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Evaluation Tool for Business Success

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CIBSE: Business Success Evaluation Tool

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Abstract

This paper describes the construction of a tool supporting decision making (DSS). The name of the tool "CIBSE'', comes from the acronym CIA-ISM for Business Success Evaluation, and it evaluates the success rate of entrepreneurial ideas by analyzing the previously modified Business Model Canvas (BMC). Modified Business Model Canvas include financial and no financial dimensions as a way to extend the original BMC. In order to analyze data, a model based on CIA-ISM is used to evaluate scenarios, and it enables the estimation of direct, indirect and cascading effects interrelationships between all dimensions to calculate an indicator of success. Moreover, this tool is able to identify weak and strong points of BMC, which will help to attain the survival goal of undertaking by reducing the level of uncertainty, or in other words, by reducing risk. Paradigm of Design Science has been used as a point of reference to design this tool, along the seven guidelines stated from the conceptualization of goal to the dissemination of results. Although this study is focused on regional context, it is associated with a project of public services of the 4th biggest region of the EU regarding the population size, as well as the 6th biggest region regarding its extent. This approach allows direct access, as well as a privileged access to data, technical resources and professionals to develop the model, tool and perform further validation having data of real projects.

Keywords: DSS, *Entrepreneurship, modeling, CIA-ISM, Validation, Information Systems, Simulation*

Evaluation Tool for Business Success

1. Introduction

Joint Research Centre-Institute for Prospective Technological Studies (JRC-IPTS) states that promoting the success of business project has become one of the main EU policies (Komarkova et al., 2015). EU aims at creating jobs and increasing economic growth rates in society and economy. In order to achieve this goal, it is required to promote venture capital (Audretsch, 2007, 2014), which is made up of sum of the following elements: framework, cultures and institutions that contributes to the establishment of businesses (Audretsch, 2009). In this regard, scientific literature reveals a growing interest in the influence of venture over economy and its development (Acs, Audretsch, Braunerhjelm, & Carlsson, 2012; Acs & Szerb, 2007; Audretsch, 2009; Audretsch & Keilbach, 2004, 2008; Fritsch & Noseleit, 2013). There are several contributions that include studies on the factors that influences venture from an environment perspective (Aparicio, Urbano, & Audretsch, 2015; Busenitz, Gómez, & Spencer, 2000; Méndez-Picazo, Galindo-Martín, & Ribeiro-Soriano, 2012; Roig-Tierno, Alcázar, & Ribeiro-Navarrete, 2015; Valliere & Peterson, 2009), as well as other studies on the individual characteristics of entrepreneur (Lumpkin & Dess, 1996; McClelland, 1961; Hao Zhao & Seibert, 2006), studies on success prediction models with financial data (Altman, 1968; Beaver, 1966) and other non-financial characteristics (Lussier, 1995). There are also more recent and innovative models as the one of Van Praag (Van Praag, 2003) or the model developed by Shawn, Gordon, Harvey and Henderson (Shaw, Gordon, Harvey, & Henderson, 2010), that purpose different approaches for measuring success.

Notwithstanding contributions mentioned above regardless the source or sort of data to evaluate, there are no papers that include all these factors under a common framework or methodology based on information technologies at predicting success of an entrepreneurial activity.

Making this tool available may be a special-interest advantage for those entrepreneurs and public and private-sector organizations, which have an interest that an entrepreneurial idea goes ahead (public services, bank institutions, local development offices, investors, etc.) Furthermore, this tool is of particular concern for decision making, since identifying the weaknesses or threats implies reducing effects of uncertainty on the survival goal of undertaking, namely reducing risk (ISO, 2009) in order to enable decision, adaptation and improvement of this purpose before its implementation and ensuring greatest chance of success.

Accordingly, this tool integrates intellectual resources with capabilities to improve the quality of decisions over semi-structure problems in Decision Support Systems (DSS) (Keen & Morton, 1978). Thus, the main goal of this paper is to create and validate a DSS that enables to evaluate the success of an entrepreneurial initiative based on financial and non-financial data (quantitative and qualitative), referred to as "CIBSE''. To attain this goal, a research strategy of information technologies has been followed, and it is based on the paradigm of Design Science (Hevner et al., 2004) which is focused on the development of artifacts designed for the purpose of providing a solution to a major problem on the environment, using the existing knowledge base. This paradigm discloses several handouts aimed at helping researchers to follow a clear and comprehensive creation process.

According to the taxonomic classification from "CIBSE'' tool, it is necessary to mention that DSS proposed is a collaborative work (Haettenschwiler, 1999) since it enables to modify different dimensions until a decision is made, but also it can be classified as a model-driven DDS (in this case, CIA-ISM methodology has been used), following the steps criteria of assist mode defined by Power (D J Power, 2002). All this has conditioned the internal structure of DSS, in line with the proposal that appears in Figure 1 (Boreisha & Myronovych, 2008).

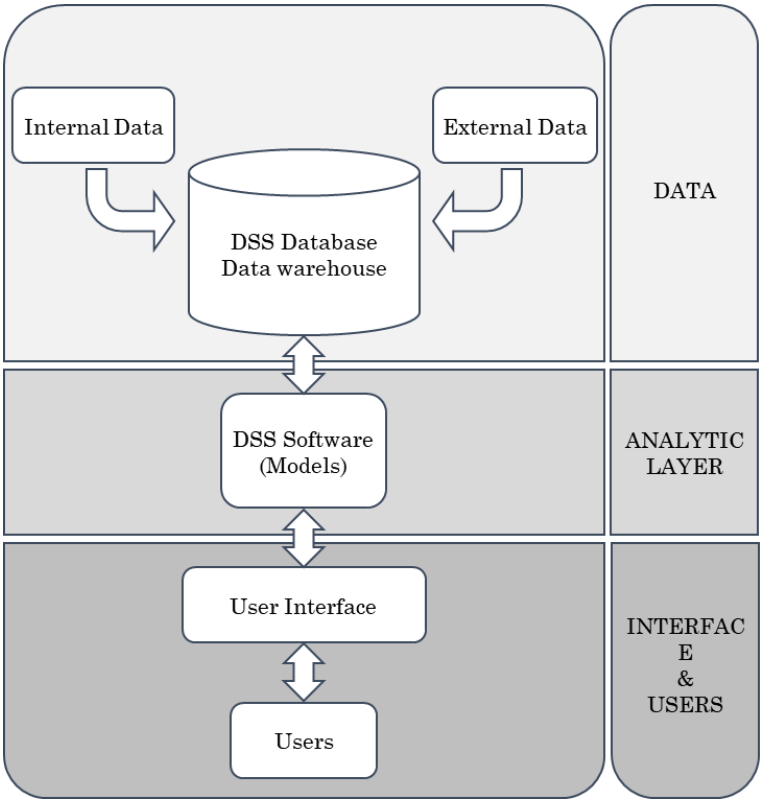


Figure 1. Key components of DSS (Boreisha & Myronovych, 2008)

Analytic layer of CIBSE tool is based on calculations performed in a model that uses Cross Impact Analysis and Interpretive Structural Modeling methodologies (CIA-ISM) (Bañuls & Turoff, 2011). The utilization of this tool will not only allow to interlink all dimensions considered before, but also to interlink direct impacts on success. In order to build this assessment model, internal and external data have been collected from different sources of information, such as economic databases, enterprise databases, expert consultations, analysis of face-to-face interviews, scientific literature, etc. All these sources of information made possible to collect data for the dimensions evaluated in 240 different business activities. Access to information and individuals was possible due to this study has been included within an entrepreneurship-building project promoted by public administrations of the Regional Government of Andalusia, one of the biggest regions in Europe. In addition, this project involved the participation of every network of local business support centers of the administration mentioned above, as well as a huge group of experts and professionals, which contributed to provide access to primary sources of data. Although the mentioned project belongs to a regional framework, it is necessary to consider that it constitutes a study validated by data collected from the 4th and 6th biggest region of Europe regarding its population and its extent, respectively. This estimation implies that the region constitutes 1.641% of the total population of the EU-28, and 1.442% of GDP and 2.017% regarding its European extension. This provides a crucial advantage when it comes to building and validating a model through real data.

Once the model has been created, a user interface based on spreadsheets must be developed with the purpose of making possible the potential users interaction with the model and collected data. This user interface is a prototype and its goal is more focused on validating the functioning instead of usability. In this case, this tool enables to analyze Business Models CANVAS (BMC) (Osterwalder et al., 2010), that have been adapted to include all business dimensions as well as interpersonal dimensions. As a result, it offered an estimate of the chances of success of the idea that was underlined in the modified BMC, as well as performing a concise analysis of possible weaknesses and threats (SWOT analysis), which would help users to make decisions and improve the plan.

This present paper is divided into five different sections which are described in the Figure 2. Each division of the graph refers to the sections of this paper:

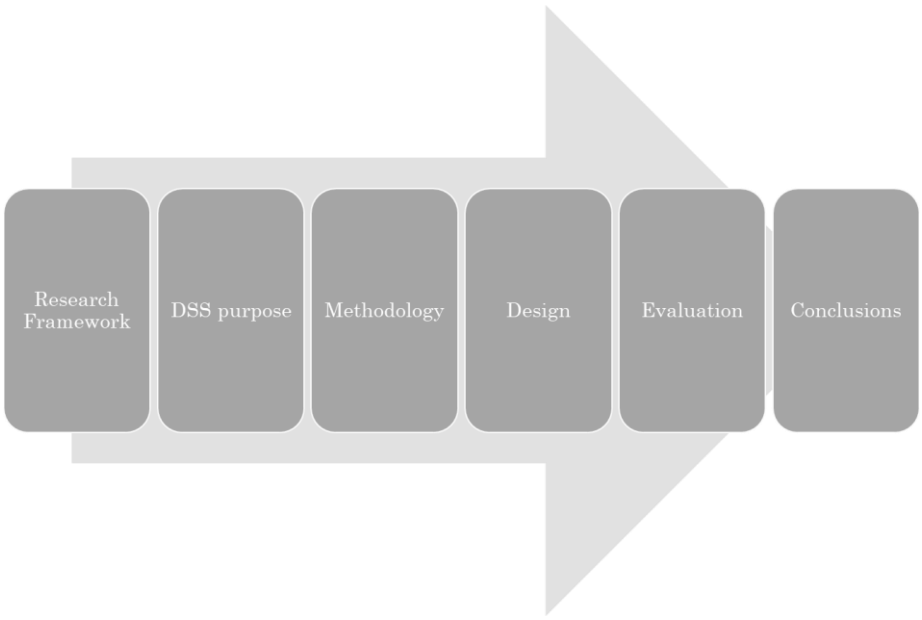


Figure 2. Different stages of research

First section is correlated with a review of literature on this research framework, where an approach to previous success assessment models: DSS and BMC tools. Following section describes research problem, goals and hypotheses, research strategy used for this work, as well as the methodology for building the simulation model. Once research has been framed, following sections describe the design process of this tool, as well as the evaluation procedure. Final section of this paper integrates research findings, weaknesses found and further research lines in this area.

