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Key success factors to business intelligence solution implementation

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ABSTRACT Business intelligence (BI) solutions have been adopted within organizations as a mean to achieve a more grounded decision making process that results in better organizational outcomes. Nowadays, about 70% to 80% of business intelligence implementation projects fail due to both technological and managerial issues. Multi-methodology proposed by Mingers (2006) was followed to develop the research in four phases: appreciation, where documental search was conducted through a literature review; analysis, where hypothetical structures related with the key success factors were proposed; assessment, where key success factors were assessed along with experts; and action, where research results discussion was shown. As a result, 13 factors that affect the business intelligence solution's success were identified. Those factors contribute to improve planning and implementation of business intelligence projects, accomplishing in a greater extent the purposes of these projects.

KEYWORDS BI projects, BI success, business intelligence, critical factors, key success factors

1. INTRODUCTION

For companies and institutions to survive in the economy and in the business world, decisions must be accurate and made on time (Karim 2011; Olszak 2016). To have trusted, accurate and timely decisions, information needs must be ideally satisfied (Rajterič 2010) since the amount of time between making a decision and its feedback (which requires a new decision) is shorter every time (Folinas 2007). For companies to remain competitive in the new economy they must dynamically respond to both environmental changes and customer requirements (Velicanu and Matei 2008).

In practice and despite the facts mentioned above, it has been noticed that a great proportion of BI projects fail. According to Gartner Inc. about 70% to 80% of BI projects fail (Ortega 2013; SAP 2013). Pham et al. (2016) estimated a rate of failure approximately between 65% to 70%. Castelán et al. (2010) claim this proportion is about 40% to 50% for systems based on data warehouses, such as BI systems, because of issues that were not considered early on. This is consistent with another study that reveals that in addition to failing, they are also abandoned at the same rate (Herrera, 2011).

Failures in the use of BI implemented solutions are significant as well. In a few cases this type of solution tends to be discarded or fails to be implementations. About 10% to 20% of projects that did not fail in the pre-implementation stage are executed result sub-utilization by those users that were supposed to use them (Arnott 2010; Yeoh and Popovič 2016).

However, existing problems in the BI project field can be seen from different perspectives. From a general point of view, there are two groups that summarize the presented failures: managerial obstacles and technological obstacles (Sakulsorn 2011). From a specific perspective there are problems related to the project leaders, sponsorship,

solution requirements, designs, training, tools, tracing, posted objectives, estimated time to execution, data, data sources, problems with the technology handling, user needs, and investments, among others (Ahmed 2014; Castelán et al. 2010; EMC Consulting 2010; Gurjar and Rathore 2013; Herrera 2011; SAP 2013).

Those failures produce problems within organizations such as wasted of resources, time, and costs of opportunity of invested capital, as well as an inability to achieve expected benefits (Ortiz 2014).

Taking into account the given failures when thinking about BI solutions and the problems that arise at the time of sharing information at an organizational level, this research aims to give a conceptual framework of key success factors to improve BI solutions success within organizations. All of these take contributions from several authors, validate those contributions at an organizational level and generate factors or specific characteristics that allow organizations to get greater effectivity rates in the adoption and implementation of these type of projects.

2. THEORETICAL BACKGROUND

Given the high failure rates, sub-utilization and the withdrawal of BI solutions, the need to approach issues that encourage good planning, use, implementation and holding of these type of solutions is evident. For that, researchers have attempted to identify those factors that could contribute to BI solution success, and are linked to benefits that could be potentially achieved (Ramamurthy and Sen 2008; Srikant 2006; Solomon 2005; Shin 2003; Hwang et al. 2004 cited in Hawking and Sellitto 2010). These factors have been called "key success factors". Issues such as solutions adoption, complexities in implementation, and business purposes justify a more focused study of key success factors for BI solutions (Yeoh et al. 2008).

The challenge for organizations is to identify factors that have the greatest influence over their BI systems (Sangar and Iahad, 2013), which is why the topic of key success factors becomes a useful concept to understand the events during a BI project. Further, it becomes a construct easy to understand by managers, executives, technology information professionals and other people from areas that can carry theory into practice (Arnott 2008).

2.1 Key success factors

"The theory of KSFs gives good basis for stating what criteria should be followed during implementation of BI applications" (Olszak 2016, 112). Key Success Factors are defined in the literature as those critical areas where everything has to work correctly for business to flourish (Umble and Umble 2003, cited in Sangar and Iahad 2013). Equally, they are seen as high level considerations that differ from a set of deliverables at the end of a project (Yeoh et al. 2006). The definition made by Olszak and Ziemba (2012) goes further and claims that they are seen as a set of tasks and procedures that must be approached to secure the BI systems achievements during their formulation and promotion. This is used as the definition in this research.

2.2 Key success factor in BI solutions

Literature presents different key criteria to ensure BI solution success (Table 1). In turn, these factors present key characteristics that describe in a detailed way the meaning and composition of each factor.

2.2.1 Directives and top management

The engagement of the key members of the management team relates to the BI project (Table 1). According to Cidrin and Adamala (2011), a high level of top management support is associated with a high level of BI project success. Likewise, it helps to manage the change process and battle the resistance against project (Arnott 2008).

Leadership figures have important influence since if these executives exert a significant influence, they will be seen as leaders, and, employees will tend to follow them (Hobek et al. 2009).

2.2.2 Business linking

According to an interviewed person from the study by Yeoh et al. (2007, 1362), "a BI system that is not business driven, is a failed system". Also Salmasi et al. (2016, 26) stated that "For BI success in an organization, information systems must meet the business needs". A solid business model must incorporate all strategic proposals that the project will approach, needed working resources, possible risks, costs to take on and deadlines to execute the project (Table 1). Thus, the model will provide justifiable motivations by which the adoption of a new solution changes the existing practices (Yeoh et al. 2007).

Table 1 Collected key success factors (characteristics) based on the literature review.

Factor	***Key characteristics***	***References***
Directives and Top Management	- Committed support and sponsorship from top management - Continuous support and support from directives - Directive sponsor, informed and committed - Active participation from actionist - Well-qualified managers and managerial teams - Project that fulfil with the sponsor needs	Arnott 2008; Chan et al. 2013; Cidrin and Adamala 2011; Dawson and Van Belle 2013; Hawking and Sellitto 2010; Olszak and Ziemba 2012; Sangar and Iahad 2013; Yeoh et al. 2006; Yeoh et al. 2007; Yeoh et al. 2008; Yeoh and Koronios 2010; Olszak, 2016; Pham et al. 2016; Yeoh and Popovič 2016.
Business Linking	- To have well defined business process and problems - Strategic BI vision linked to company initiatives - Align business needs - To have well defined business requirements related to information - To have well defined business model - Identify key performance indicators (KPI) - Involve business affairs with the technical side - Establish metrics and classifications handled by business side - To govern the information handled by business - To formulate a methodology and a project management handled by business side - To have a theoretical and upgradeable framework managed by business side - To formulate a project approach handled by business side - Well-stablished business case	Arnott 2008; Cidrin and Adamala 2011; Hawking and Sellitto 2010; Sangar and Iahad 2013; Olszak and Ziemba 2012; Yeoh et al. 2007; Yeoh et al. 2008; Yeoh and Koronios 2010; Yeoh and Popovič 2016.
Project Leader or "Champion" set-up	- High-level person with business knowledge - Business oriented Champion - Project Champion	Sangar and Iahad 2013; Dawson and Van Belle 2013; Hawking and Sellitto 2010; Yeoh et al. 2006; Yeoh et al. 2008; Yeoh and Koronios 2010.
Strategy	- Clear mission and vision - Strategical vision of the BI project - Business vision - Clear business plan - Strategic and extensible technical framework -	Cidrin and Adamala 2011; Dawson and Van Belle 2013; Sangar and Iahad 2013; Olszak and Ziemba 2012; Yeoh et al. 2008; Yeoh and Koronios 2010; Olszak, 2016; Pham et al. 2016; Yeoh and Popovič 2016.
Change Management	- Suitable and effective change management due to BI Project - User-oriented change management	Hawking and Sellitto 2010; Olszak and Ziemba 2012; Sangar and Iahad 2013; Yeoh et al. 2008; Yeoh and Koronios 2010; Pham et al. 2016; Yeoh and Popovič 2016.
Project	- Project planning - To define and manage project scope - Project that delivers "quick wins" - Effective project management - Solutions design - Solutions design based on the end user - Clear link between business objectives - Project methodology - Project performance - Competent BI project manager - Respond to lack of flexibility and answer to user requirements - To build a project pilot which introduce incremental changes - Iterative development handled by business part	Arnott 2008; Cidrin and Adamala 2011; Hawking and Sellitto 2010; Olszak and Ziemba 2012; Sangar and Iahad 2013; Yeoh et al. 2007.
People and Human Talent Teams	- Support from an external consultant in the start phase - Formal an interactive engagement with participation of the end user during project life cycle. - Appropriate mixed skills team - Well defined user expectations - Balanced skills and composition of the team -	Arnott 2008; Dawson and Van Belle 2013; Olszak and Ziemba 2012; Sangar and Iahad 2013; Yeoh et al. 2006; Yeoh et al. 2007; Yeoh and Koronios 2010; Pham et al. 2016; Yeoh and Popovič 2016.
Learning and Skills	- Education and suitable and formal user learning - Easy learning solutions - In-site education, learning and support - Team knowledge and skills - Committed experience from the business side	Chan et al. 2013; Sangar and Iahad 2013; Yeoh et al. 2006; Yeoh et al. 2007; Olszak, 2016.

