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Prospective scenarios: A literature review on the Scopus database

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A B S T R A C T

The use of prospective scenarios has been discussed by companies in different sectors. As such, this work seeks to study the literature on the prospection of scenarios, permitting different types of analyses and applications. A bibliometric study was performed on the Scopus database, accessed from the CAPES portal in April 2015 and updated in June 2017 in order to identify how the articles about the term prospective scenarios are presented in the literature. 87 articles on the subject were found indexed on Scopus, of which only 17 were from Brazil. It is expected, therefore, that this work will contribute to the construction of an overview of the existing literature on prospective scenarios in order to stimulate the interest of more researchers for the subject.

1. Introduction

The application of prospective techniques to the formulation of strategy and definition of priorities has increased dramatically in the last ten years (Johnston, 2010), increasing the complexity in the definition of strategies that ensure the survival of organizations in a competitive environment (Oliveira & Forte, 2010).

According to Schwartz (1998), scenarios are platforms for strategic discussions that lead to continued organizational learning regarding its key decisions and priorities. Planning based on trends is becoming less effective, since the discontinuities in organizational environments are increasingly emergencies (Junior, de Oliveira, & Kilimnik, 2010).

For Moritz et al. (2010), planning through the study of prospective scenarios means formulating strategies that will help define the life of organizations in their future. In addition to reducing risks in decision making and increasing the probability of making the correct decision regarding these inevitable changes, it allows the company to be managed with more assertiveness in the maintenance of its business (Rodrigues, Rojo, & Bertolini, 2013).

In this context, the following question arises: How are articles related to the term prospective scenarios presented in the literature?

This study can be justified because it addresses a current subject, since the adoption of effective models contributes to decision making in organizations and, consequently, to their results.

The objective of this study is:

a) To review the literature on the prospection of scenarios, enabling different types of analyses and applications, and
b) To establish a bibliographic framework, forming a starting point for the development of an overview of the applications of prospective scenarios existing in the context of business organizations, since the prospective scenarios approach has been discussed by companies from different business sectors, in addition to being a focus of study for researchers active in academia.

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Table 1
Scenario planning methods quantitative and non quantitative.

Quantitative Scenario Planning Methods	References
Cross Interactive Impact Stimulation (INTERAX) / SMIC (French acronym for Cross Impact Systems and Matrices) − Interax	Huss, Hoton, 1987
Future Intuitive Stimulation (IFS) − known as BASICS (BATTELLE Scenario Inputs to Corporate) − Basics	Georgantzas, Acar, 1995
Impact Trend Analysis (TIA)	Gordon, 1992
Cognitive Fuzzy Maps (FCM) scenario-based planning method	Jetter, Schweinfort, 2011
Prospective and Multicriteria − Unified Method for Strategic Prospective Planning and associated with the acronym Momentum	(Gomes, Costa, 2013, Gomes et al, 2017)
Non-quantitative scenario planning methods	**References**
Intuitive Logic	Schwartz, 1998
Prospective analysis	Godet, 2000
Future mapping	Mason, 1994
Global Business Network Methodology (GBN)	GBN, 1998
Morphological analysis	Godet, 1996
Delphi method	Dalke, Helmer, (1963)
SRI International (Stanford Research Institute)	Vieira et al (2017)

Section 2 presents the concept and a brief history of the prospective scenarios approach used in this paper. This section includes the scenarios methods classification existents; and a new propososol classification in Table 1. The main method and the new methods are described in 2.2.

Section 3 describes the applied research method in this review.

Section 4 presents the results obtained in the bibliometric study; and Section 5 ends with the conclusion.

2. Prospective scenarios

The study of scenarios can be defined as a study of events that may come to occur in the future, organized in a limited and structured list with the possible future situations. According to De Carvalho (2009), this methodology enables the organization to understand the environment and how it develops over time, preparing itself in advance for a scenario that may become real.

The methods and techniques to plan for the future are called Scenario Planning, Development Scenario, Forecasting, and Foresight or more generally, Future Studies. Scenarios are the products of Future Studies whilst they are the stories that represent the future (Dias, Vianna, & Felby, 2016)

The development of scenarios and their use in organizations is an approach to develop strategies and strategic thinking that recognizes the inherent unpredictability of the future (Ericson, 2010).