After having introduced the major outlines of this work, it is required to go in-depth on each section. Review of scientific literature is included in the following section, specially focusing on previous success assessment models, DSS associated with business and BMC.

2. Literature Review

2.1. Models for measuring business success

Models for predicting business success have evolved over time. First author to use data in order to predict business success was Beaver (Beaver, 1966), followed by Altman (Altman, 1968), although the methodology changed a great deal since first univariate analysis were carried out until the same author developed ZETA models (Altman, 2000). Most of the studies carried out for modeling business success have been based on financial data. While this represents distinct advantage at performing calculations and helping to develop mathematical models, a tendency in literature states that using only this variable type is insufficient to foresee the future, since they reflect the old days (Foster, 1986) and may be handled or just be too simple for predicting (Hillegeist, Keating, Cram, & Lundstedt, 2004).

As noted above, methods on the basis of financial analysis have been the most commonly used historically. However, it is interesting to consider recent literature, where the importance of non-financial variables is discussed in the study on business success for young businesses, as the one carried out by Kernell and Wallin (Kernell & Wallin, 2011). This study is based on a review of previous published data on models for predicting business success (or predicting bankruptcy). Kerner and Wallin state that bankruptcy predictions have been developed through the support of financial information (Altman, 1968; Ohlson, 1980). However, the feature characteristics of business entrepreneurship may not result in enough information (Keasey & Watson, 1987). In addition, other authors find evidence in literature where financial reports must be matched by other sources of information (Keasey & Watson, 1987; Peel, Peel, & Pope, 1986).

Other authors as Lussier (Lussier, 1995) already identified in his articles a number of characteristics/variables that contribute to business entrepreneurship, where financial and non-financial data are included, giving way to a long list of articles related to this perspective. (Lussier, 1996a, 1996b; Lussier & Pfeifer, 2001). In this context, the importance of merging economic and financial data as well as other data are included in studies carried out by Van Praag (Van Praag, 2003), where other non-financial variables are analyzed to foresee entrepreneur success defined and length of self-employment.

Lastly, it is necessary to point out the model developed by Shaw for banking in India in 2008 (Shaw et al., 2010). This model takes three predicting variables that are used as a benchmark for this current model: entrepreneurship characteristics, individual's business skills and attitude. Said variables are evaluated on a scale of 1 to 5 to provide a final prediction. Said model is, to some extent, the motivation for writing this article.

Therefore, it is reasonable considering that assessment of entrepreneurs' success entails a complex task where many diverse variables have an influence on outcomes. It is also necessary to consider financial and non-financial variables, qualitative and quantitative variables, but also the fact that interrelations between those variables are not known beforehand. Thus, most of statistical studies can end up being inconsistent. Generally, there are different types of variable, a great number of risk and lack of information which hinder the task of evaluating if any business venture is going to be successful or not. All these features in terms of complexity, uncertainty and lack of information are those that make us to consider the use of DSS to sort out semi-structure problems as the one at hand.

2.2. DSS: Applications, Disciplines and Structures.

Literature defines DSS as a tool to combine intellectual resources and competencies in order to enhance the quality of decisions over semi-structure problems (Keen & Morton, 1978). It is necessary to make clear that semi-structure problems are those where not all variables of a decision may be measured quantitatively (Gorry & Morton, 1971). In this case, we are going to

focus on quantitative and qualitative variables which are subjected to an environment of high uncertainty as it is entrepreneurship.

In literature, DSS may be found in different fields of application, such as business management education, military, government and health applications, environmental areas or agriculture, amongst others. There are many academic papers that perform a thorough analysis of scientific literature. According to the authors, one of the most interesting is the work of Eom and Lee (H. B. Eom & Lee, 1990) where more than 203 bibliographic references, categorized into 9 major groups, are analyzed. Standing out for its size, "business management'' category is divided into 8 subdivisions. This characteristic is not shared by the rest of the groups.

Subdivisions (DSS Business Management)
Accounting
Finance
Human Resources
Internationalization
Information systems
Marketing/Logistics
Production y operations
Strategic management

Table 1. Subdivisions of DSS in Business Management. Eom & Lee (1990)

The immediate conclusion we can draw from DSS is that, although its use is widely spread over other fields of application, in Business Management section there is greater job development. Moreover, the second conclusion is that although authors carried out detailed analysis and a classification of scientific literature, there is any DSS application related to the assessment of entrepreneurship or business success.

Extension of works carried out by these authors has been used in other papers (S. B. Eom, 1995), where an analysis of 692 academic papers is performed in the field of DSS by identifying 7 common factors (4 primary and 3 secondary). Said factor are: *foundations, DSS groups, Models/Data Management, Individual Variations, Organizational Science, Multi-Criteria Decision Models and Artificial Intelligence.* Last three factors are the weakest and less present, what increase the motivation for throwing research works that provide knowledge to this fields, particularly Organizational Science and the application of Artificial Intelligence Systems.

At this point, it is required to allude to the different classifications of DSS in literature, considering taxonomy, type of assistance and general structure of this tool.

Taxonomically described, there are different types of DSS (Haettenschwiler, 1999) which are active, passive and cooperative. Last type is those DSS that allow to consider suggestions until a decision is taken, which implies the possibility of creating an interactive system to make modifications until reaching the best one. On the other hand, following the classification according to the type of assistance offered by DSS (D J Power, 2002), there are 5 different types: model-driven DDS, communication-driven DDS, data-driven DDS, document-driven DDS and knowledge-driven DDS. While, given DSS structure it is possible to find combinations of those.

Although there are different approaches about the internal structure of DSS, where different elements are identified (Sprague Jr. & Carlson, 1982). In general, it is normally similar to the classification made by Haah, McCubrey and Cummings (Haag, McCubbrey, & Cummings, 2003) or the classification made by Boreisha and Myronovych (Boreisha & Myronovych, 2008) (Figure 1), where it is possible to find three different elements:

- Data layer: data warehouse used for decision-making and composed by a set of data from different sources.
- Analytic layer: model/software used to perform calculations in order to obtain outcomes.
- User interface layer: responsible for making possible interrelations between the user and the tool through a computer or mobile application, spreadsheets…

Upon the introduction of the possible models to measure business success and review over DSS tools, it is necessary to describe business models as tools that comprise different factors for a business plan.

2.3. Business Success Evaluation and Business Models.

There are different studies focused on success factors for entrepreneurs, since first modern studies on entrepreneurship were carried out taking as a reference the definition of Schumpeter (Schumpeter, 1934), where entrepreneurs are "individuals who exploit market opportunity through technical innovation and/or organizational innovation''.

As a thematic review of literature, it is noted the evolution of the different theories based on the analysis of the entrepreneur and its characteristics, as well as theories underlying the individual characteristics and its attitudinal characteristics (Lumpkin & Dess, 1996; McClelland, 1961). It has evolved and integrated different dimensions as for example, the entrepreneurs' behavior approach (Gartner, 1988; H. Zhao, Seibert, & Hills, 2005) or the models that include different cognitive variables or factors of the business environment (Rauch & Frese, 2007). Modern approaches also extend beyond the individual characteristics, by evaluating the impact of the environment, infrastructures, business opportunities and entrepreneurship in both economic and qualitative terms (Busenitz et al., 2000).

It is realistic to assume that apart from the entrepreneur and environment characteristics, it is necessary to evaluate the characteristics of the idea proposed and of those elements that compose it. In this respect, comprising more than just financial statements, it becomes interesting to evaluate business plans as an abstract and indicators of the entrepreneurial idea. Since the

implementation of a good idea must be allocated on a proper actor, guideline and scenario in order to be successfully implemented and to analyze the possible success or failure, it may result in an incomplete analysis in case we do not take into account these three pillars.

The types of business models have evolved strongly in recent years. Their form and content changed depending on the objectives pursued and the perspective of theoretical approach to follow. In any event, both the perspective of Schumpeter to the perspectives based on innovation, business models attempt to represent the functioning and the organizations' expectations conceptually.

As the creator of CANVAS MODEL (BMC) defined "A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm'' (Osterwalder, 2004). In one of his most recent works the author states " "a business model describes the rationale of how an organization creates, delivers, and captures value" (Osterwalder et al., 2010).

Following these two major ideas, the present paper has selected BMC as a type of standard model to carry out this study. We consider that the authors of BMC previously performed a great review of literature, by comparing different business models as outlined in the doctoral thesis of Osterwalder. Key factors of entrepreneurship are found in a study of ontology on business plans, as well as in a comparative study on the dimensions taken into account in literature (see more information in Table 42 of Osterwalder's doctoral thesis). On the other hand, the simple structure of BMC and ease of use for those who are not business organization-literate make it a suitable tool. Despite being structured and organized, it is innovative, easy to use and an open system. Moreover, the concept of BMC is an open notion and in constant evolution, where plenty of information can be found in literature, such as critical analyses over its strengths and weaknesses (Coes, 2014), as well as expansions of the model as the examples of models with different layers (Joyce & Paquin, 2016), or LEAN BMC of Ash Mayura (Maurya, 2014) that modifies original BMC to focus it on startups. Philosophy of Osterwalder and Pigneur in BMC pretends to create a living and questionable structure that involves the community at the time to evolve depending on the requirements but always conserving same source and format.

CANVAS model proposed by Joyce and Paquin integrates two more data layers than the original proposal of Osterwalder y Pigneur, and extending the economic concept to the creation of social and environmental value of the organization. On the other hand, LEAN BMC is mostly focused on entrepreneurship, by using a combination of LEAN STARTUP (Ries, 2011) and BMC.

In summary, literature related to BMC affirms why 9 dimensions are used, but it leaves open the possibility of including modifications to the current model, as they are described in the preceding paragraph or the ones included in this work.

In our case and on the basis of the original BMC, dimensions that we consider necessary to carry out a further in-depth study on entrepreneurship success are included. Original BMC provides

information about the firm, generation of value, environment, but it provides no or little such information about the characteristics of entrepreneur. A review on literature over entrepreneurship success (Hornaday & Aboud, 1987; McClelland, 1961) helps to integrate in the analysis individual characteristics as well as technical characteristics of entrepreneurs.

After completion of this literature review, it should give way to following section where methodology framework is described, as well as goals, hypothesis and research strategy.

3. Methodology

To develop a tool for decision-making in a rigorous way entails considering a set of methodological guidelines to lead the research. Since we use a design work linked to information systems, we have decided to follow the directions set in one of the most accepted design works on research in information systems, following the paradigm of Design Science from Hevner.

3.1. Research problem

Nowadays, there is any tool to evaluate the feasibility of success of business proposals, considering the characteristics of entrepreneur (or entrepreneurial group), characteristics of the project itself, type of business and its location.

The great number of variables and complexity of interrelations increases the level of uncertainty, making difficult to evaluate success. Having available a tool to take decisions based on entrepreneurship, to detect risks and threats over success, makes it a promising idea that would be a great help to agents involved, such as entrepreneurs themselves, potential investors and public administrations, among others.