Information and Technology	- Suitable technology and tools - Technologies development - Evolving development - Set a strategic, extensible and upgradable technical framework - Contents according to the business - High data quality and confident sources - Sustainability - Tests - Interaction with other systems - Report strategies - Date government - Data security - Effective data management - Source data systems - Data and information integrity and accuracy - Partners for implementation - Friendly BI system use - Sustainability quantity and quality of data - Hardware and software sustainability - System confidence, upgradability and flexibility - Friendly user-oriented technologies - Solutions fit to user expectations - Dimensional model of data and metadata - Use of a test prototype - Source systems stable in site - Availability of information department - Customization - Devices security - Authentication - Device independency - Usability - Accessibility - Connectivity to networks - Flexibility - Consistency - Re-usability - Functionality - Support of interactive systems - Timely reports	Arnott 2008; Chan et al. 2013; Cidrin and Adamala 2011; Hawking and Sellitto 2010; Olszak and Ziemba 2012; Sangar and Iahad 2013; Yeoh et al. 2006; Yeoh et al. 2007; Yeoh et al. 2008; Yeoh and Koronios 2010; Pham et al. 2016; Yeoh and Popovič 2016.
Resources	- Intellectual suitable resources - Technological suitable resources - Suitable budget - Strategic human and financial resources	Arnott 2008; Olszak and Ziemba 2012; Yeoh et al. 2006; Yeoh et al. 2007; Chasanlow 2009 cited by Salmasi et al. 2016
Metrics	- Current system use - Perceived system utility - Net benefits obtained - User satisfaction - Use intention - Service quality - System quality - Information quality	Nemec 2011; Sangar and Iahad 2013.
Environment	- Organizational culture - Solving of non-technical issues - Cooperation with BI suppliers based on past experiences	Cidrin and Adamala 2011; Olszak and Ziemba 2012; Sangar and Iahad 2013.

The project must have a clear link to the business, this way it will be economically supported in terms of its economic value (Arnott 2008). According to Yeoh and Koronios (2010), the main cause of BI solutions failure is not technological but a poor alignment with the business, its vision and objectives. This result in the impossibility of satisfying both the business and the costumers' needs and objectives.

2.2.3 Project leader or "champion" set up

This makes reference to a team leader appointment, in a few cases it is the same Chief Information Officer (CIO) (Table 1). This person must have enough technical and functional knowledge and at the same time he/she must have excellent interpersonal

abilities to solve organizational conflicts (Yeoh et al. 2006).

This makes choosing a leader a challenge as that person will carry the project baton, and foresee organizational challenges and course changes on time (Yeoh and Koronios 2010). He/she will see the solution from an organizational and strategic perspective, not only technological. If he/she understands both business and technology, he/she could translate business requirements in the technological architecture and vice versa (Yeoh et al. 2007).

2.2.4 Strategy

The fixed strategic vision is summarized in the results obtained by Yeoh et al. (2007). Their findings suggest that a long-term strategy results in a continuum improvement at an organizational level, and the impact of the solution and the expected results depend on its understanding (Table 1). Top management must be committed and give the needed support for project success (Yeoh et al. 2006).

The project must have a vision of BI as well, it must provide needed resources to fulfil it and must insist on the use of information at the decision making process (Watson and Wixom 2007). Equally important are the goals or objectives. It is a fundamental input to have a clear way to which the organizations want to reach. It also works to dispose the resources, actions, processes and everything needed to reach a desired state. Although the company may fix it, sometimes there is doubt about their use from the employees in their daily operations (Popescu 2012).

2.2.5 Change management

A change management program is important in the sense that it reduces implementation resistance and in the way that it favors its adoption (Hawking 2013) especially when technologies are ongoing, because it is the moment in which there are greater possibilities for changes to happen (Hobek et al. 2009; Fourati-Jamoussi et al. 2016) (Table 1).

Communication is an important factor for the change management. It must appear in the project formulation step so employees can prepare on their own to receive change (Hobek et al. 2009) and for them to know first-hand the impact it will have at individual level (Hawking 2013).

2.2.6 Project

The BI project is one of the most important factors, considered to be a key one. The authors (Arnott 2008; Hawking and Sellitto 2010; Yeoh et al. 2006; Yeoh et al. 2007) claim a marked emphasis in the scope is an important issue for the success of the BI project. With that, the main objective of its formulation, deadlines, advances and final results can be achieved, framed and aligned with the business purposes strategically posted early by the top management (Table 1).

2.2.7 People and human talent teams

Individuals as project members must have appropriate experience, knowledge and skills (Arnott 2008; Rouhani et al. 2012; Salmasi et al. 2016).

According to interviews made by Yeoh et al. (2007), they showed that experts agreed that team conformation and the skills of people engaged in the project greatly influenced its implementation success. It is ideal that participant teams are composed of people from diverse areas, who have technical expertise and a deep business knowledge (Burton et al. 2006 cited by Yeoh et al. 2007) (Table 1).

2.2.8 Learning and skills

It is important that organizations provide workers with the skills and knowledge to use the BI solutions (McCalister 2012; Arnott 2008; Wixom and Watson 2001, cited by Chan et al., 2013).

Taking into account that this kind of project demands high technical engagement, it must dispose a team that gives support and more precisely training in order to educate and shape everyone about the BI project (Adamala and Cidrin 2011; Olszak 2016.) (Table 1). That team can be shaped by people supporting both the technical and human parties. Based on this training it is important that people give feedback about their experience since they will continue to use the BI solutions (Bălăceanu 2007; Muntean 2007).

Learning tools enter here to mediate. They must be offered and disposed to acquaint people with the new solution environment, since human behavior related to decision making is not generally aligned with tools capacity (Feng et al. 2009).

2.2.9 Information and technology

This key success factor is one of the most used in BI research, since it is focused on

architecture, software and tools development and tangible elements whose impact is reflected in practice by its operative characteristics (Loshin 2013).

According to Yeoh et al. (2007) the first step is to do a requirements analysis whereby a solution can secure the shape of organizational conditions over the time.

As second step that analysis must conclude in a match between organizational needs and their alignment in the company's strategic framework whereby it fulfills the proposed objectives and posted vision (Knoben and Oerlemans 2006).

A third step is related to information management, established sources and articulation of needed means, for instance strategic and tactical integration with other tools like BPM (Business Process Management), which offers innovative solutions to decision making (Linden et al. 2011), policies for processing and processing information. Not estimating the magnitude of unsolved information problems generally resonates in a project failure (Rosado and Rico 2010).