Modeling future scenarios has become a tool of civil and military intelligence agencies, of governments that employ strategic planning, and of large corporations, in addition to its countless scientific applications in the most varied fields, including meteorology, astronomy, environmental sciences, economics, marketing, finance and demography (Polesi, 2006). Whoever prospects the future and acts proactively, will have a better chance of success than its competitors (Sturari, 2008).

When planning with the use of prospective scenarios, strategies are therefore developed in order to assist managers in the definition of the life of the organization through the most varied methodologies, and, as such, to better define the uncertainties of the environment in order to build a better future (Moritz et al., 2010).

According to Johnston (2010), management analysts are predominant in this approach because qualitative transformations are happening in structures and attitudes. The past provides no guidance for the future and there is a need for companies to develop models geared to a different way of planning and operating to overcome this uncertainty and change.

For Godet (2000) there is no single method for developing scenarios, but an infinite number of methods that permit their construction, with some being simpler and others more elaborated. However, this author states that there is a consensus that the scenarios method should only be applied in an approach that contains a number of specific inter-related steps – systems analysis, retrospective analysis, actor strategies and scenario development.

Santos, Coelho, Santos, and Fellows Filho (2004) present two scenario categories: exploratory scenarios, which reveal past,

present and future trends; and anticipating scenarios, also known as normative scenarios, which are constructed based on possible future visions, indicating desirable scenarios and scenarios that should be avoided.

Wright and Spers (2006) describe seven steps in the construction of scenarios:

definition of the scenario's scope and objectives; identification of variables, trends and fundamental events; structuring of the scenario's variables; projection of the future states of the variables and the probability of their occurrence; identification of the driving themes of the scenarios; assembly of a morphological matrix for each scenario; drafting and validation of scenarios.

When developing scenarios, it is important to have consistent and possible descriptions of future situations, and not to predict something, knowing the real situation and each future scenario, highlighting the factors relevant to decisions that need to be taken (Wright & Spers, 2006).

According to Machado, Souza, and Valverde (2010), if the objective of organizations is based on profitability, growth and survival, then developing future scenarios turns into a strategic stimulus, since anticipating obstacles will enable organizations to reach their goals (Wright & Spers, 2006).

Defining scenarios for a country means mapping probable futures, identifying trends and uncertainties and anticipating opportunities and threats (Wright, Silva, & Spers, 2010). It is important to emphasize that scenarios are developed in order to reduce the uncertainties and guide the strategic decisions of managers on how to build the best possible future. Nobody should therefore make scenarios in order to guess, predict or preview the future (Sturari, 2008).

2.1. Classification of scenario planning methods

Bishop (Bishop, Hines, & Collins, 2007) classified the methods and techniques of producing scenarios in eight groups:

- Judgment
- Baseline
- Elaboration of fix scenarios
- Event sequence
- Back-casting
- Dimension of uncertainty
- Cross impact analysis
- Systems modelling

For Amer, Daim, and Jetter (2013), there are three schools of techniques or major approaches for the development of scenarios having some sub-techniques Two out of these three principal approaches for scenario development are initiated from Anglophone countries USA and UK, and one emerged from France.

These approaches are:

(1) intuitive logics, does not use any mathematical algorithm and scenario development models
(2) probabilistic modified trends (PMT) methodology; This school of scenario planning incorporates two quite different matrix based methodologies, trend impact analysis (TIA) and cross impact analysis. These techniques involve the probabilistic modification of extrapolated trends; as BASICS (BATTELLE Scenario Inputs to Corporate Strategies) developed by the Battelle Memorial Institute, INTERAX (Interactive Cross Impact Simulation) developed by Enzer at the Center for Future Research (CFR), University of Southern California, and SMIC (French acronym for Cross Impact Systems) and
(3) the French approach of La prospective, this approach develops normative scenarios of the future and articulates idealistic future images so that scenarios can serve as a guiding vision to policy makers and provide a basis for future action