The context of this study is linked to a project for promoting entrepreneurship, which is carried out by the Public Administration of the regional government, and which has involved every network of local business support center in one of the biggest European regions regarding its extent and population. It is noteworthy that previous works performed in the same context stand out some important data at the regional level, particularly in 2016 this network of local business support centers helped at creating 15.773 jobs and played an active role in the creation of more than 12.700 firms with an estimated investment of approximately 176 million dollars. Furthermore, mentoring services have been provided to almost 1.800 firms in 2016 (at least during three continuous months). Regarding the business survival rates (active for at least 12 to 23 months since its inception), data in this region suggest that they comprise 68.86%, but since the firms have been supported and mentored, the survival probability increases in 74.24% (+8.38%). In addition, a more thoroughgoing study shows that business survival decreases significantly if we change the number of years to 3 (only 50% of the firms created in 2010 were active in 2013). Therefore, it is necessary to consider that the secondary goal pursued is increasing survival in more than 3 years, since those that survive for more than 3 years have more chances to remain active and will no longer be considered as new businesses.

Summarizing, one of the problems that entrepreneurs face when undertaking is facing uncertainty which entails lack of knowledge with regard to if the business idea is going to be successful or will survive. Moreover, as it has been noted at the beginning of this paper, there are many factors

that have an impact on business survival, whether they are linked to entrepreneur, project or environment. In this sense, having available a tool to minimize risk by reducing uncertainty and helping decision-making to improve scheduling, as well as strengthening weaknesses found, will solve many of said problems.

- Entrepreneur will be able to improve his business model to make it better and stronger.
- Investor will be able to analyze if the business model present weaknesses and if it has good chances of survival.
- Public administration will be able to detect which are the most common weaknesses, depending the type of activity and location, so as to optimize the resources used to promote a successful entrepreneurship.

In any event, these three perspectives have as common goal the improvement in the indicator of business survival and therefore, job generation and improvement of overall economic situation.

Therefore, the major problem for organizations is not having available appropriate tools to evaluate success of an entrepreneurial idea, by considering different types of factors associated to entrepreneur, project and environment.

3.2. Objectives and Hypotheses

The objective of this paper is to develop a tool (artifact) to help decision making (DSS) and enable us to evaluate success in business models, characteristics of entrepreneur (or entrepreneurial team) by considering the environment and type of business. Furthermore, this tool must also provide SWOT type relevant information about characteristics evaluated.

As it has been previously mentioned "the capacity to evaluate feasibility of a business initiative beyond economic and financial aspects, constitutes one of the most complex challenges which agents involved in local development face''. Thus, present paper pretends to address this problem by designing a model to evaluate success over local business initiatives in the form of artifact or DSS tool. This tool will consider local environment based on each sector of activity (partnerships, market and resource access), as well as internal factors (key competencies, value proposed) and entrepreneur himself (individual's profile, training and skills).

Following the paradigm of Design Science, as described below, we will use the existing knowledge database (background and methodologies) that will be extended and adapted in order to achieve the objective in view.

On the other hand, once the tool is developed, it must meet the following major hypotheses to achieve the objective pursued:

H1. This tool/artifact is able to evaluate properly the success of business initiatives.

H2. This tool/artifact is able to identify strengths and weaknesses of business initiatives.

H3. Differential between estimate of business initiatives success and medium level of sector success is a reliable indicator of success.

After presenting the research problem and having established the hypotheses, next step consists in introducing the research strategy conducted.

3.3. Research Strategy

As noted at the beginning of this section, Hevner classify the characteristics of design science for research within information system. "*The paradigm of design science seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artifacts''*. Said artifacts must meet all needs (from environment) by using an applicable knowledge database (in a rigorous way). In addition, in the process of development, all these needs must be justified and evaluated following an iterative improvement process. Eventually, it becomes an applicable tool to solve all these real problems and may be added to the knowledge database, which are information systems in this case.

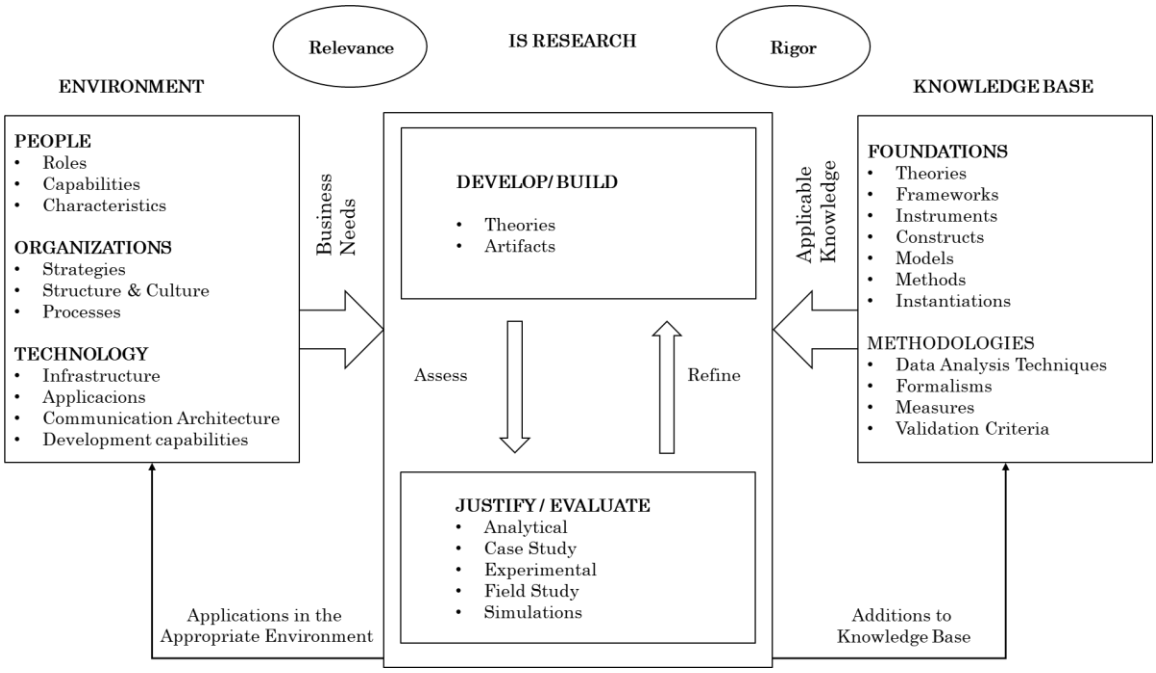


Figure 3. Framework Information System Research. (Hevner et al, 2004. Fig. 2)

This framework proposed by Hevner (Figure 3) can be seen in a two-fold manner:

- In a horizontal manner, where we must consider the Relevance to the Environment and the Rigor of Research in terms of the knowledge base.
- In a vertical manner, where proposed developments (Theories or Artifacts) must be Justified and Evaluated in an iterative assessment and refining process.

With the aim of conducting a proper research, authors proposed 7 working guides/work patterns in order to help researchers to carry out more effective science design research. Our purpose consists in following the same working guides or work patterns, but for practical reasons we will change the order of some of them. The following is a table with more detailed information about each of those work patterns defined and its description.

Work Patterns	Description
Pattern 1: Design an artifact/tool	Research on Design Science must produce a viable artifact or tool such a theoretical construct, model or method.
Pattern 2: Relevance of the problem	The goal of research in design science is to develop solutions based on technology to solve important and relevant business problems.
Pattern 3: Assessment of the design	Quality, usefulness and effectiveness of an artifact of design must be proved strictly through methods of assessment executed by all members.
Pattern 4: Contributions of Research	The effective design science research must provide clear scientific contributions and must be also verifiable in the areas for artifacts design, design of foundations and methodologies design.
Pattern 5: Rigor of research	Research in design science is based on the implementation of rigorous methods for construction and assessment of the artifact of design.
Pattern 6: Design as a process of seeking	The search of an effective artifact requires the utilization of the means available to achieve the targets pursued for the environment of problems.
Pattern 7: Communication of Research	Research in design science must be presented in an effective manner for technological direction as well as for the administration's.

Table 2. Work patterns for Design Science Research (Hevner et al, 2004)

It must be noted that all the process related to research has been performed taking great care in the Rigor of research, both for its construction and assessment, as well as trying to meet the pattern number 5 perfectly, which was postulated in the article mentioned.

The following section introduces different methods that can be used in the analytic layer such as mechanisms for decision analysis, particularly those based on simulations, since they adapt better to the problem we address and the context where we must analyze the qualitative and quantitative variables.

3.4. Methodologies for Simulation

As it has been noted in previous sections, internal model of an analytic layer in DSS varies depending on the type of implementation, available data and environment. As it is described below, we have opted for an application of simulation methodologies for the development of the internal model.

3.4.1. Simulation in DSS

There are multiple techniques and simulation methods that can be used in the analytic layer of a DSS (Daniel J. Power & Sharda, 2007), in his work both authors identify some of the most common simulation systems used in this kind of models, as for example Monte Carlo simulations. These simulations include traditional mathematical analysis, probability simulation, data simulations, agent-based and multi-agent based simulations and visual simulations. In his work, they highlighted that simulations can assist dynamic and static analysis of a specific system, by helping specialists to create a simulation that reports the findings in certain situations. Each kind of simulation technique is implemented to fit better within the context, problem or system to evaluate, whether quantitative analysis as Monte-Carlo simulations (Evans & Olson, 2002) or qualitative analysis, using agent behavior modelling techniques. (Bratman, Israel, & Pollack, 1988)

However, Power y Sharda, states that DSS based on data and models pose different challenges and they outlined those associated to complexity management of the systems that are used to simulate, as well as the possibility of performing simulations in real-time, for those complex models that must be created as well as their linked challenges. Both challenges can be addressed using current simulation techniques or a combination of techniques that have been successfully used in other contexts. In this case, cross-impact analysis (CIA) and interpretative structural modelling (ISM), together (CIA-ISM) makes possible to combat this complexity problem of models and perform simulations in real-time, so they can become good candidates to build the analytic layer of a Model-Driven-DSS.

3.4.2. CIA-ISM

CIA is a methodology used to help in stablishing interrelations between elements and how said relationships between different events (elements) can have an impact on other events, by reducing the level of uncertainty in the future. Due to the capability of CIA to analyze complex contexts with a high degree of interactions, Cia is one of the techniques most common used to generate and analyze scenarios as historically referred to (Turoff, 1971) and currently (Bañuls & Turoff 2011).

The analytical approach proposed by Murray Turoff (Turoff, 1971) has been specifically developed to restructure properly formalisms of cross impact for its use in an interactive computer terminal. This requires users to modify and repeat all estimates until they consider that the conclusion deduced is consistent with their points of view. In addition, this method is based on the idea that a unique event can occur in the sense that it can occur just once (that is to say, a discovery in particular or the outbreak of a specific war).

According to Turoff (1971) CIA can be used in events that generally do not have an occurrence as a significant historical event. Using CIA, the inference of probability of occurrence is possible. In this case, the problem of Cross-Impact Analysis consists in inferring causal relationships between different perspectives. This is performed based on disturbance of the vision of a participant, who understands the problem of each event individually. In other words, the opinions of experts estimate the causality. Analytically, estimates of correlation coefficients (C_{ij}) can be calculated using a deviation of Fermi-Dirac distribution function. (*Equation 1*).

$$P_i = 1/\left[1 + exp\left(-G_i - \sum_{i \neq k} C_{ik} P_k\right)\right]$$

Equation 1. Fermi-Dirac distribution function.