Choosing a solution is the last step; it should be matched to the organization's needs (Arnott 2008). It must require a detailed plan formulation. If the organization is supported only by tools without a plan, purchasing solutions will become a distraction to the proposed goals (Loshin 2013) (Table 1).

2.2.10 Resources

Generally, this factor is seen from a clearly economic view, mainly for the top management which assess this kind of project through cost-benefit relations. While it is not a mistake, is clear that intellectual, economic and physical factors have equal weight within a BI project since suitable handling and engaged management are key to real and verifiable benefits (Hobek et al. 2009; Yeoh et al. 2007) (Table 1).

2.2.11 Metrics

Metrics are always important to know projects results and in this case, it is not an exception. Following the research proposal of Nemec (2011) based on a literature review focused on DeLone y McLean studies, dimensions posted by these authors in their information systems success model can be seen as key factors when a BI project is assessed (Table 1).

Nemec (2011) formulates issues like benefits, utility, quality and satisfaction, which are perceived by users as influencing elements in a BI solution's success. It will result in relevant information about acceptance and real use that could be obtained by the project.

2.2.12 Environment

Organizations that do not have information to process, need information systems that can improve that situation and give them a better understanding about environment forces, with which they can improve their performance by producing and using useful information (Sangar and Iahad 2013).

Based on results from a big survey, Watson and Haley 1997 (cited by Yeoh et al. 2008), stated that critical factors for BI project success are organizational by nature. With a key success factor framework, engaged stakeholders can identify those necessary elements to improve efficacy and efficiency of planning and implementation activities, understanding the background, which is conducive to BI project implementation to success (Yeoh et al. 2008) (Table 1).

3. RESEARCH METHODOLOGY

The methodology used is the multi-methology proposed by Mingers (2006), which follows the phases: appreciation, where document search is conducted through a literature review; analysis, where hypothetical structures related with the key success factors are proposed; assessment, where key success factors are assessed along with experts; and action, where research result discussion is shown.

3.1 Literature review

Bibliography and references search were conducted in: Scopus and Web of Science and in a small amount in Google Scholar. Indexed journal articles, conference proceedings, book sections and corporate reports on BI were collected. It was conducted by equations restricted to databases: EBSCOHost (Business Source Complete and Academic Source Complete), Jstor, Emerald, IEEE, Science Direct, Springer Journal, Springer Books and Taylor & Francys. Once documents were obtained, a detailed check of abstracts and keywords was done to corroborate the material's relevance to the research. Table 2 shows the process outcomes. A total of 12 documents that explicitly treat the topic key success factors on BI solutions were found.

Table 2 Search and document outcomes. Table shows the equations used to retrieve important information to gather documents on the topic: "key success factors" in business intelligence which were applied to the database search.

Search equations
((Critical (or) (+) key (or) (+) csf (or) (+) ksf) and (success (or) (+) factors (or) (+) success factors) and (information systems (or) (+) business intelligence (or) (+) competitive intelligence (or) (+) information (or) (+) bi (or) (+) ci (or) (+) it))

Documents finally worked		
Academic	**Corporate**	**Total**
11	1	12

3.1.1 Document codification

According to Serbia (2007), a topics analysis was conducted. By using the NVIVO10 software, it was structured as: a primary node with the topic Key Success Factors on BI and twelve secondary nodes, ten of which are matched with the referred authors. Similarly, twelve tertiary nodes that represent the main identified factors according to a systematic literature review on this topic were formulated. This structure was established taking as reference the topics analysis conducted by Fernández Núñez (2006), referring to free text analysis through Key Words in Context (KWIC) to proceed to codify the contents on those nodes.

Next, this node structure is presented (Figure 1). The discontinuous line refers to contributions and its complement of author and exposed factors.

3.2 Information collecting

Interviews of seven experts in the field who have participated in research or

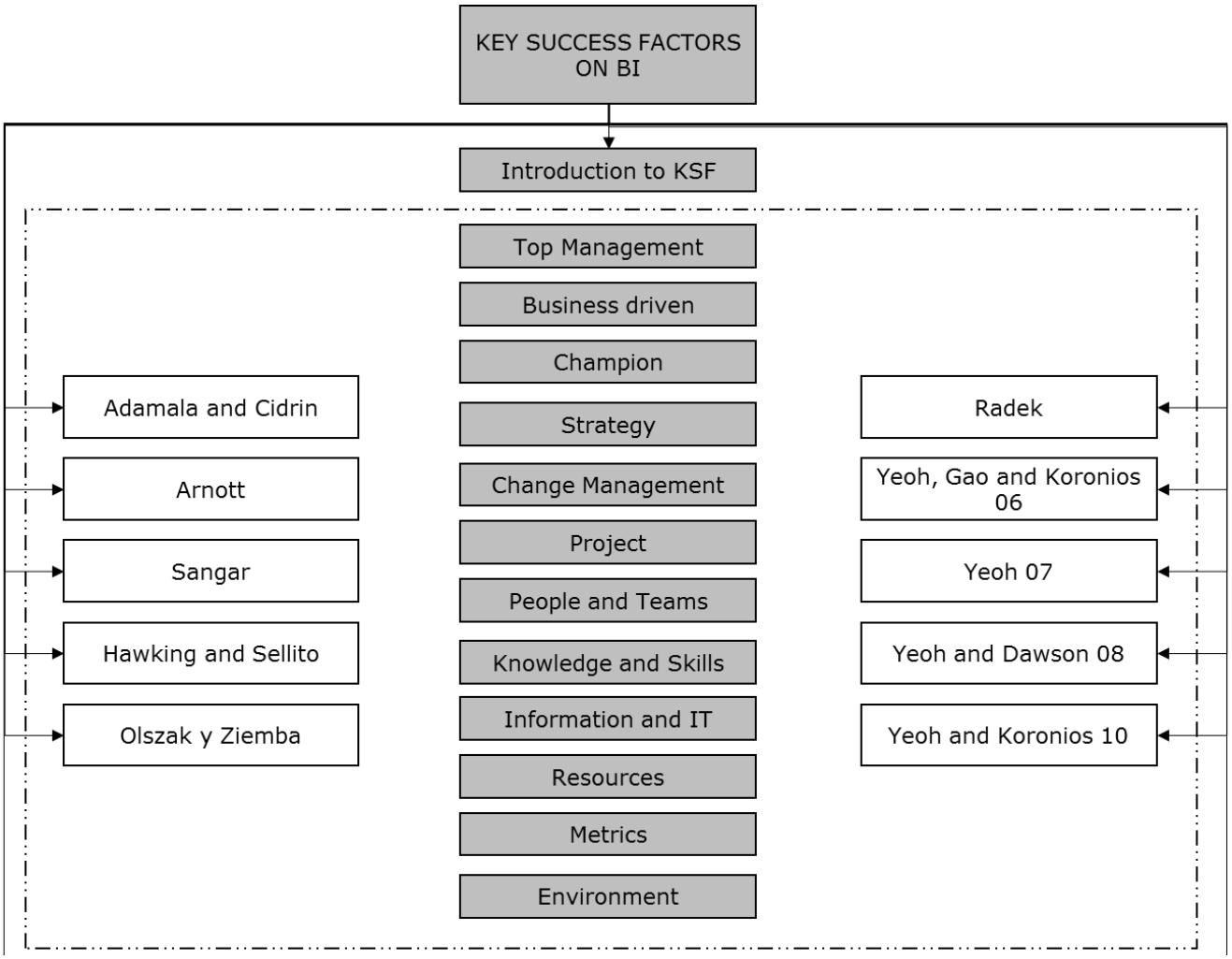

Figure 1 Node classification of key success factors on BI articles. This shows the node structure that is presented for the topic "key success factors on BI". The discontinuous line refers to contributions and its complementarity of each author to every exposed factor.

implementation of BI solutions were conducted (Table 3). According to Morse (1994) and Kuzel (1992) cited in Guest et al. (2006), a suitable number of interviewed participants in a qualitative study ranged from 6 to 8 people. Other studies (Fairer-Wessels and Malherbe, 2012; Fusch and Ness 2015; Mason 2010) argued that despite not having an ideal number of participants, saturation of information is a good stop index.