Dator (2002); proposes the following archetypes:
Continued growth: In this future, it is assumed that current conditions and trends are enhanced.
Collapse: This future results as continued growth fails and there are great contradictions.
Steady state: This future seeks to arrest growth and find a balance in the economy and with nature. It highlights a balanced, softer and fairer society.
Transformation: This future tries to change the basic assumptions of the other three. It comes out either through dramatic technological change or spiritual change.
Aspirational futures: an approach to learn about future and its uncertainty from the understanding what might happen and commitment for creating the preferred future
For Porer et al. (1991) scenarios are classified into descriptive and normative scenarios [31]. Descriptive scenarios are extrapolative in nature and present a range of future likely alternative events. Normative scenarios are goal directed and respond to policy planning concerns in order to achieve desired targets.
Scenarios are also classified on the basis of scenario (Mietznera & Reger, 2005) topic (problem specific versus global scenarios), breadth of the scenario scope (i.e. one sector versus multi-sector scenarios), focus of action (i.e. environmental versus policy scenarios), and level of aggregation (i.e. micro versus macro scenarios) [69].
For Armer et al. (2013) there are four Quantitative scenario planning methods. Gomes, Costa, and de Barros (2017) includes one more Prospective and Multicriteria.

This paper includes scenario planning methods, non quantitative (Vieira et al. 2017; Gomes et al., 2017). The Table 1 merged this conception:

2.2. Scenario methods

Intrerax

1. Define the main question and the analysis period;
2. Identify the key-indicators;
3. Projections of the key-indicators;
4. Probability distribution of the event;
5. Monte Carlo Simulation
6. Estimate the impacts of events over trends;
7. Cross-impact matrix;
8. Develop the scenarios

IFS or BATTELLE

1. Define the structure of the subject to be searched;
2. Identify and structure areas of influence on the subject;
3. Define the descriptors, with the logic for each one and assign initial probabilities of occurrence to each state of them;
4. Fill the Cross Impact Matrix with the odds identified in step 3
5. Run the BASICS program;
6. Select scenarios and elaborate their narrative;
7. Introduce low probability events (with high impact), and conduct the sensitivity analysis;
8. Develop projections arising from scenarios and assess their implications

TIA

1) focus setting – issues that need to be answered to define the limits of the scenarios to be created;
2) mapping of the driving forces that are better able to shape the future of the industry.
3) construction of the scenery space with classification of various future states as a function of the driving forces;
4) selection of scenarios to be detailed;
5) detailing of the scenarios, relating trends and the events required to reach each of the final states.
6) documentation, including pictures and narratives that describe the history represented in each scenario;
7) evidence of the implications of each scenario – how different the decisions about business will be according to each type of scenario.

FCM
Knowledge of the experts is captured in a weighted causal map
Experts also help to identify various combinations of input vectors for performing FCM simulation.
Momentum

1. *System overview*: In this step, the system is analysed as whole, identifying all its inputs and outputs
2. *Relevant actors mapping*: After obtaining the system overview, the next step is to define relevant actor involved in the process, such as govern, industry, syndicates and other stakeholders
3. *Variables identification*: Define the variables that can affect the future scenarios
4. *System's SWOT analysis*: To understand the system's strengths, weaknesses (internal variables), opportunities and threats (external variables)
5. *Uncertainties elicitation*: As previously explained, uncertainties are central to the process of scenario building. They bring doubts and focus the approach in the development of future scenarios. The main goal of this step is to reduce the level of uncertainty of the future by bringing actions and strategies for the present, so that one can prepare and anticipate striking variations in environment
6. *Relevant variables selection*: In this step, after having all the uncertainties collected, matrix of cross-impact (Godet, 1996) is applied to reduce the variables set for the scenarios building
7. *Key indicators definition*: In this stage, a set of key indicators are defined to provide better analysis of the selected relevant variables
8. *Prospective scenario design*: In this step, based on the results from the previous ones, the scenarios are finally built
9. *Criteria definition*: Select the criteria set to be adopted for alternatives evaluation in each scenario. At this point, the decision maker can evaluate how each alternative operates in each scenario, and can assign weights to each criterion for each scenario. With the integration of MCDA with prospective analysis, it is recommended the decision-maker to re-evaluate the weights/values that have been assigned to each criterion, once the future scenario becomes unforeseeable

10. *Alternatives elicitation*: Once the scenario was already built, the alternatives that can be used in each scenario are defined
11. Define the weights of each criterion for all the scenarios _
12. Evaluate the alternatives under each criterion viewpoint. This should be done for all the criteria and all scenarios
13. Apply the ranking algorithm to the collected data