Where:

- P_i represents the probability of occurrence of the i-th event.

-Coefficient C_{ik} represents the impact of the i-th event over the k-th event.

- G_i (gamma factor) represent the effect of events that have not been specified in the model

- C_{ik} positive coefficient means that k increases if i occurs and negative coefficient means that occurrence decreases.

In other words, CIA methodology infers the occurrence probability of a specific event given the occurrence of other event, apart from the correlation between all of them, on the basis that none of them have history archive so that conventional inference is possible. Moreover, these events are classified as trigger events (those that are the first to occur and cannot be directly

"manipulated''), dynamic events (those that occur between trigger and the outcomes and are susceptible of being slightly altered or modified), and finally Outcomes (those that bring together the final result of the model and have no influence over other elements that do not belong to their type).

Cross-Impact Analysis enables also to consider two types of relationships between events, namely those that occur as the rest if a particular event takes place in a specific level (R_{ij}) and those that occur given that an event does not take place in said level (S_{ij}). Without going into technical details, we have a double matrix where two types of relationships are considered: those that occur when the event takes place, and those that occur when the event does not take place. For more information, see the article (Turoff, 1971), where said relationships can be seen in the impact matrix in rows R and S.

The use of this type of relationships between R and S, will make possible to adjust more accurately the relationships between events (dimensions) that compose impact matrix. This way the model takes into account if a specific dimension does appear or not, and in case it appears, hence depending on its value, it may affect to the others in different ways. This type of impact matrix, which are more complex, allow to reflect more closely the behavior of relationships between elements that compose it and constitutes an innovative contribution to this work when developing the proposed tool.

Finally, given the factors of influence as linear (positive and negative), we can show that estimators of relative relationships are consistent between any event and those that influence them, by mapping this relationships in linear scale. Then, we can use a different modelling method, as ISM to analyze the complexity of the resulting and balanced influence diagram (Warfield, 1976). The following extent would enable people to see a graphic display from their judgements, as well as improving their capability to make improvements.

On the other hand, ISM developed by Warfield (Warfield, 1976), is a method that perfectly combines CIA approach used by Turoff and Bañuls. ISM has been used to easily represent the existing interrelationships between the elements of a CIA matrix and see the direct, indirect and cascade relationships established by the model that this matrix generates.

In its start-up, ISM is composed by a number of elements (n) that forms an S set (*Equation 2*):

$$S=(s1, s2,\ldots, sn)$$

Equation 2. Set of ISM elements

The existing relationships between the elements of the set can be represented using a matrix (nxn). After completing an easy mathematical work with ISM matrixes, it is possible to calculate

the Reachability Matrix (M). This is a square, reflective, transitive and binary matrix that reveals the relationships between the elements of S set. If the element $M(s_i,s_j)=1$ shows there is one way between element *si* and the element *sj*, and on the contrary, if $M(s_i,s_j)=0$ shows there is no way. Each element of S set can be considered as a node and find a solution through graph theory.

For a few years now, this theory has been reformulated in order to make it compatible with both methodologies, by integrating them in a single one, CIA-ISM (Turoff, Hiltz, Bañuls, & Van Den Eede, 2013). This reformulation is based on converting greater absolute values of impacts in 1, and maintaining the rest in 0, thus examining Matrix C_{ij} which is transformed into an accessibility matrix. All this allows for a classification in different sensitivity levels to note the development of interrelationships between the multiple elements.

This system allows also to make graphics noted below that enable us to observe the interrelationships between different elements, by categorizing its significance and relevance, and thus providing an overview of direct, indirect and cascading interrelationships of elements in an easy and organize manner.

After having carried out a review of literature, it is necessary to start working on the development of the tool. For this purpose, it is necessary to describe and make clear its structure, make-up and each of the parts that comprise it.

4. Model-Driven DSS (CIBSE)

4.1. Structure

The purpose of this article is to combine CIA-ISM scenarios methodology with Business Models CANVAS (BMC) postulated by Osterwalder in order to develop a tool for decision support systems. This tool will make possible to evaluate BMC and perform a SWOT analysis of the elements that comprise it. DSS will have a CIA-ISM assessment model as a core, that will be created taking as key data the expert opinions and primary and secondary data analysis. Once construction of DSS has been completed, it would have a structure similar to the one in **Figure 1**, and will allow the assessment of BMC through user interface. Moreover, using a modified BMC to collect all required information will enable us to have a standardized system to facilitate the use of the tool and adjusting to the interface, as mentioned in the heading 4.1.1 of this article and adjusting the interface.

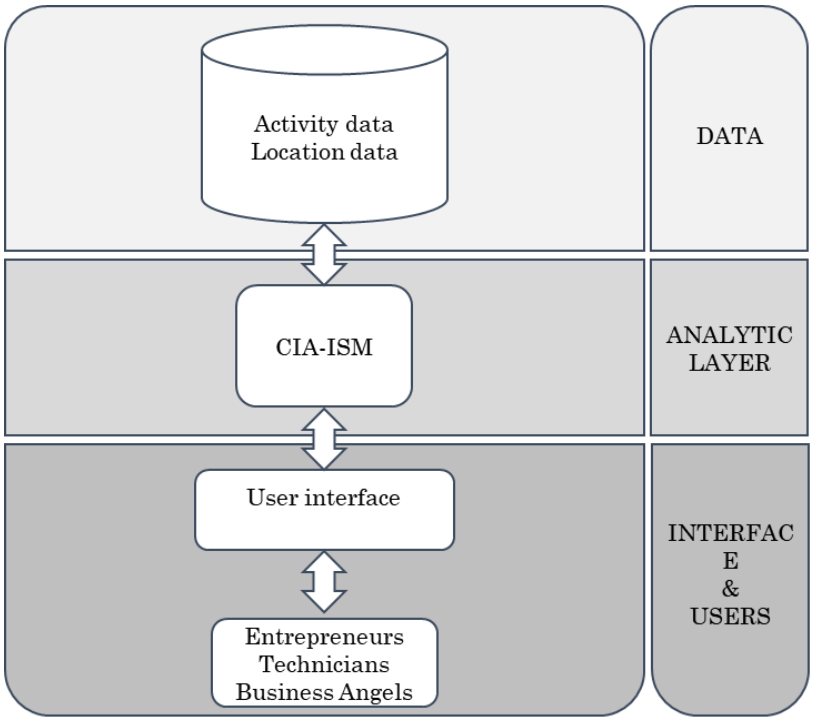


Figure 4. Major components of the structure proposed. Based on Figure 1.

CIBSE operation is easy. User only need to entry all data of the modified BMC into the tool and this analyze them using CIA-ISM. Finally, data output (success assessment and SWOT) is obtained. User can then take the decision to undertake or change the modified BMC in order to get a greater level of success considering SWOT (Figure 5). This tool will take into account the analyzed BMC, type of business and even the location where the business will run, as well as it enables users (experts, entrepreneurs, investors and others) to have a useful support tool available for decision-making.

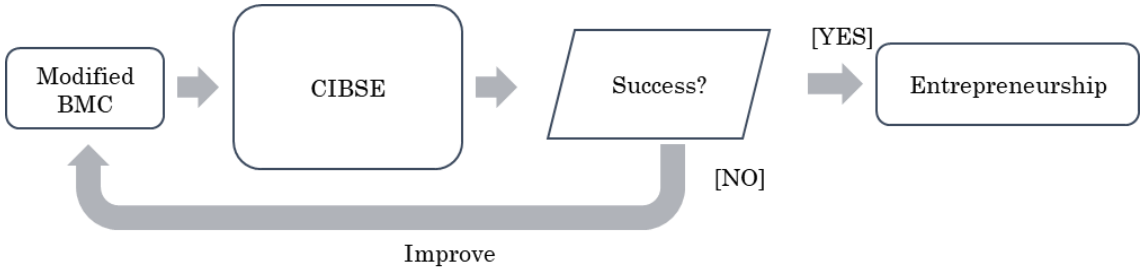


Figure 5. Use of CIBSE

Once the structure and functioning of the tool has been described, it is necessary to describe each of the layers that comprise it, taking into account as previously mentioned, that at the moment the objective consist in developing a data layer and analytic layer, leaving for later the development of the user interface.

4.1.1. Data Layer

Data layer of this tool contains knowledge base (reference information) of the tool. This layer has data from different internal and external sources that will be used during decision-making process over each of the dimensions that comprise the model.

Naturally, data layer must have a data structure similar to the problem we intend to solve. In this case, entrepreneurship must contain not only general data of the dimensions considered, but also those related to the environment, business type, etc.

In our case, it is necessary to have a solid and contrasted data structure that consider the dimensions that have influence on entrepreneurship success. In addition, as previously stated, characteristics of business plan itself, entrepreneur and environment must be considered. It is true that we will further pursue the design of the tool, but we consider necessary using a standardized model to design the data layers' structure. Dimensions of modified BMC provide an applicable structure to data layer of this tool, as well as making possible to build the assessment model in a second step.

Once introduction of data structure used to build DSS has been presented, we must move towards the analytic layer description.

4.1.2. Analytic layer

Analytic layer is the core of this tool. In this layer, it is possible to find data analysis engine that enable us to assess different options and take decisions. There are multiple modelling methodologies that can be used in the analysis of semi structure problems. Particularly, scenarios methodologies, as previously mentioned, allow performing of simulations and assessment of similar problems. Among them, we choose Cross-Impact Analysis and Interpretative Structural Modeling (CIA-ISM). This combination has been implemented in contexts of high uncertainty that include quantitative and qualitative variables and making possible to draw inferences over interrelationships of multiple variables. All this help to mitigate the issue of simplifying, as well as considering direct, indirect and cascading interrelationships. Finally, it is possible to perform simulations in real time, which would solve two of the major issues raised by Power and Sharda.

After having introduced data layer and analytic data, it is possible to start describing the process of designing this tool, by beginning with the definition of variables, simulation model and finally, interface presentation.

4.2. Design of the artifact

4.2.1. Definition of the variables of the model.

As previously mentioned, literature related to entrepreneurship success contain information about traditional financial approaches, as well as those that include non-financial features, such as

technical skills or, personal attributes of entrepreneur, such as autonomy, competitiveness, orientation towards innovation and risk-taking (Lumpkin & Dess, 1996), or the contribution of Zhao and Seibert about great authors (Ciavarella, Buchholtz, Riordan, Gatewood, & Stokes, 2004; Hao Zhao & Seibert, 2006). In addition, it also refers to technical attributes that differentiate successful entrepreneurs (Vilas et al, 2014), as for example, conceptual, managerial, strategic skills or opportunity recognition. In short, financial and non-financial features are not key factor of entrepreneurship and have been widely developed in literature about business management, business strategy, entrepreneurship, psychology and economy. However, despite the great amount of information about this matter of research, there are no integrated approached that bridge the knowledge in different disciplines.