Each interview was made up of 30 questions (Appendix 1), two general questions to begin and end with a closer and conclusive conversation and 28 more focused on key success factors identified on literature that was exposed early on.

Based on the application, interviews duration ranged from 35 minutes to 82 minutes. Six were conducted in person and one on Skype.

Table 3 Experts participating in the study. This summarizes the main information about the experts who participated in the research. It contains basic information like degrees and practical and academic experience. Note: The distribution number is based on the order in which experts were interviewed, so this is not an important or significant factor in this research.

No.	*Position*	*Education*	*Experience*	*Means*
1	**Director** Information Technologies and Communications DNTIC - UN	Systems Engineer and Master in Systems Engineering	He has worked in the BI solutions industry for more than 25 years, 10 of which he worked as businessman and partner of a firm with which BI projects were designed and implemented in Colombia and Central America. He has been consultant and lecturer (outliner) in BI graduate courses.	Personal
2	**Professor** National University of Colombia	Mechanical Engineer, Telecommunications Engineering Specialist and Master in Systems Engineering.	20 years of experience in BI. He has worked with companies like *Latino BI* with the product *Cognos* in both, academic and industrial fields. He teaches BI subjects and works jointly with BI vendors like *IBM* and *Oracle*, developing events of presentation of solutions and consultancy by those vendors in the university.	Personal
3	**Professor** Konrad Lorenz University	Economist, Statistical Specialist, Master in Administration and PhD in Industry and Organizations	BI analyst for '*Casa Editorial El Tiempo'*. Also, BI and marketing research Director in the '*New Means and Transactional Portals Unit'* in the same organization, BI consultant and professor.	Personal
4	**Professor** University of the Andes	Systems Engineer, Master in Systems Engineering and PhD in Informatics	More than 20 years of experience in BI topics, data warehouses, physical designs and ETL in different sectors. She has served as project intervener, consultant, adviser and professor mainly in subjects like BI and business analytics.	Personal
5	**BI Manager** Philips Mexicana	Business Administrator, Marketing Specialist and Master in Multinational Administration	She has worked in the BI field since 2011 in worldwide companies like *Jhonson & Jhonson* and *Philips Mexicana* in data analysis as specialist and manager. She jointly works data analysis and financial analysis topics.	Skype
6	**Senior Analytics Architect - Cross Unit** IBM Colombia - S&D	Systems Engineer and Master in Systems Engineering	*Latino BI* partner jointly with *Cognos Corporation* and *Procalidad,* working on BI projects for companies in Colombia. *Cognos* Partner for Spanish companies. He worked with *Cognos Corporation* developing projects in Latin America. Since 2008 he served as Specialist and Architect in BI solutions, statistical and predictive solutions, operative and financial risk solutions and fraud solutions at *IBM*.	Personal
7	**Business Intelligence Project Director** On Data S.A.	Systems Engineer, emphasis in organizational information systems. Certificate in Management of information systems	She has served in BPM and BI as well as software quality insurance. Software quality Leader and BI Project Director for *On Data*. She focuses in planning, development and implementation of BI solutions for important companies both national and international located in Colombia in different sectors.	Personal

3.3 Information analysis

Interview processing was done with the NVIVO10 software based on a word frequency query applied to the seven documents of the interviews. It was a primary landscape of terms and keywords that were important in context, which were coincident with the early identified factors in the literature on key success factors in BI. With those terms a node structure was generated to classify and group information obtained from interviews. Table 4 shows the node classification and denomination that was used in the interviews processing.

Table 4 Node classification to interviews analysis. This shows the node classification and denomination that was used to the interviews processing with the NVIVO software.

Name	Resources	References
1. Directives and Top Management	7	20
2. Business Linking	7	25
Organizational Structure	7	12
Central control entity	5	7
3. Project Leader or "Champion" set up	7	24
4. Business Strategy	7	13
5. Change management	7	17
6. BI Project deployment	7	25
Requests	4	6
7. People and Human Talent Teams	7	22
People	7	14
Trust	5	9
Collaboration	2	8
Communication	5	8
Coordination	4	5
Engagement	3	4
Cooperation	3	4
8. Learning and Skills	7	33
9. Information and Technologies	7	45
10. Resources	7	35
Economic	7	9
Intellectual	7	9
Technological	7	17
11. Metrics	2	2
12. Environment	3	7
Argumentations	6	19

Table 4 shows the number of resources that were linked to the codification, which range from 0 (when no resources allude to each factor) to 7 (the maximum number of documents of experts interviewed). Likewise, it shows the number of references (codifications) made for each considered node. Almost all of the factors achieve the maximum number of resources, which means that most factors were treated by the experts in the interviews.

After identifying the primary and secondary nodes based on interviews, one-by-one-factor analysis was made. Pieces of interviews were taken to support the exposed ideas and outcomes as well as a text matrix summarizing the experts' arguments that support the outcomes.

According to the gathered information from the experts, a general structure which characterizes success factors in BI solutions in organizational environments was posted (research results). This structure is aligned and matches with the reviewed literature and is a product of a detailed content analysis of conducted interviews with the NVIVO10 software.

3.4 Proposition of hypothetical explicative structures to study the phenomenon

According to the identified factors from the literature, a single applicable hypothetical structure was formulated for each factor:

HS_0: *The identified factor does not affect the BI solution's success*

HS_1: *The identified factor affects the BI solution's success*

4. RESEARCH RESULTS

From the topics analysis of conducted interviews, results show that twelve pieces of literature identified factors that are consistent with experts' perceptions about BI solutions success, adding the *Professional Networks* factor according its importance to the experts. Figure 2 shows the obtained results.

Figure 2 shows the importance of every factor to the experts based on keywords attributed to each one, depending on the context in which each keyword was used by the experts. It should be noted that for this analysis 25% of the interviewees' transcript in the interviewed documents was used. Words or elements with less importance (which did not have a strong enough consistence to constitute an independent factor) according to this

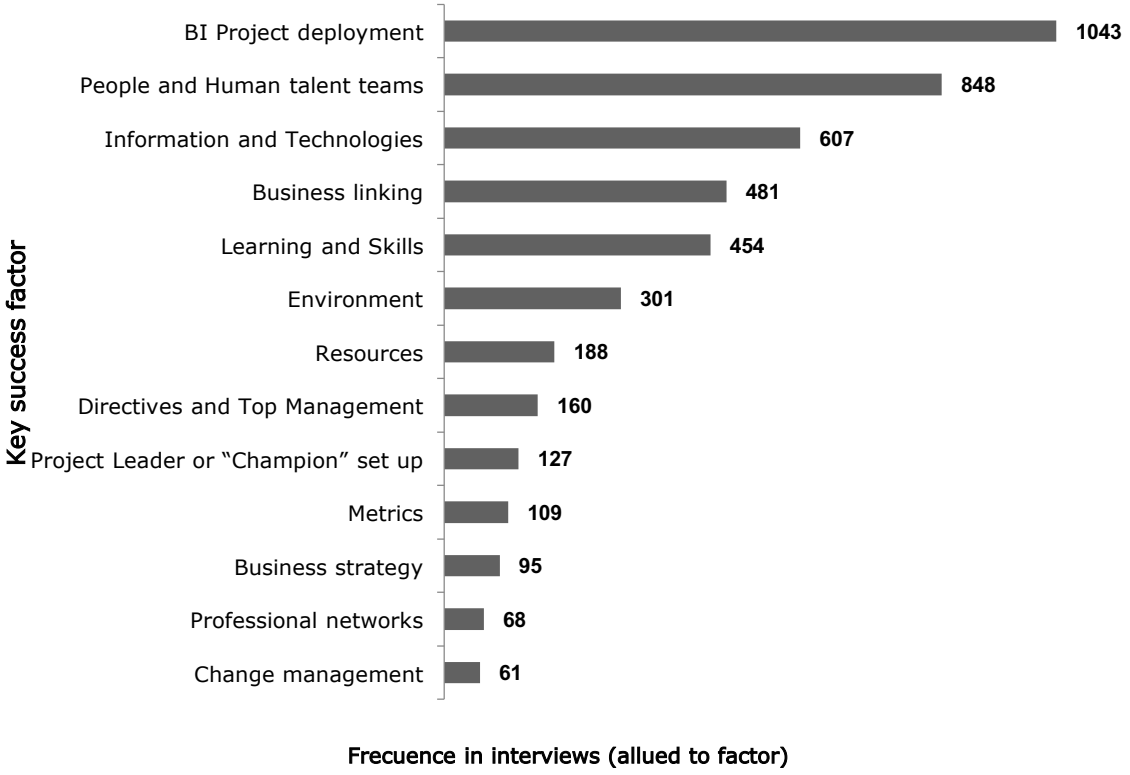

Figure 2 Importance degree of key success factors of BI solutions. shows the importance of the thirteen identified factors to the experts based on keywords attributed to each one, depending on the context in which each keyword was used by the experts.

analysis, were classified within the thirteen posted factors.

