innovative capacity: radical, evolutionary and incremental. -Human capital is a key factor for the success of incremental innovation is also a mitigating factor for radical and evolutionary innovation. - Structural capital is a critical element for the evolutionary innovation success and a mitigation factor in radical innovation. -Capital relational is a key factor in the success of radical innovation.
Xiaobo Wu, V. Sivalogathan (Wu & Sivalogathan, 2013).	70 participants from the Sri Lankan clothing industry.	- The results of the study indicate that the intellectual capital components, human capital, organizational (structural) and social (relational), are positively related to the capacity for innovation and performance in the Sri Lanka industry.
Mir Dost, Yuosre F. Badir, Zeeshan Ali, Adeel Tariq (Mir Dost, Yuosre F. Badir, Zeeshan Ali, Adeel Tariq,	318 respondents from the firms involved in chemical production.	-Human capital and organizational capital correlated significantly with innovation generation.

[2016](#)).

- Human capital and organizational capital also found to correlate significantly with innovation adoption.
- The effect of organizational capital on innovation adoption was positive and significant.
- The effects of social capital on innovation adoption was positive and significant
- The effects of social capital on innovation generation were significant.
- Human capital has a strong and positive influence on innovation generation.
- Organizational capital has a strong and positive impact on innovation adoption.

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318 SMEs selected from the Business Longitudinal Database (BLD) obtained from the Australian Bureau of Statistics (ABS).

- Innovation performance constructs that are product, process, and administration innovation variables were positively associated with human capital and resource capital.
- Human capital significantly predicts process and administration innovation.
- The human capital impact of process and administration innovation is somehow similar to [Subramaniam and Youndt \(2005\)](#) who found that human capital impacts incremental innovation .

Source: Own elaboration with information of the cited authors.

In summary, the results of the table show that the intellectual capital and its individual components influence the innovation capacity of companies. The influence is at different levels, depending on the company's innovation strategy, whether radical or incremental. This information interests those who decide in organizations, to dictate investment strategies in the various components of the intellectual capital, giving to the innovation model of their choice.

3. Framework of work

We carried exploratory research out to establish the reference framework for the identification of intellectual capital as a generator of innovation capabilities in companies.

The source of data consulted were scientific databases such as ScienceDirect, Emerald, Elsevier, Wiley, and indifferent Journals, among which the Journal of Technology Management & Innovation , the Journal of intellectual capital and the Harvard Business Review , among others.

The search criteria for information were keywords, intellectual capital, and innovation. To outline a global vision of the relationship between intellectual capital and innovation, empirical studies were included in different areas and business levels, that is, at the company level, a set of companies from the same industry, a set of companies from different sectors and region level.

To carry out this work, several tasks were carried out, beginning with the discrimination of the publications considered relevant to concepts, ideas, data, references and examples related to the keywords. Subsequently, the selected articles were analyzed in detail. Finally, the present article is structured and fed.



CONCLUSION

The literature review is one of the most important exercises because it allows the following objectives: identify research topics that have not been studied enough or the approaches that need to be covered, the variants in the styles and profiles that each author retakes and the more novel information about the variables; Determine and write the theoretical approaches and aspects of the conceptual framework; review methodological approaches; rediscover new lines of research suggested by the authors, among other relevant possibilities. Likewise, preparing matrix tables that include the breakdown of the main information makes its assessment, control, and analysis of the sources chosen for a research project relevant. It is a work that has been carried out step by step, discovering on the way its transcendence and forming a cycle not yet finished.

This literature review intended to clarify the standing figure of knowledge linked to the associations between intellectual capital and innovation. We have implemented a systematic approach to carry out this literature review.

Most applied research recommends using qualitative studies to review, in a more holistic way, what, how, or why certain phenomena occur. Although they have the limitation that their quantifications are appreciations of each investigation -and we can hardly make conclusive assertions as in quantitative research- it is feasible to establish a panorama and reflect the reality of the phenomenon. These studies suggest the use of data collection instruments such as questionnaires, semi-structured interviews, free observations and participants.

Intellectual capital and innovation are two areas that are closely related. To speak of innovation in a company is to refer to the individual talents that its staff possesses. We support the innovations that are generated through the company's infrastructure: its processes, systems, databases, and patents. Innovations are enhanced when knowledge and experience are shared through the company's collaboration networks.

This empirical study examined show that intellectual capital and its individual components generate the development of innovation capabilities of companies, albeit at different levels. The relationship with the highest level of influence is established between relational capital and radical innovation. The reason for this finding could be explained because when knowledge is shared between the different internal and external actors, the exploration time of the phenomenon to be innovated is minimized. Structural capital has a greater influence on incremental innovation. And human capital by itself has no greater influence on innovation unless knowledge is shared through collaborative networks.

We conclude that companies should strengthen their intellectual capital, to have greater possibilities for innovation and meet the demands of the market.

LIMITATIONS OF THE STUDY AND STUDY FORWARD

The systematic review of importance principally depends on the issue. The systematic review result depends on the studies carried out. In this case, we chose a critical aspect comprising two phases. The initial is the identification stage or literature research, in which we determine possible investigations. In the second step, significant criteria are used (Figure 1) to build a register of studies for involvement. Three insidious problems limit this systematic review: publication and research bias in the identification state and selection bias in the collection step. A practical limitation of a systematic review use is that the research may be inconclusive because of the limited investigation number utilized in this article.

In projecting future investigations, our findings may have a vital purpose in figuring out when to use the different theories, designs and which technique to apply. This would be the process when there is heterogeneity among the examined studies.

IMPLICATIONS OF THE STUDY

The volume of information generated in intellectual capital and innovation correlation is becoming overwhelming, even for experienced investigators. To help understand the information, this study presents the results of numerous studies. Combining accessible information about intellectual capital and innovation relationships to generate a coordinated result looks rational and can manage a reasonable amount of resources. This article can bring valuable information to researchers to perform forthcoming research.

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