In order to include both types of features in the dimensions to assess, BMC has been taken as an initial structure, since it is a planning tool that includes great majority of fundamental dimensions to assess any plan, and it can be also modified. For example, original BMC includes a specific section "Key Activities'', and on the other hand entrepreneurs' abilities are assumed. As the main objective of our purpose consist in using the business model in order to evaluate success, we also integrate the valuation of "Key Activities'' within "Value Proposition'', since this section also includes information about what is pretended to be done, how we pretend to make it and even which differential is available by that time. Secondly, the model proposed in this work include two new dimensions "Technical Skills'' and "Personal Skills'' of the entrepreneurial team (even if it has only one-member o more). In this way, figure of actors is also included within the assessment system.

This is the first contribution to this work but also to the original BMC. Two new dimensions "Technical Skills'' and "Personal Skills'' are included in the modified BMC model that will be part of our cross-impact matrix, by considering those factors in the success assessment.

Once initial decision of using a modified BMC was taken, it was necessary to include particular aspects of the entrepreneur in order to define, operationalize and value variables/dimensions. Differences can generally be observed in comparison with original BMC in Table 3.

Original BMC	Differences	Modified BMC
Market Segment	ORIGINAL	Market Segment
Value Proposition		Value Proposition
Channels		Channel
Customer Relationships		Customer Relationships
Income Sources		Income
Key Sources		Sources

Key Activities		[Within "Value Proposition"]
Key Associations		Partnerships
Cost Structure		Costs
	EXTENT	Technical Skills
		Personal Skills

Table 3. BMC Dimensions Vs Modified BMC

Modified BMC has an internal structure perfectly defined that makes possible to group 10 selected dimensions into 4 criteria, and this in turn, into two different groups (Table 4). Hence, internal structure would be the following:

A) Those influenced by Entrepreneur, naming the group and criteria they belong to and include dimensions directly influenced by entrepreneur. This group include contributions to original BMC.
B) Those affected by Economic Activity and the environment. This group can be subdivided following these criteria:

i) Market.
ii) Economics.
iii) Infrastructures.

Group	Criterion	Dimensions	#
Entrepreneur	Entrepreneur	Value Proposition	1
		Customers Relationships	2
		Personal Skills	3
		Technical Skills	4
Activity Sector	Market	Customer Segment	5
		Channel	6
	Infrastructures	Key Sources	7
		Partnerships	8
	Economics	Income	9
		Costs	10

Table 4. Dimensions, Criteria and Groups.

After having clarify the structure, it is required to define each of those criteria and dimensions:

- **Entrepreneur:** Entrepreneur present certain distinctive or acquired characteristics, which together with its business idea (Value Proposition) makes him different from the rest of entrepreneurs or business ideas.
    - **Value proposition:** Degree of specificity depending on the business type, as well as its capability to focus differentially on competitiveness when finding a solution for specific needs of customers.
    - **Customer relationships:** This include the adaptation to the way of addressing and communicating with customers, positioning and marketing plan. All of them make possible to know better the value proposition and to build repeatable relationships.
    - **Personal skills:** personal abilities and attitudinal skills of entrepreneurs (Ciavarella et al., 2004; Lumpkin & Dess, 1996; Hao Zhao & Seibert, 2006). Particularly, the contribution of Zhao and Seiber about the "greater authors'' of de Ciavarella et al. has served as a reference for operationalizing this feature.
    - **Technical Skills:** Training, experience, official qualifications, certificates or accreditations that provide a deep understanding of the economic activity and its context (providers, resources, customer segments, production processes, product characteristics, trends…).
- **Infrastructures:** Firm can build necessary partnerships to execute the business model with total quality of assurance, to complement capabilities and optimize value proposition, as well as having access to necessary key sources for the functioning of the business.
    - Partnerships: collaboration agreements with third parties (providers, strategic partners, industry partners, investor partners) that enable the firm to design, develop and manage all their business projects.
    - Resources: Key resources are the most important assets so that business model works properly (natural resources, facilities and machinery).
- **Market:** the firm has a specific market that ensures access to potential customers segments for business, as well as the channels to communicate, and reaching and delivering the value proposition to customers.
    - **Customers segment:** set of goal customers to which the firm has directed its value proposition.
    - **Channel:** means of communication whereby firm communicate, reach and deliver the value proposition to customers.
- **Economics:** Firm has the possibility of generating income and having an adequate cost structure to achieve the target.
    - **Costs:** cost level and structure that the firm has available in order to operate business model.
    - **Income:** way in which firm generate funds by their economic activity.

In the end, it is necessary to take into account that the objective of this tool is to evaluate "success of an initiative'' thus, we must add this new dimension to the list as "event/dimension resulting'' that will act as dependent variable. Definition of **"Success''** in entrepreneurship can be expressed using different terms, such financial and non-financial, and including survival. In this sense, and

as detailed in heading 3.1, we stablish as variable of "Success'' the survival of any project for more than three years since the beginning of trading.

4.2.2. Previous Delphi procedure

After having defined the elements that constitutes part of this tool (10 dimension), next step is to develop DSS model. According to the approach of Turoff about CIA methodology, it is necessary to know previously certain data that will enable us to estimate the "correlations'' between the elements of the model. For that purpose, it is required to interview a group of experts that provide information so that Cross-Impact Matrix can be calculated. As is usual in literature, this process has been carried out using surveys and iterative processes of questions. In our case, we used a Delphi procedure (Linstone & Turoff, 1975) formed by several rounds until an acceptable level of agreement between the six participants of the process is reached.

Following the mentioned procedure to obtain initial relational data, the view of experts must be altered through several questions regarding occurrence of certain events, in case other occur or not, and inquiring into R and S relationships previously discussed (3.4.2). This case in particular used a survey in which experts where asked to what extent a specific dimension will have an impact over the rest, one by one, as well as taking into account if that dimension was present or not.

For example: "*Assuming that, if THERE IS a specific strategy to reach a specific customer segment, please specify how it affect to the rest of events of the model to take place or not''.* Similarly, experts were asked the same but on the contrary "*Assuming that THERE IS NO specific strategy to reach a specific customer segment, please specify how it affect to the rest of events of the models to take place or not''.* This way is possible to obtain information about the existing interrelationships between the different dimensions or events, regardless if the variable is present or not. In order to assess these relationships, interviewers must answer these questions using a single scale, for both directions. Linker-type scale (Likert, 1932) shows which is the degree of relationship between the dimension and the rest, even if this takes place or not. Furthermore, said qualitative label is associated to a quantitative assessment that enables us to operate with values and perform calculations

Table 5).

	NC	No Impact	Moderately	Likely	Highly likely	Highly probable
Exist	-	50%	60%	70%	80%	90%
Does not exist	-	50%	40%	30%	20%	10%

Table 5. Assessment scales of relationships.

Using Delphi procedure implied the performing of several rounds of surveys until a level of agreement between responses of experts was reached. After having achieved said level, responses were integrated through Dalkey average (Dalkey, 1975) that made possible to have initial probabilities to start making the calculations of the impact matrix.

4.3. Cross-Impact Analysis (CIA)

After knowing the initial probabilities of the Matrix (P_{ij}), CIA methodology can be applied. It is important to remind that in this model we consider the impact of a dimension over the rest, by keeping in mind that said dimension is present or the impact they receive in case they are not present. Due to this characteristic matrix of R and S factors is obtained (Table 6), as shown below:

		Technical skills	Personal skills	Value proposition	Customer relationships	Partnerships	Resources	Customer segment	Channel	Costs	Income	Success of intiative
R	Technical skils	OVP	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
S	Technical skills	OVP	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
R	Personal skills	0.50	OVP	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
S	Personal skills	0.50	OVP	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
R	Value proposition	0.68	0.58	OVP	0.63	0.50	0.50	0.50	0.50	0.50	0.50	0.50
S	Value proposition	0.20	0.40	OVP	0.40	0.50	0.50	0.50	0.50	0.50	0.50	0.50
R	Customer relationships	0.62	0.68	0.68	OVP	0.50	0.50	0.50	0.50	0.50	0.50	0.50
S	Customer relationships	0.30	0.35	0.40	OVP	0.50	0.50	0.50	0.50	0.50	0.50	0.50
R	Partnerships	0.68	0.68	0.63	0.60	OVP	0.75	0.60	0.65	0.50	0.50	0.50
S	Partnerships	0.30	0.35	0.40	0.40	OVP	0.30	0.35	0.40	0.50	0.50	0.50
R	Resources	0.64	0.58	0.60	0.63	0.85	OVP	0.60	0.60	0.50	0.50	0.50
S	Resources	0.25	0.45	0.45	0.50	0.25	OVP	0.40	0.40	0.50	0.50	0.50
R	Customer segment	0.74	0.65	0.70	0.78	0.75	0.60	OVP	0.80	0.50	0.50	0.50
S	Customer segment	0.30	0.35	0.40	0.10	0.30	0.35	OVP	0.15	0.50	0.50	0.50
R	Channel	0.70	0.63	0.60	0.73	0.70	0.70	0.75	OVP	0.50	0.50	0.50
S	Channel	0.35	0.40	0.45	0.15	0.35	0.30	0.30	OVP	0.50	0.50	0.50
R	Costs	0.66	0.50	0.53	0.53	0.75	0.75	0.50	0.65	OVP	0.65	0.50
S	Costs	0.20	0.45	0.35	0.35	0.35	0.25	0.30	0.40	OVP	0.35	0.50

R	Income	0.64	0.63	0.65	0.68	0.75	0.70	0.80	0.80	0.70	OVP	0.50
S	Income	0.20	0.35	0.20	0.15	0.35	0.30	0.25	0.20	0.30	OVP	0.50
R	Success of Initiative	0.70	0.75	0.85	0.70	0.60	0.65	0.80	0.70	0.60	0.85	OVP
S	Success of Initiative	0.25	0.30	0.40	0.35	0.40	0.10	0.25	0.30	0.15	0.20	OVP

Table 6. Matrix of R and S Factors

All those factors are measured on a scale of zero to five. In the case of a tie, the level of uncertainty is of 0.5. If any event is under this level (between 0 and 0.5), it is assumed that the impact on the rest will be negative, since it is considered that is does not appear a minimal number of times. Said "negative'' impact can be read in rows S. On the contrary, if an event/dimension has a value exceeding the level of uncertainty, is taken for granted that the effect on the rest will be positive and thus, its impact can be read in rows R. It is worth noting that the last column "success of initiative'' has no influence on the rest, since it is used as an outcome variable, but it has direct and indirect impacts of the rest of events/dimensions.

It should be made clear that this "level of uncertainty'' (named P_i in CIA model) can be modified, thus the model can define different levels for each dimension or type of activity. For example, to carry out an engineering work the level of technical knowledge must be high, therefore the level is increased from 0.5 to 0.75, and any under 0.75 will have an impact S on the rest of values. Conversely, if an activity does not require specific knowledge, P_i can be marked with 0.25 and any above this level will have R impact.