The next part focuses on presenting detailed research results after making an analysis of content based on the codification. Table 5 summarizes some of the experts' arguments taken from the documents of the interviews in support of the affirmations.

4.1 Directives and top management success factors

According to the experts there are four important characteristics around this factor. As a first step, making a decision about developing a project or implementing a solution is a top management affair: a manager, an owner, a steering committee or, by default, a third party with influence at the managerial level. All this leaves aside suppositions that the decision is made by organizational technology areas, as is commented on by the experts.

A second step is the deep knowledge about the request. A manager or top management executive of an organization is who decides what he/she needs. Although it could lead to misrepresentations and, sometimes, to incorrect BI project conceptions and developments due to the power or the political position these people may have within organizations, bad decisions could be made with expensive and useless projects, and may also discard more useful and viable projects because of individual decisions.

The third characteristic is the existence of a sponsor who is going to authorize and fund the idea of developing a BI project in an organization. The future of this kind of solutions depends on the top management's credibility since they will provide resources (mainly financial) and will sponsor efforts to achieve their objectives and goals.

Finally, handling of power and politics plays a fundamental role. It is evident that when experts say that these are projects focused on the top management, which is political by nature, forces that go beyond single decisions, requests and social relations are played. For instance, there are deep-root personal interests when there is a pursuit for personal favoring or figuration. In spite of that, it may be a positive point since it helps to analyze engaged actors in the project, and by this way to determine the best way to reach them, taking into account that there will always be detractors and followers with different levels of power and influence.

Table 5 Expert's arguments regarding to identified factors. This summarizes some of the expert's arguments taken from the documents of the interviews as support of the affirmations made within the article.

Validated factor	***Contributions by Expert***						
	E1	***E2***	***E3***	***E4***	***E5***	***E6***	***E7***
Directives and top mgmt	*It has got to have the top management's credibility and sponsorship or neither buy nor install.*	*(...) directive is who says what he/she needs. Simple! Put the request*	*[Projects] sometimes it depends a lot on directive's strength*	*If they are not convinced of benefits, it has little success probabilities*	*You Have to buy the idea 100%. If the initiative does not emerge from them, you should get a good sponsor with good influence*	*Nowadays there is not BI initiative if it does not come from a directive or VP*	*Manager contact us, we make him an offer and he is who say if products are bought or not*
Business linking	*[Important] is what concerns with indexes, objectives, goals and monitoring. It is the opportunity to accompany the business.*	*Enterprise structure is determinant especially for functions and responsibilities*	*The System must adapt to the organization as well as the organization to the system*	*(…) You start by understanding the sector in which the enterprise is into. You Understand the business and then needs and opportunities*	*You need to know what works, what doesn't work, and what you want to improve.*	*You have to define a strategy, where it goes to, what you want to get and how, how much you want to bet and what will be the earning.*	*You cannot implement anything if you do not know the business and customer's needs.*
Project Leader or "Champion" set up	*Generally all projects need a manager, particularly in informatics projects*	*Projects managers or project leaders have a different scope depending on their self-organization*	*This is a person who have to survive between daily fires and technological stream adoption*	*It is required, you have to have a specific leader there.*	*It is mandatory needed.*	*He/she Must be from the start, and, generally, it does not work with a single person, but with several leaders*	*It is a role which is totally indispensable*
Business strategy	*Implementation supports strategy*	*If I fix a strategy, I have to carry it out. It is just what makes a manager or a leader.*	*To the extent that the environment changes, strategy changes*	*It is necessary to know what the business strategy is, weaknesses and strengths [to know] where it goes to*	*Everything have to be routed to strategy*	*This project does not exist if there is not data, people, technologies and business strategy.*	*Who buy our products and services are not IT areas but strategy and decision making areas.*
Change mgmt	*In any project and generally an informatics project, change management is needed*	*Sometimes changes are due to a greater control and it does not like to people*	*I think there is a change resistance given more in a group than at individual level.*	*First I need to start evangelizing people regarding to what this is.*	*It is the main barrier, as I told you.*	*Human resources are needed to operate all this kind of solutions and an important process of change management is needed as well.*	*We are in a great paradigm shift which is to leave the Power Point to use Tableau*
BI Project deployment	*All informatics project needs planning.*	*(…) with that you can fix needed tasks, schedules and resources.*	*It implies a process organization, planning, collection, control and infrastructur e to generate data.*	*There is a follow-up, from business and the technical side. Posing how to conceive and how to implement.*	*From the beginning you need to know what you are looking for.*	*We assemble role pyramids: manager, technical leader, functional leader, solutions architect and consultants.*	*This kind of projects does not have neither a beginning nor an end, has a continuity.*
People and Human talent teams	*People who belong to a functional area are going to be engaged within the solution.*	*A single person cannot make everything, but the whole team can know about all of them who are needed.*	*A topic that is important for me is the forces' organization or work teams around this kind of projects.*	*He/she might not have the experience but he/she may know where people who have it are, and it helps the project to be more effective.*	*If you have well assembled a team than can implement and execute, they really could work better or worse with one or another technology.*	*[they are] vital because if not, project tend to fail*	*Team support makes valid why I am the projects' director, for instance.*
Learning and Skills	*In BI solutions value creation is*	*You need to train people*	*Learning is given at the*	*In the extent they*	*Technologies help you and*	*It is necessary to start doing*	*Agreements are*

Validated factor	*Contributions by Expert*						
	E1	***E2***	***E3***	***E4***	***E5***	***E6***	***E7***
	so evident, it makes all people get engaged.	*and remove their fear to the obstacles.*	*slowest person pace, this to avoid barriers in the process.*	*understand, information is obtained and a set of requests is collectively built.*	*facilitate learning.*	*knowledge transfer works.*	*fundamental. Training, consultancy.*
Information and technology	*Solutions are not expensive per se, They must be seen in a cost-benefit way. Solution choosing depends on cost-benefit relation.*	*By using technology you can do whatever you want, good and bad, It depends on how you look at this. Technology is able to make a lot of things, even imaginable things.*	*You have to change perspective about "this" is only technology nor just to buy a software, a hardware or to make a databases, etc.*	*I think that we are still in the first maturity levels in the adequate information treatment.*	*I think that tools are as good as information you enter, so you have to start with that.*	*There is a lot of information. It depends on what it is needed to the project and the working area.*	*Obviously there is a strong relationship, but there is no conditionality, that is to say, you do not depend on any technology to make anything.*
Prof networks	*Value creation is so evident, it makes all people get engaged.*	*It is so important that now all what is about networks, it is an input. Here I talk about professional and social networks.*	*External consultants and competence are the most important actors in that network.*	*The more you go expanding your circle, the more you enrich your learning.*	*It helps you a lot if you are leading a project. You receive opinions about how to implement or how to carry out the systems.*	*I look internally to see who has the skills to do it. Or externally, and see how experienced they are. That is how my network gets bigger.*	*Network is outsize and united, and I think it is valuable to know about what the others are doing.*
Resources	*To acquire a solution, a cost-benefit analysis must be done, it implies resources.*	*It must be allocated since the project planning stage.*	*There Must be people with intellectual capacities.*	*Online social networks are an important resource.*	*If I would have to decide, I would choose intellectual resources. I greatly appreciate technologies but they are just tools.*	*Solutions must be upgradable in all senses.*	*There Must be agreements with suppliers.*
Metrics	*Indexes allow to measure goals achievement, these allow to measure objectives achievement and objectives allow to make strategies.*	*When I have a decision, I do not think about what my heart feelings and my experience say, but I have a support on some indicators.*	*The project must have clarity about what results it targets and what are its KPI and its performance indicators.*	*One of the problems from the technical side is that you get indicators and deliver that, but, Does it have any sense?*	*You can measure all of your KPI with one or another tool. It facilitates your life and makes it fast.*	*I must take into account those indicators to which I want to reach and how I get it.*	*To be perceptive about what you have to sell: What generates value. Which indicator you can set. Why do not to formulate a metric?*
Environ-ment	-	*Now there is a globalized world because the sources, the sizes, the ways to work and the approaches are different. Paradigms have changed. Then notice that is not only that but all the environment.*	*The Project must not change if environment changes.*	*If you do not take into account organizational culture when you design a project like this, it could be a problem or a critical success factor of your project.*	-	-	*Value chain has to be transversal, it must have an amazing synergic to get this really arisen.*