The characteristic of this methodology, that implies the use of different levels of uncertainty to take R and S values, makes possible to adapt the model to the specific characteristics of each type of business, as will be clarified below in this heading.

Finally, we can say that the second contribution of this model is that it takes into account the probability of presence of a specific event/dimension, as well as the degree of severity, that is to say, the extent and direction affects the rest of the elements that comprise the model of this work.

To understand better in a more visual way and checking the internal consistency, as well as the relationships between the different events/dimensions, graphic analysis of those interrelationships between variables was carried out using ISM methodology. This methodology enables us to see a concept map of interrelationships and validate if these relations are consistent with the theoretical structure of the model (5.1).

4.4. Values of dimensions and type of activity.

In order perform calculation, analytic layer of this tool consider two different groups of dimensions (entrepreneur and business sector). Analytic layer evaluates generic value of each dimension (uncertainty value) as well as the value assigned by users.

The model consider that all dimensions linked to "Entrepreneur'' will have an Initial Probability (P_i) of 0.5 (classified as "marginal'' in Table 8) as detailed later, user is responsible to evaluate if each of the dimension of this group must be modified by increasing or decreasing them. For that, it is necessary to consider each of the dimensions separately and contrasting them with information available.

On the other hand, in order to evaluate the dimensions linked to Business Sector, we took into account 240 businesses that appear in a list standardized at national level. Those businesses that could not be conducted in the scope of this study were discarded. A group of experts associated to local support center for entrepreneurship evaluated each of the 6 dimensions for those 240 activities, by completing questionnaires of assessment similar to those used to evaluate the relationships of dimensions in an impact matrix.

Said questionnaire consisted in asking technicians and experts about the level of initial influence that each of these 6 dimensions had on the success of the initiative. For that, it is necessary to take into account the type of entrepreneurial activity assessed. As shown in (Table 7):

Code	Activity	Partnership	Resources	Segment	Channel	Income	Costs
561	Restaurants and food stalls	Marginal	Excelent	Excelent	Excelent	Inappropiate	Innappropiate

Table 7. Example of assessment depending on the type of activity

Answers of interviewers were used to execute two calculations. Firstly, as with impact matrix, values of responses average were calculated in order to obtain reference values of sector. Second calculation is based on creating a ranking of activities with higher chance of success in the general context we have assessed, taking into account also the list of best activities in the municipality.

These assessments are integrated in data layer of the tool and they are used as recommendations of the initial value to perform calculations on success of the evaluated model. This does not involve fixed values. In case the evaluator has different information, he can modify recommended values in order to set the assessment for each case.

As explained in the following section, assigning of values by users must follow a protocol that make them able to assign a value of Table 8 for each of the dimensions shown in Table 4 of modified BMC. For that, initial value is assigned to the dimension depending on the type of activity they belong to. This system pretends to balance subjective perception of users with objective information available, characteristic of unstructured problems as the one we address.

4.5. Interface construction and Functioning

Next step in the development of this tool was to build an interface prototype to stablish the relationship between user and assessment system (Model) in order to perform simulations on the basis of data collected by Modified BMC. Although main objective of this work is focused on the internal functioning of the model (Data layer and Analytic layer), first user interface was created using a spreadsheet and paying special attention, so that it is friendly for a user that may have not knowledge the use of this type of tools.

Interface makes possible to entry users' valuations according to the ten dimensions considered, and offering as a result an estimate of strengths and weaknesses for each of them, regarding the activity to evaluate, as well as the valuation of the chance of success in the evaluated BMC.

The use, as we say, implies the assignment of values by users for each of those dimensions, and it is performed selecting a level of the drop-down list within the interface itself. Each of those descriptive levels present internally a numerical assignation that makes possible to make calculations based on simulations. Different levels can be seen in the following table (Table 8):

Level	Criteria
Excellent	Exceed dramatically minimum levels that are described in references
Appropriate	Exceed minimum levels that are described in references
Marginal	Match levels that are described in references
Inappropriate	Does not reach levels that are described in references
Poor	Below the levels that are described in refences
Invalid	Entirely absent

Table 8. Values selectable in valuation tool.

We suggest that the evaluator should take into account the level recommended by the tool for the dimensions of the group "Activity sector'', as well as he should assess the differential between dimensions of BMC to assess, and this recommendation once we entry economic activity code. Moreover, the network of local business support centers had 500 business guidelines in format BMC that may be used to identify differences between general plans and the one proposed. In case references about any of the dimension can be found, assigning recommended values by the tool should be chosen.

In order to assign values to dimensions of the group "Entrepreneur'', 500 standardized business guidelines we mentioned previously are taken as a main reference. However, different particularities must be considered. For "Value proposition'' new offered contributions can be taken into account, as well as manufacturing method, provision of services, or if the assessed model deserves any kind of acknowledge, award or mention on behalf of any public or private body, or if it presents any remarkable differential with regard to BMC of reference. Increasing or decreasing of "degree of marginalization'' must be performed in a linear and proportional way.

Similarly, valuation of "Technical competences'' is performed by comparison of technical needs, mentioned in the reference guide, with the previous technical skills of the individual or entrepreneurial team, by modifying and increasing and decreasing depending on the requirements. For "Customer relationships'' it must be considered if members of an entrepreneurial team present any kind of specific training, or if they were previously in contact with potential customers. Both positive and negative perspectives would change the level of said dimension.

Due to lack of clear and defined consensus in literature, this work establishes a different criterion for "Personal skills''. This criterion is based on the idea that entrepreneurial team present any of the personal skills defined by the great five authors previously mentioned, and using a linear scale, where 2 should be considered as "marginal'' and will not have a serious outcome in "Poor''.

Following table (Table 9) summarize sources of references taken for each dimension. As previously stated, the evaluation of each of those dimensions is performed through linear comparison between modified BMC and the source of reference. This is conducted by adjusting the value on the basis of the initial level assigned by the benchmark.

Dimension	Reference
Value proposition	Standard BMC
Customer Relationships	
Technical Skills	
Personal Skills	"The great 5 authors''
Customer Segment	Initial assignment of DSS
Channel	
Key Sources	
Partnerships	
Income	
Costs	

Table 9. Dimensions y references.

The process of evaluation and the use of this interface can be summarized easily. Once entrepreneurial team complete their own modified BMC, user can take the developed interface to evaluate the changes of success of said BMC. For that, as we mentioned, data of the business

sector have been added to this tool, as well as 500 specific plans that are available, data of modified BMC and his own assessment, following the guidelines previously stated.

In addition, this tool makes possible to introduce the name or code of this "guide'' or "Business Plans'' taken as reference, and the name of the "project'' that must be evaluated.

Once data have been entered into the tool, it shows the evaluations for each of those dimensions (Table 10).

Element	Description
Result	Numeric data
Risk	Qualitative indication
SWOT	Identification of threat / Chance with a level associated.
Recommendation	Message with a general recommendation for said dimension.
Chance of Success	Valuation of survival probabilities.

Table 10. Data output: Types and description.

Finally, tool or artifact provides the "Chance of success'' of the initiative in a percentage, as well as through a descriptive text.

At this point, we can state that the objective of elaborating a DSS tool based on CIA-ISM methodology in combination with modified BMC that makes possible to meet those two hypotheses stated beforehand in the section focused on objectives: evaluate success and identify chances/threats.

As stated in Pattern 3, next step consists in evaluating if the design of this artifact proposed is suitable or not for the achievement of the objective of this paper, as well as the stated hypotheses. Next section contains information about the process conducted in order to validate the outcomes of said process.

5. Evaluation of the design

Pattern 3 develop recommendations about the possible methods that can be used in order to assess the design of a research with all these characteristics. Particularly, Hevner states that this research may present the following characteristics: observational, analytical, experimental, probationary or descriptive.

Regarding the methods that consist in observational studies, field survey is identified as the method where an evaluator uses an artifact in multiple projects. As we will explain later, the evaluation method for the outcomes have been conducted following this pattern to check

goodness of fit. This analysis is performed in comparison with the outcomes obtain from the artifact, as well as those noted in real term. Furthermore, BMC&CIA-ISM can make predictions more or less correct in comparison with real term.

The use of analytical methods involves different process that pursue different objectives: check the structure, adjustment to architecture, optimum properties or dynamic studies. In this work, CIA-ISM methodology has been introduced as better methodology to make this kind of calculations. Having available data pool, where ten dimensions have been assessed for 130 different firms, enables us to apply exploratory analysis techniques in said pool to note if obtained outcomes have greater consistency and/or relevance than the outcomes obtained through the use of CIA-ISM. In this article, we pretend to validate if the artifact is able to predict accurately success or failure of modified BMC, but also to understand internal consistency of interrelationships between variables since this bring more complexity to the matter.

Descriptive method has been defined several times throughout this article, as for example the definition of relationships of impact matrix in Table 6 or as ISM graphics that can be seen in Figure 6 and Figure 7.

Although two other methods are mentioned as probationary and experimental studies. This will be used for future works based on the following rounds and iterations to adjust the artifact and optimize usefulness and usability of said artifacts, as we will state in future lines of research.

5.1. Descriptive method

As it is stated in the last part of previous section, scenarios and well-reasoned reports have been used in the different sections of this paper. Particularly, those that pretend to test the structure of this tool and check its internal consistency.

CIA-ISM methodology allows to face and perform simulation in complex contexts more affordable. In our case and addressing the complexity of the assessed system, it is necessary to note that it is a system composed by 11 elements. Following calculations (Table 11) postulated by Turoff (Turoff, 1971) we can state that complexity of different systems in comparison with the number of solutions (possible scenarios).

Number of Events (N)	CIA (N^2)	System without Memory ($N*2^{N-1}$)	System with Memory (e*N!)
11	121	11.264	108.505.112

Table 11. Number of possible combinations

Working with 121 elements is much comfortable and manageable than generating more than 108 Million combinations in a system with memory. In this sense, it seems that using the artifact proposed is more efficient than using traditional systems.

On the other hand, as previously mentioned, CIA methodology in combination with ISM, allows displaying direct and indirect relationships of dimensions by considering even the relationships direction (positive "R'' and negative "S''). Moreover, in structure of impact matrix in Table 6 is possible to note how dimensions of entrepreneur have an impact on the rest of dimensions, as well as the activity that have an impact on them and on the outcome. Except for Costs and Income that are associated between them and is also related to final outcome. This information can be graphically displayed following the patterns postulated in ISM methodology.

Before showing the graphics obtained through impact matrix analysis, we must keep in mind that CIA-ISM classifies the elements of the system into types of events:

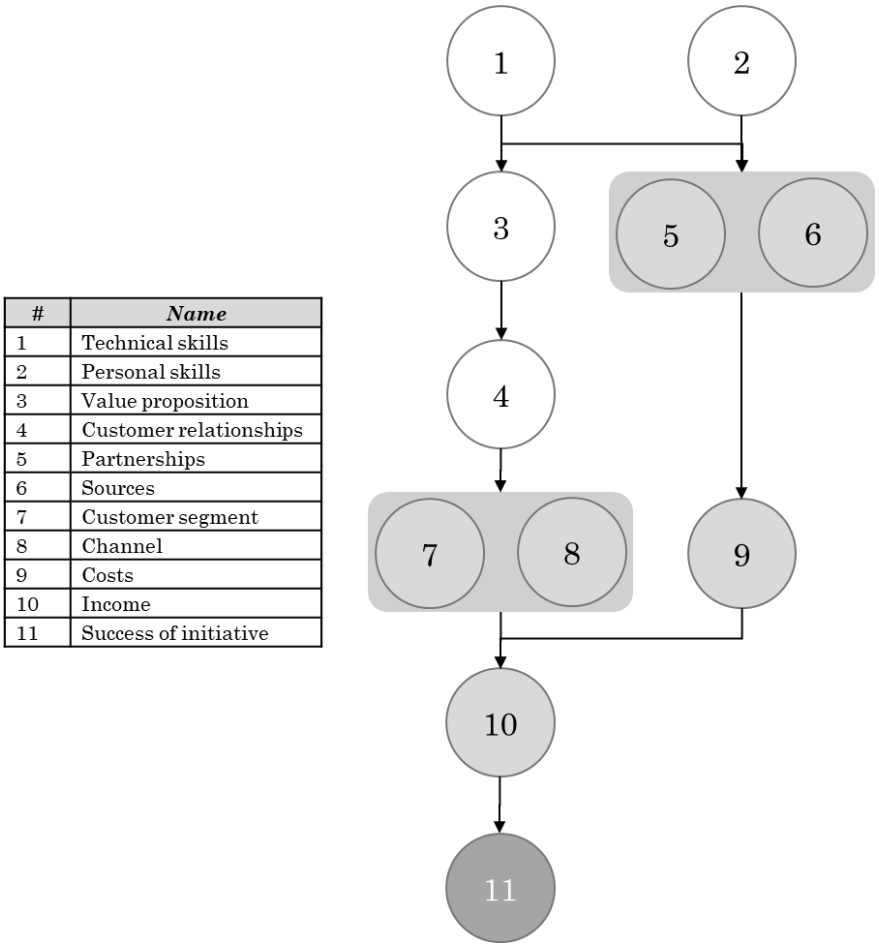
- Inception events: Those events that take place even before that dynamic events of the model start to have effect. In our case, four dimensions are defined within the group "Entrepreneur''.
- Dynamic event: those events that are directly influenced by the scenario where analysis is conducted. In our case, those are the events included within the group "Activity sector''.

Using ISM methodology makes possible to convert information of impact matrix into the pointed graphics. It is necessary to select a trigger level to turn CIA matrix into binary matrix, where 1 show if there is any relationship between an event/dimension and another.

We will show through two different graphics how events/dimensions of our work model are associated. The first graphic shows the relationships between events that have a positive impact on the success of any initiative. The other graphic show how they have a negative impact. Moreover, it can be noted how events are classified with the regard to if they are inception, dynamic and outcome events, as well as taking into account if they have influences of other events or not.

Finally, to understand better the graphic, it its necessary to observe that sometimes evens of the same group have also an influence on each other, creating a micro-scenario or macro-event, as it is referenced in literature. Said micro-scenarios are illustrated by framing within a square the events involved.

Graphic analysis of values R (those that have a positive impact on the success of an initiative)



#	*Name*
1	Technical skills
2	Personal skills
3	Value proposition
4	Customer relationships
5	Partnerships
6	Sources
7	Customer segment
8	Channel
9	Costs
10	Income
11	Success of initiative

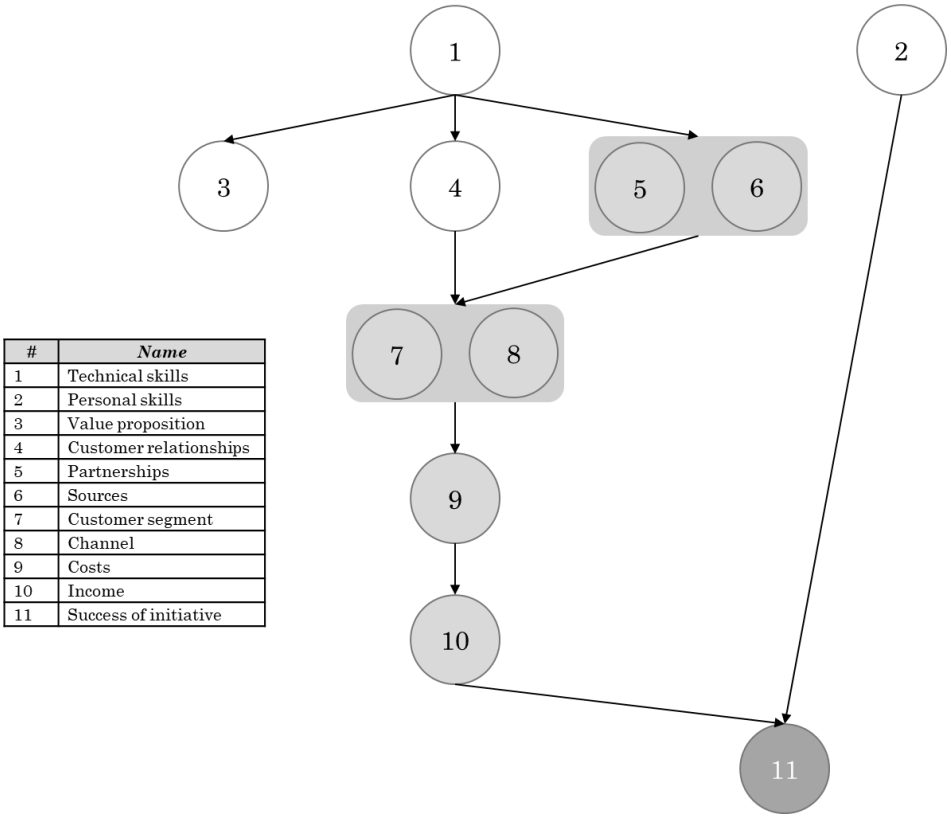
Figure 6. ISM graphic of values R

This graphic (Figure 6) illustrates positive relationships between events selected for Cij level. Obviously, technical and personal skills of entrepreneurial team have been considered as inception events that have positive repercussions on relationships of the whole model. It is also interesting how Partnership and Resources group, that develop its own micro-scenario (Criterion: Infrastructures), is directly influenced by the abilities of entrepreneurial team. Similarly, Customer segment and Channel (Criterion: Market) develop its own micro-scenario influenced by events of Criteria: Entrepreneur and Market.

In addition, it can be noted how Infrastructures have direct influence on cost, as well as the rest on income.

Finally, all the events/dimensions have an influence on success of initiative, that represents the Outcome event of the model.

Graphic analysis of values S (those that have negative impact on the success of the initiative)



#	*Name*
1	Technical skills
2	Personal skills
3	Value proposition
4	Customer relationships
5	Partnerships
6	Sources
7	Customer segment
8	Channel
9	Costs
10	Income
11	Success of initiative

Figure 7. Graphic ISM of values S

As we have previously seen negative relationships between different events (Figure 7), it is possible also to notice how those trigger events (1-4) are situated at the top of the graphic the outcome (11) at the last part, and dynamic events located in the middle, which indicates that this aspect of the model works consistently.

In general, it is almost a copy of positive relationships since various aspects can be remarkable. Position of costs over income shows the negative effect that the wrong structure of costs has on the ability of generating income, and not the other way around. It is also remarkable that personal skills, in C_{ij} level, have direct influence on the success of initiative, by showing somehow the way personal skills of entrepreneurial team itself have on success of data, mentioned in literature when entrepreneurial teams present certain personal skills and the fact that, not having these characteristics is negative rather than positive.

Both cases, matrixes and graphics, it is possible to see perfectly which are the interrelationships between groups, criteria and dimensions. Without repeating what has been previously stated, in graphics (Table 6 and Figure 7) it is possible to see how dimensions are divided into levels (from top to bottom) according to the group they belong to. Dimensions are also divided into micro-scenarios depending on the criteria that associate them. On the other hand, CIA matrix (Table 6) shows how dimensions are interrelated between them, even if we talk about how many times they

occur or the lack of a specific level of said dimensions. By comparison of those obtained results with the map shown in Table 4, it seems consistent to say that the system, that has been created, shares the relational structure that was conceptually raised at the very first stage of this paper. Dimension assigned to "entrepreneur'' group are associated to those assigned to activity, and altogether they have influence on success or failure of this business model.

5.2. Observational method

Some of the activities carried out by the network of local support centers for entrepreneurship, include the development of 500 business plans following BMC in 2015. This business plans are linked to the 240 economic activities previously mentioned, and as an adjunct to those plans, 600 personal interviews to business people of all types of sectors. After completing the project, authors had access to databases that comprise all information gathered. Thus, access to information will be used as reference to estimate the reliability of evaluations performed by this tool.

Validation system used is based on the comparison of results between the outcomes offered by the tool and reality. For that, it was necessary having a sufficient sample in order to note the number of hits and mistakes of the tool for predicting survival.

Firstly, it was necessary having a big enough population to contrast results. For that purpose, 600 interviewed firms in 2015 were taken as overall population. Selection of the population under study of 128 firms was conducted, and its common feature was that they have not been operating for more than three years when interviews were conducted.

In a second step, it would be required to identify which of those organizations continued operating or had been operating for more than three years. To deal with this task, information was collected from different sources of 128 firms in order to identified said data. As a result, 96 of this firms were still operating and 32 had stop being working.

Therefore, a second sample with 128 firms was available, where the group of success was composed by 96 firms and the group of failure was composed by 32 firms. Then, we add into our data base a variable (Operating_2017) with value 0 or 1, in order to state if the organization was still operating or not. Collecting this information is enough to move on the next step that consists in assigning a value to ten dimensions of those 128 examples.

Next step is the assignment of values to perform the simulation, which has been the most laborious part of this project. Following indications stated in heading 4.5 to validate dimensions, analysis of those 128 interviews was conducted. Said interviews, even if they were too informal and unstructured, contained enough information to evaluate most dimensions. However, as previous explained, this model presents neutral valuations for the dimensions that do not have available enough information to be assessed, although for that case reliability of prediction may

be less accurate. It is remarkable that the process of assigning values was conducted anonymously, without knowing if the firm was actually operating or not.

As stated in the quoted heading, in order to cover dimensions of the group "Activity Sector'', differential of each of those models assesses were evaluated with regard to a business plan taken as reference from the mentioned reference guide that contain 500 successful business plans.

In the case of "Entrepreneur'' group, more complex task was carried out as previously said in the quoted heading. In case of "Value proposition'' it was taken into account if the assessed model had obtained any kind of acknowledge, award or mention on behalf of any public or private body, or if the assessed model had any remarkable differential regarding to BMC of reference. "Technical skills'' were assessed by contrasting reference guides and the profile of entrepreneurial team. In "Relationships with customers'' it was considered if the member of entrepreneurial team expressed any specific view about their abilities, training or if they were previously in direct contact with potential customers. Positive and negative comments would modify the level of said dimension.