4.2 Business linking success factors

Business linking is the starting point of any BI project. There is a consensus among several experts around the first-hand knowledge of the kind of business or organization and, derived from that, the sector in which it operates, activities developed by organization and, in itself, its position in economy. Furthermore, addressing business strategy becomes the second essential element in this factor since it represents the mission, vision, strategies, objectives, needs and, generally, all issues than have led the organization to think about a BI solution. Based on that, further actions can be determined in order to make a more optimal and efficient project.

This factor is the roadmap to project development since it sets a frame to follow according to the collected information that characterizes conditions in which an organization operates both internally and externally. Thus, subsequent actions can be stated to achieve results and fulfil the initially posted goals which justify the BI project development.

4.3 Project leader or "champion" set up success factor

It is vitally important to establish the project leader role. As experts stated, it is not reduced to a person but a position regardless of its denomination. They also emphasize the strategic importance that this role has within the project development.

This person is integral at technical, operative and personal levels. They must always be at the knowledge vanguard in favor of the BI project, and guiding all participant members according to that acquired knowledge and experience, not only technically but professionally and personally.

He/she must be influential in order to persuade other people of the benefits and the individual role within the project. Equally, he/she must be strategist at forming teams and groups in such a way that he/she exploits individual and group capacities for the common benefit.

He/she must be a person with values, always transparent to avoid influences from the top management or the operative side, understanding each one. This person will be in charge of negotiations among the parties involved, both internally and externally, dealing with problems and situations derived from the development and execution of the project.

This person must match efforts through technological, intellectual and personal resources coordination, exploiting individual capacities, serving as a central project axis and propending for centralization of activities and delegating responsibilities to all participants.

4.4 Business strategy success factors

As a first step, business strategy works to align input between project development and its proposed objectives and its implementation. As Expert 5 says *"all has to be routed to the strategy. That is why it also has to be aligned with the top management, it will be the primary line"*.

What is the importance of business strategy for a BI project? In the words of Expert 6 *"any process and in this case a BI process, it is part of a strategy. The first thing to define is: what is going to be the strategy? What do you want and where do you want to go to? What are the goals and objectives you want to achieve? That is the first thing you have to establish. Then you define a plan: how can you achieve that?"* It indicates what works as a support factor for the organizational processes.

In relation to the above, Expert 4 states that *"it is required to know what the strategy of the business is, weaknesses and strengths to know where it is oriented"* It summarizes that the business strategy factor works as a diagnosis tool, allowing one to know what the initial situation is without BI project, and what the desired state to reach with the project is.

Business strategy is not static. Thus, it is also presented with a factor of dynamism. According to the experts "*There must be clarity that strategy is normally emergent"* and it is dependent from the organizational environment, *"to the extent in which the environment changes, strategy changes"* otherwise the expected results could not possibly be achieved" states Expert 3.

It is evident that business strategy becomes a guide and at the same time a driving force that promotes the planning and implementation of a BI project, specifically its execution since the project will match the initial requests posted by the top management and the other people engaged.

4.5 Change management success factors

It is a linked factor to the organization's culture in which the BI project will be developed. According to Expert 1 *"there should be an early and simultaneous preparation. In any project,*

generally an informatics project, change management is needed. More in business intelligence. You need it as a key success factor to technology implementation"

Fear of change, as in any daily life situation, is present in this kind of project. Linked to that, the perception of BI tools in the project as a means of control, makes users and affected people in general take negative attitudes towards the BI initiative. Added to that, reactivity to carry out new processes and change the ones that exist, along with people's perceptions about being replaced by technical tools, reaffirms negative perceptions regarding actions in the BI project.

Although the above is not positive for the project, positive perceptions are also found at the moment of managing the change. According to the Experts' opinions, to innovate with a BI project in an organization allows the organizations to optimize processes that were tedious before, improving developed activities and achieving better results.

Likewise, there is the perception of specialization, which gives the person an image opposite to which he/she can form based on the established organizational culture, receiving benefits and learning new ways to perform the same processes.

4.6 BI project deployment success factors

According to the interviews with experts, the word *Project* holds the first use-frequency place (number of times it is repeated within the texts) by experts interviewed. It is no wonder, since it is the most important part of a BI solution. It includes in detail all issues, from the beginning to the end, being the center of all activities.

Consistent with the experts, the first step to follow must be evangelization and engagement of all of the actors who are going to be immersed in the project. In order to make them participate in its development, one must take them into account and show them the importance that it is going to represent to both their individual work and the organizational processes. This is achieved by training, meetings and constant and accurate information exchange.

At a general level, the BI project must start by setting its scope, thus, the relevant actions to formulate the project in detail should be set. That scope must obey the already set business requests mentioned, which indicate the need and relevance of formulating a BI solution, taking into account the expected goals.

Once those elements have been established, next one must undertake the project planning, which will determine in detail the schedules, tasks, and necessary resources (economic, intellectual and temporary) as well as business processes that will be engaged to achieve the goals established. Equally important is the responsibilities and role distribution for the process development.

Within these business processes, experts ensure that is important to detail issues such as: planning, and data collection, structuring, control and quality, as well as infrastructure, feedback and environment adaptation, continuity of activities and their follow-up. The latter is very important since it must be seen from three different points of view: business, technical and analytical, always guaranteeing business continuity.

4.7 People and human talent team success factors

Although social relations present difficulties due to their dependence on emotional, cultural and personal factors, among others, BI solutions are developed in environments where everyone has their role, responsibilities and an awareness of being part of a team that aims to achieve the agreed objectives.

The work team and the experience that members acquire are essential elements when developing a BI project. Based on this, the knowledge building, meanings and experiences that will benefit both individuals and organizations are important. Similarly, it is shown that the work team and its composition are mediated by six characteristics that could grow or limit its performance and development: collaboration, engagement, communication, trust, cooperation and coordination.

Collaboration is the first characteristic. According to Expert 6, along with coordination, *"[They are] vital because the project could tend to fail*", it must be immersed within the project from the conception because *"[within] the plan there must be all details of collaboration strategy in different fronts*" in order to know where you want to go with that collaborative work, and who must participate.

The second characteristic is engagement. According to Expert 2, *"engagement [must be] formal, formalized engagement works well because when it does not, it ends badly. [It] is the first thing to be workable, to have engaged people. When people are engaged, they will*

surely be responsible" but that is not so easy in practice because *"engagement is usually too low since we are hunters of opportunities and to the extent in which we find a better one, we will go behind it"* stated Expert 3.

Communication appears in the third place. It *"has to be open"* said Expert 6. According to Expert 5, everything that happens, regardless of the kind of information, must be communicated. *"(…) it is conveyed alike, if there is a day I do not inform people, small or big things, they work well or not*" problems could appear, so *"[it] must be as transparent as possible"*.