Finally, "Personal skills'' has been the most difficult dimension to valuate for each of the models assessed. With the aim at following a consistent assessment protocol, dimensions stablished by (Ciavarella et al., 2004) were taken as indicators of said "Personal Skills''. These dimensions are also known as the dimensions of the "five greater authors'': extraversion, emotional stability, kindness, conscientiousness and openness to experience. Knowing all characteristics and elements, process of text analysis was conducted by neutral evaluators, followed by Delphi procedure in order to achieve unification of criteria. Evaluators that review these 128 interviews individually were looking for indicators for each of these five dimensions. After having conducted the first round of questions, results were contrasted and a discussion about differences founded took place with the assistance of a judge. Reaching the agreement, total this time, we proceed to evaluate "personal abilities'' in a linear manner as stated in heading 4.5.

After knowing values of all dimensions of these real examples, evaluation of the level of success of each of those was conducted by means of the tool. Then, "Estimate of success'' must be stated for each of those and this value must be contrasted with the actual situation.

Said comparison provided two major outcomes. First one, is that if estimates of the cases are compared without taking into account the average level of success of each type of activity, tool has an accurate percentage of 76% with low sensitivity when assigning failure values. Outcome is due to, difficulty while achieving success of a specific activity to develop must be taken into account, either on the complexity of activity, technical requirements or special needs among other factors.

Second outcome obtained from comparison is directly associated to the Hypothesis 3 "*Differential between estimate of business initiatives success and medium level of sector success is a reliable indicator of success'',* as proposed in heading 3.2. Success of activities was evaluated taking only data from the dimension of the activity sector assigned by experts, as the example of Table 7 shows, obtaining average of success depending on the sector. After knowing both values, differential between both was calculated and it is named as "Net Success Indicator'' (NSI) (Equation 3).

NSI= Estimate Success – Average Sector Success

Equation 3. Net Success Indicator

Value of NSI range between -10.47% and 41.46%, and it is compared with the dichotomous variable "Operating_2017 to obtain following results:

Operating_2017	**N**	**NSI (per 1)**	**N**	**Group %**	**Total %**
1	96	<0.00	96	100%	75%
0	32	NSI<0.00	21	65.625%	16.4%
		0.00<NSI<0.044	9	28.125%	7.04%
		NSI>0.044	2**	6.25%	1.56%

Table 12. Outcomes of NSI evaluations. ** outsiders.

Generally, all those firms that were still operating had a value NSI >0.00 and firms that belong to "NOT_Operating_2017'' had NSI <0.044 with the exception of two cases that we will explained later.

As me mention, NSI was greater than 0.00% for those assessed cases that were still operating in 2017.

NOT_Operating_2017 group was more fragmented. It was possible to count 21 out of 32 cases with NSI < 0.00.

Nine examples of NOT_Operating_2017 had NSI between 0.001 and 0.044.

Finally, two examples taken as exceptions of the group NOT_Operating_2017 had values higher than 0.1.

Interpreting results has been considered a promising task. Taking as trigger value NSI=0.00, it is possible to state that all firms that were operating in 2017 have NSI positive differential (greater than 0.00%). Moreover, 21 of the 32 firms that were not still operating in 2017 have NSI negative differential. Operating firms are well identified taken as trigger value INE=0 represent 100% of the operating group and 75% of the total number of firms that have been evaluated.

Firms from NOT_Operating_2017 group that have been well assessed and present NSI<0.00% are 21 from those 32 firms, which results in 65.625% of the NOT_Operating_2017 group, and 16.4% of the total.

Therefore, there is 91.4% of firms well classified with regard to the chance of success, by considering success as operating for three or more years.

There are nine assessed firms, whose NSI is defined between 0.00% and 4.4%, should be operating but have closed. This mistake can be read in different ways, since a wrong development of the model or a wrong assignment of valuation to dimensions to assess. In any event, difference is under 5%, which is relatively acceptable, although in future lines of research we will work to improve the adjustment of artifact as it will be explained in the next section and following Pattern 6 stated by Hevner.

Finally, there are two cases whose valuations are well above the acceptable margin of error mentioned above. These examples attract the attention of researchers' team, since they could find entrepreneurs and ask them why their businesses were closed.

All of them answer the same. Their businesses did not close because of lack of success, but in both cases a greater firm offered them better work conditions, greater stability wage security. To some extent, it can be also considered that they "bought'' success, since both entrepreneurs currently work in firms of the same business sector and operate in the same geographical area. In case they did not close, both would be still operating and add to two more hits to the model.

To summarize, indicator purposed in Hypothesis 3 is a great indicator of success estimation and hence, also of the functioning of this tool.

5.3. Analytic method

Two more analysis can be added to the analysis of the model structure through observation of obtained outcomes after having developed BMC&CIA-ISM work model, and the analysis of the goodness of fit with the simulations previously mentioned. All this can be completed with analytical outcomes that we may obtained while applying other statistical methods. It is important to remind that we have available the valuation of 20 dimensions for the 128 interviewed firms. This pool of data is enough to conduct and exploratory analysis to find out the structure that

allows generating an explicative model of characteristics similar to the one obtained by means of cross-impact analysis.

First factorial and exploratory analysis of 10 considered dimensions, consists in using as criterion the extraction of maximum likelihood estimation, with no turnover and 250 iterations → Component matrix is not possible to be calculated.

By conducting a similar analysis, but this time using as extraction method Major Components → Component matrix can be calculated. At this point, we can expect that dimensions are grouped similarly to the way purposed in Table 4, in criteria or in groups. However, this time outcomes were different.

Noting obtained component matrix, three possible grouping can be illustrated (Table 13):

Component Matrix

	Component		
	1	2	3
Technical skills	.061	.389	**.563**
Personal skills	.056	**.620**	-.340
Value proposition	.202	.560	.295
Customer relationships	.246	**.825**	-.099
Alliances with partners	**.928**	-.035	.053
Resource access	**.860**	-.352	.013
Customer segment	**.877**	.051	-.294
Channels	**.876**	-.030	-.335
Income	.565	-.127	**.650**
Costs	**.863**	.015	.085

Table 13. Extraction of components.

First component (Column 1) includes almost all dimensions of the Group "Activity Sector'' but Income are phased out. Group 2 include dimensions of "Entrepreneur'' Group, although values are very low for "Personal Skills'' and "Value proposition'', which make us think that consistency is too low. Moreover, "Technical skills'' are phased out Group 3 and included within "Income'' that came out Group 1.

Given the little brighter results, the following step consist in analyzing the consistency of the factors that are found through reliability analysis.

Component	1	2	3
N of Elements	5	3	2
Conbrach's alpha	0.934	0.515	0.263

Table 14. Components Reliability.

As it is illustrated (Table 14), values from Conbrach's alpha are quite disparate. The only component that shows internal consistency is Component 1. On the contrary, other two components do not yield enough consistency; therefore, it would be not necessary to develop any kind of explanation. Once we obtain analyzed data and obtained outcomes, it seems that there is not information and enough reliability to develop an explicative model that include all these variables beyond the ones included in Component 1.

It is not our intention to put any other type of statistical analysis, but just revealing that model introduced seems to meet better the necessary and raised requirements of the initial concept map. Obviously, we keep in mind that maybe, it may be necessary to conduct other in-depth statistical analysis that go beyond a simple exploratory analysis.

6. Conclusions

Taking into account the patterns stated by Hevner, is necessary to reference patterns 4, 5, 6 and 7 (Contributions, Rigor, Process of seeking and Communication of Research). It is now time to start with contributions.

6.1. Contributions

Firstly, we must remember which the objectives and hypotheses are raised in heading 3.2 of this paper. Objective purposed has been achieved, since DSS has been developed. In this case, DSS is aimed at evaluating entrepreneurial success through the assessment of BMC by using the model developed by CIA-ISM (Objective). Furthermore, three raised hypotheses can be accepted, since the tool is able to evaluate success of BMC (H1), as well as NSI offer a level of accuracy of 91.4% (H3), by stating that this tool has great predictive power. On the other hand, this tool is able to conduct SWOT analysis of dimension of a specific project applied in a specific activity sector (H2).

Secondly, considering the contributions make along the article, we can conclude that this tool is able to consolidate different perspectives and methodologies for the factors that have impact on entrepreneurial success. "Technical skills'' and "Personal skills'' are included in the assessment model by modifying the purpose of Osterwalder.

In the third place, application of CIA-ISM as methodology enable to evaluate effects of ten mentioned dimensions on entrepreneurship success, by considering direct, indirect and cascading

effects, which entails more than 108 million possible relationships for each of those 240 considered activities. As a result, almost 26.000 million possible relationships are identified.

Fourthly, this is the first time that cross impact matrix is used in a study on entrepreneurship. This cross-impact matrix includes different types of relationships, that may be positive or negative depending of the valuation of each of those dimensions. In addition, different adjustments can be performed that will be used in similar backgrounds.

At the global level, we expect that this tool enables agents involved in entrepreneurship to have available a tool based on business information systems. This would minimize risk levels of entrepreneurship, by helping to identify strengths and weaknesses that reduce the high levels of uncertainty that entrepreneurs face.

6.2. Weaknesses and further steps

Pattern 6 states that research process in information system must be an open and iterative process until optimal outcome is obtained. In this sense, although obtained outcomes are hopeful, we must keep in mind weaknesses and shortcomings presented at this study.

Although the methodological combination of CIA-ISM has been already applied in many scenarios, much remains to be done in this area. In our view, most important aspect to consider is conducting a comparative analysis in-depth about the advantages and disadvantages of the use of CIA-ISM against other type of analysis. As well as improving reliability of the presented model. Moreover, it is intended to undertake different modifications by using mixed modelling systems that integrate CIA, system theory, structural equation modelling, etc.

Next step is focused on the development of a functional interface and user-friendly that can be use remotely. This project of development might extent towards integration of DSS tool in a global IS that could make possible the update and extent of available information in the data layer. This would make possible the integration of this layer to this tool and to the analytic layer by means of business intelligence tools.

Other future lines of research consist in continue refining this model so that it may be used in other geographic areas. For that purpose, it will be necessary to improve the interface as well as the core.

It is important also to review some information about scales and assessments models for each of those dimensions so that adjustment to said dimensions becomes more accurate. In this sense, it would also avoid errors in valuations and make easier the use of this tool for agents.

Finally, we will continue working on the application of methodological combinations based on CIA-ISM in different areas where there is a high degree of uncertainty and minimize this way risk and help in decision making.

6.3. Communication of outcomes (Pattern 7)

The last purpose of Hevner refers to communication of the findings of research. This goes beyond publishing of this document. Authors consider that at this point is necessary to take a step further towards transfer of academic knowledge, as well as transferring outcomes to entrepreneurial area. Currently, we are working with the same network of public agents and collaborators by carrying out actions, organizing presentations and conferences with the aim of showing obtained outcomes in a practice and real environment. The objective of those action is twofold, since on the one hand we provide an approximation to those outcomes and tool developed for potential users, and on the other hand, we obtain a great amount of information of user after using this tool. All this enables us to continue with the iterative process of improvement as mentioned in the research strategy section.

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