Trust is the fourth characteristic. As Expert 4 states, "*is an essential element*", also for Expert 5 who comments that *"it is indispensable and it must be totally transparent in order to achieve integration of all engaged people in your project"*. As Expert 6 states "*trust has to be vital, because everything that will be implement from the BI point of view is to improve the business"*.

The fifth place, and not the least important, is cooperation, which is essential because of the interdisciplinary nature of BI projects. As an Expert states *"if we do not cooperate between business, technical and analytic parties, it will be a failure"* which is shared by another Expert who states that *"cooperation is important because these kinds of solutions or systems are naturally made for several working teams, they are not made for a single person"*. Indeed, cooperative work ends up being synergic by nature.

Finally, coordination is the last characteristic. This one "*goes hand in hand with activities and responsibilities of each one and how I coordinate myself, with my pairs, my partners, to achieve the common goal, what is expected from all of these implementations*" states Expert 6. It is *"one of the needed skills for a person who wants to be on BI"* remarks Expert 5.

Besides those elements and characteristics that are present in the teamwork, there are other cross constructs in group activities which are essential to the job. Those are: involvement, empowering and participation which depend on organization of individuals.

4.8 Learning and skills success factors

Learning processes, according to experts, are generated at several levels. First, at a macro level, in which there is a conception of value generation for collective learning. Thereupon, there is a meso level, which is referred to as the existing relationship with external agents who foster learning through practices and knowledge that are initially foreign to the organization. Finally, there is a micro level, which involves technology as a tool or a way to learn and apprehend knowledge in a suitable environment. That environment counts on issues such as the individual insertion within the project, involvement, constant communication, a continuing information flow to get feedback and improvement, and a practice and operation stage that will work as a foundation to gain knowledge and then create new knowledge.

To promote that learning, an individual must possess certain types of skills, which make him/her liable to get and generate a specialized knowledge within a BI project. Both technical and non-technical skills shape the set that will give a result of specialized knowledge and learning in the field. According to Expert 3 *"people's skills in all levels are very heterogeneous"* and likewise *"they will depend on the role that individuals have within the project"* states Expert 6.

In agreement with what the experts say at a general level, it is important to have technical and non-technical skills that carry them to be "*people with a lot of negotiation skills, they must know how to listen to the internal client's needs and have an open attitude, they have to be very analytic people that solve conflicts"* affirm Expert 5. Concordant with that, they must *"learn and apprehend"* and *"develop the ability of questioning, this for them to talk the same business language"* state Experts 3 and 4.

On the other hand, it is necessary to have certain technical skills "*which are related to structuring and designing a project of this nature. That is done by specialized people in BI"*. According to Expert 1's opinion. *"If the part of models is worked, analytic models, statistical models, [there] must be a person who has this skill, this knowledge; a person who does not know about it cannot be there"* concludes Expert 6.

According to Expert 4 it can be summarized in professional and cross skills, which allow one to understand a business situation, give a suitable use and interpretation, and thus *"[be] able to carry this business request to a specific technical request."*

4.9 Information and technologies success factors

One of the essential inputs of BI solutions is information. According to the experts, it is more important than technologies because it could take the second or even third place when it is about seeing the importance of the component of the solutions.

Although data and information that could be generated are abundant, experts agree that information depends on the kind of project to be handled, for instance, financial projects, marketing projects, or human resources projects. With that, the kind of structure and design needed for its development can be established.

To have access to that information, the first thing is to conceive the study and design access roles. Not all users have the right to access to the same information and equally it must be ensured that the information they can access is pertinent to his/her task development. It happens to both internal information and external information coming from suppliers, customers and all related stakeholders.

However, to discern, use, analyze and get meaning from the information obtained, an operation by using technologies is needed. Those depend on the project scope, size of the organization, purposes, available resources and all elements analyzed above in the success factor of the BI project's development. According to the experts, technology does not take a privileged place when thinking of a BI solution because it is only a tool that gives options and facilitates the development of actions that could not be done without it.

In the words of one of the interviewed experts, there is a *"very strong relation, but there is not conditionality, that is to say, it does not depend on any technology to do anything. Not even on the use of Excel [since] you can do an analysis generated by the experience, an industry analysis [for instance] with the simple fact of knowing how many new clients came"*. It is concordant with the opinion of a second expert who says *"they are marvelous but sometimes are overvalued, I can tell you that there are BI projects that perfectly work with Excel"*.

According to Expert 6 *"whether it is wanted or not, technologies are important. (…) those tools exist for any reason, they are made for a different type of requirement"*. Those tools "*must possess both functional and non-functional characteristics"*. They must be also intuitive, friendly and accessible, as much as possible, always thinking about the users. As Expert 1 states, maybe the most important issue of those technologies must be their usability, since "*it must be addressed to final user, not to the informatics technicians"*. Likewise *"they are made to be a tool for the functional areas, not only for technicians' use, it is not a tool for the informatics area, but from this area tools are enabled to be used by final users"*.

Technologies in BI solutions must work as learning tools in order to improve skills and facilitate issues such as communication, relationship consolidation and the strengthening of organizational processes. They should be used as complementary tools, generating timely advantages, even when it is only a supporting tool. This must be done without omitting key issues such as security and the collaboration developed jointly with new information technologies.

It must be taken into account that technology, regardless of it costs, brand or reputation, must obey a need and must work under a cost-benefit logic, regarding the organization's needs. *"Tools are as good as information you enter, that's where all should start"* states Expert 5. *"Its investment will depend on its future return*" argues Expert 1.

4.10 Professional networks success factors

Despite the fact that "Professional Networks" is not one of the most used terms in the experts' speeches, it is also one of the key success factors for BI solutions as it could be observed. This is based on statements made by the six interviewed experts, who agreed that the fact of belonging or keeping up with what happens in professional networks, more exactly about BI topics, potentiates some faculties for professional and personal development in order to get more successful BI projects and solutions.

According to the collected information, six features that characterizes professional networks as BI key success factor could be observed. First they work as input sources for the project development because they find information from third parties, which could complement specific project developments, according to their characteristics and past experiences.

As a second step, an element to overcome obstacles is used, allowing one to beat possible personal and organizational barriers presented during the development of this kind of project.

Linked to the above and with a remarkable importance, it works as a synergy source, meeting and centralizing the resources available in the network to the project benefit. This, taking into account that complementary visions could be reached, and concepts, roles, experiences and resources, among others, could be shared.

An enrichment source is the fourth feature, having access to information and resources which allow a continuing learning and updating, based on interactions with third parties. Similarly, resource sources that provides knowledge, human and intellectual capital, both internal and external, depend on the organizational needs and itself the BI project through collaborative work.

Finally, an associated source achieves the constant articulation and communication among parties which will contribute resources, source and whole network quality improvement. It is important to mark that this feature goes hand in hand with communication and tracking to have knowledge about activities that other parties, which belong to the network, are developing.

4.11 Resource success factors

4.11.1 Economic resources

As Expert 1 states, BI project or solution choice is based on a cost-benefit relation, for him *"a solution is not expensive by itself, it must be seen in a cost-benefit context. Solution choice depends on this relation"*. Although this topic is sensitive at an organizational level since it involves monetary resources, it is essential when working on a BI solution. As Expert 2 states, "*those are resources that must be used from the [project] planning stage"* because *"when there is money involved, the first word is always NOT. Second is for what?"* States Expert 5.

Expert 3 asserts, *"these kinds of projects are not usually cheap and enterprises are prevented because they have invested a gross quantity of money and do not see quick incomes"*. This makes it more sensitive because when immediate results are not seen, BI solutions begin to be seen as great investments without any contribution or earning.

Regarding this topic, Expert 6 affirms that it is viable to have two concepts of financial resource planning in the projects. As a first step, top down planning could be set "*where [you have] a budget, a resource and [you plan] from that, trying to see what you do with what you have"*. The second option is the reverse, a bottom up plan where *"a series of plans and strategic initiatives are defined and consolidated, then give as a result a money quantity and then you see and look for funding, where money comes from and what to do to guarantee this resources"*.

4.11.2 Intellectual resources

According to Expert 3, *"there is not [any] technology that works without the human element and intellectual capacity for processing and analyze information. You could have marvelous systems but if you do not have people behind it, who have the capacity to exploit it to the maximum, there is no way to make it work"*.

Meanwhile Experts 1 and 2 state that *"when [there] is a project, [it] is necessary to know which experts [are] needed to be involved"* given that and to develop it, *"a specialization is necessary (…) [Since it involves] specialized people in the BI field, [which] cannot be done by anyone, that is why there are firms specialized in BI"*. It makes evident the importance of the kind of requested resource, facing also that it is *"a fundamental intellectual resource, [which makes it] so difficult to get an expert person in the field"*.

As a conclusion and as Experts 4 and 5 affirm, *"If there is a well-formed team which can implement and execute it, they really could work better or worse with one or another technology but they will carry out and will get the best from that. If you have the best technology but you do not have the people who could carry it out, it will not work"* therefore *"you need the technology knowledge and you need people who have the knowledge around it"*.

4.11.3 Technological resources

According to Expert 6: "*A technological resource is important because it often determines the success or not of the BI initiative. (…) it is not the same to make it with a software, product or hardware resource of low performance, poor upgradeability which does not have the capacity to grow in a corporate environment with all of what it involves: security, versioning, collaboration and all corporate issues you could have, compared with a tool that gives us this kind of possibilities"*.

It is concordant and it goes hand in hand with the affirmation of Expert 7 saying that "*technologies will be used, it should be the best existing in the market"* and it is advisable that *"a project like that (BI project) must have an alliance with infrastructure organizations, because [it] needs servers, machines, etc."* With

that you get constant updates and avant-garde technologies are promoted.

In this point, Online Social Networks (OSN) are presented as *"a still well-unexplored field",* Expert 4 states, and adduces that: *"there is an opportunity. (…) one of the current trends is: why do we not take advantage of that which is in social networks? Why do not we bring it and transform it? Since those data exist there, why do not we transform it into knowledge for the organization?*

Although OSNs were not considered to be a key success factor in BI solutions, they are involved at the time to think in sources, data handling, ETL, market analysis, brand perception and generally, issues related with marketing, as experts said.

4.12 Metrics key success factors

According to information gathered from the experts, metrics allow one to fix goals and to know where to go with the project development or what one wants to achieve. Accordingly, indexes allow one to do a follow-up of the project development, showing results based on the initial goals.

Metrics also allow one to determine behaviors during the development and execution of the project, which allows them to handle it in less uncertain environments, and establish proactive and reactive actions. It allows the organization to identify the degree in which objective fulfilment has been achieved and thus the achievement of dependent activities of the strategy that gave rise to the project development.

They are also immersed as management tools as part of the advanced reports or the project's results, and this works itself, supporting the management decisions based on real and consolidated information backed up by reliable systems or technologies. This success factor is key as a management tool since it allows one to analyze, diagnose, preview and make decisions in favor of the project development in order to be successful.

4.13 Environment key success factor

This success factor refers to the conditions that are inherent to the BI project during its planning, development and execution on behalf of both internal and external environmental factors, which have influence and direct involvement in the project activities and the people involved in the project.

Since environment is changing, project condition must change as well according to new demands. It is part of the paradigmatic rupture of always doing things the same way.

As is evident in interviews, BI solutions, by engaging a set of processes and new or improved technologies, present a resistance on behalf of individual and/or the group culture that is formed at an organizational level, or by the sum of the individual cultures that generate environmental conditions both positively and negatively.

These environmental conditions, despite the fact that they generate barriers, also generate benefits as joint problem solutions on behalf of positive issues formed by the organizational culture. Factors like founded organizational structure are influential in solving problems, since bases of personal and group relationships that operate through past experiences have been settled.

5. CONCLUSIONS

Up to now, academic research on the key success factors of implementing BI systems were still rare, limited in the scope of analysis (Pham et al. 2016) and poorly understood (Yeoh and Popovič 2016). Although BI solutions try to focus on success in the technological component, they adopt an approach that puts business needs first (Yeoh and Koronios 2010; Yeoh and Popovič 2016). Thus, BI solutions must be part of the company strategy, managed in a centralized way, involving all users from the first initiative, appropriating skills and suitable and needed knowledge.

Research exhibits 13 factors that contribute to improve the success rate of BI solution implementation. These solutions must involve a sponsor from the top management, permanently developing and adapting the expectations and challenges that face the organization, providing training as well as human, material, technical and economic resources needed for its development (Olszak and Ziemba 2012), all aligned with the strategy and the environment in which the organization operates. When all of these elements are identified from the beginning and are used as drivers for the implementation effort, there is a greater probability of success in the BI solutions implementation (Yeoh and Koronios 2010).

Although this literature review identified a total of 12 key success factors for BI solutions, another contribution from the research was the Professional Networks key success factor. This has emerged due to new trends in practice communities, a disseminated access to

knowledge and the narrowing of the professional ties among professionals from different or even the same industries or economic sectors.

For further research, this work may involve a greater sample of experts that allow for a more detailed analysis by economic sector, industry and likewise by distinguishing the kind of affiliation (public and private). Also, it could include participants who participated in projects as final users, since this research was developed based on experts who participated as implementers or were part of the top management team that was not necessarily implied to be a user.

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Appendix 1

Conducted interview to experts

Objective: To explore and to know about experiences that have had people considered as experts due to their academic and practice knowledge in business intelligence solutions implementation.

General question

1. Please shortly tell me about your professional and academic background regarding business intelligence and implementations of this kind of solutions.

Top management and directives block questions

2. How do you think people of top management influence on this kind of implementations?
3. How has the communication between top management and the rest of organization's people at the time to think in this kind of implementations been?
4. Describe in a single phrase the role that the next factors play between people and top management at the time to make BI solutions implementations:
   a) Trust b) Cooperation c) Coordination
5. How do you think power or people political influence impacts on the BI solutions implementations?

Business issues block questions

6. How do you perceive the influence of business in the BI solution implementation planning?
7. Likewise, how do you perceive the role of technologies and information inside the business issues?

"Champion" block questions

8. How do you perceive the idea of establishing a leader of the project for the BI solution implantation? Is it necessary?
9. How do you think the engaged people's trust is influenced by the fact of having a leader figure?
10. How do you perceive the influence of a leader within the negotiations that there may be among people involved in the project?

Strategy block questions

11. From your point of view, what is the role of the strategy in the project planning?
12. How do you think the adopted strategy to the BI project influences the collaborative processes performed in the organization?

Change management block questions

13. How do you see the impact in the change resistance on behalf of individual and group culture at the time to make an implementation?
14. How do technologies impact the change management at the time of making an implementation?

Project developing block questions

15. How do people's participation within the project usually happens?
16. How are learning topics and knowledge management handled at the time to conceive the project and implement it?
17. Have a central control entity figure to make the implementation been stablished? How does it work?
18. Do you think organizational structure influences in some way the BI solutions implementation? If yes, how does it happen?
19. How do technologies influence the project implementation?
20. What kind of information is handled during the project development? Who has access to that information?

People and human talent teams block questions

21. Which role do people's networks play when thinking about BI solutions? (it is not referred to online social networks)
22. What do you think about the influence of proximity among people in their collaborative work under the project execution? Understanding proximity as common issues existent among people.

Learning and Skills block questions

23. How learning processes happen and what abilities are required from the people participating in these implementations?
24. How do people's communications and commitment influence their learning processes and skills development?
25. How do people's networks influence their learning and skills development?

Technologies and Information block questions

26. How do you describe the role of social networks and its relation with

technologies and information used in Bi solutions?

27. Describe in a single phrase the relation (if there is any) that you find between technologies and information in a BI solution and:
    a) Learning
    b) Abilities
    c) Communication among participants

Resources block questions

28. What is your opinion about the relation between planning and economic resources used in a BI solution?
29. How do you define the importance of technological and intellectual resources in BI solutions?
30. What additional factors do you consider that affect/impact? Is there anything else, positively or negatively, related to this collaborative work?