Intuitive Logics
Intuition, expert opinion, STEEP analysis, brainstorming Techniques
PROSPECTIVE ANALYSIS

1. Analyse the problem and delimit the system;
2. Diagnosis of the company;
3. Structural analysis;
4. Enterprise dynamics in the environment;
5. Environmental scenarios;
6. Identify strategies;
7. Evaluate strategies;
8. Select strategies;
9. Develop action plans and monitor strategy

Future Mapping

1. Create the final stages and events;
2. Explicit the current mental model − conventional wisdom scenarios;
3. Map the final stages; Participants are divided into groups;
4. Build the scenarios for presentation to the group;
5. Analyse the common and divergent points for the scenarios;
6. Select the most desirable final state;
7. Map the strategic direction

GBN

1. Identify the issue or central decision;
2. Identify the key-factors in local environment;
3. Identify the macro-environment driving forces;
4. Rank the key factors by importance and uncertainty;
5. Select the scenarios logic;
6. Scenarios drafting;
7. Analyse the implications;
8. Select early indicators and warning signs for future monitoring

Morphological Analysis

1. Define the system in a precise way;
2. Analysis, description and identification of parameters;
3. Evaluate parameters and define their states (situations that can be assumed);
4. Include restrictions in order to eliminate inconsistent combinations;
5. Combine alternatives between the states of each parameter considering its restrictions

3. Methodology

An extensive literature review on the Scopus data, accessed from the Capes Portal of Journals, using the term "*prospective scenarios*" for the *article title, abstract and keywords*, and the document type *article*. Sixty (60) articles were identified. The search was updated in June 2017 and 89 (eighty-nine) articles were identified.

The objective of the bibliometric survey was to analyze the articles that addressed the prospective scenarios subject and to present the main topics of the selected articles, forming an initial core as a contribution to a bibliographic reference. The main topics of the selected articles were described in order to provide a more detailed view of the literature on prospective scenarios.

Proposed by Costa (2010) the Webibliomining model (Costa, 2010; Silva, Costa, & Barros, 2015) aims to provide an initial set of references for a literature review (Pereira, Verocai, Cordeiro, Gomes, & Costa, 2015; Pereira, Costa, & Pereira, 2017; Rodriguez, Costa, & Do Carmo, 2013). It integrates concepts of Bibliometrics, Webmetrics, Informetrics and Biblioming and consists of the following steps:

- Define survey sample;
- Research in the sample, with the abstracts and title;
- Research in the sample, with the keywords;
- Identify authors of publications;
- Identify h-index authors;
- Identify "the largest production cycles" (Chronology of production);
- Identify affiliation;
- Identify journal;
- Identify country;
- Identify fields of knowledge.
- Numbers of scenarios.

4. Results

The bibliometric study performed in 2015 on the Scopus database considering the term *"prospective scenarios"* for the *article title, abstract and keywords*, and the document type *article,* generated 60 records.

Articles in the field of future scenarios began appearing in 1989, but only became more frequent after 2002, with the apex in 2013 with 11 articles. France has 26 articles, standing out among the rest, and Brazil appears in second place with only 9 articles. The National Center of Scientific Research (France) has 3 publications that use the term prospective scenarios. One of the few exceptions is the Universidade Nova de Lisboa, located in Portugal.

The articles listed by this study are from different authors, and there is apparently no great reference in the field. In the same way, there is no greater preference for one *journal* in particular, with the publications being spread across several journals.

4.1. Analysis

Below, the results of this research are presented, highlighting the main points observed about prospective scenarios:

Dudley, Brown, Thomson, and Eckersley (1989) describe an approach in which prospective scenarios are used, reaching a faster analysis of the new technique effect for decision-making. Durance and Godet (2010) tried to answer simple and important questions: What is a scenario? How to judge the quality of a scenario? What are the strategies for scenarios? According to these authors, the prospective strategy tools applications are contigent and modular. Lange (2012) presents what is possible out of the method of prospective scenarios in the general and mandatory education, seeking through empirical approach and case study, to determine its feasibility, its contributions, its limitations and find the scientific educational place in the preparation of "Vulnerability" perception.

Rallet (2001) and Hudrisier (2002) study the impact of new technologies on urban organization and the technologic culture. In the results, several prospective scenarios are proposed in order to better understand this relationship. Blois and Souza (2008), Boon, Aarden, and Broerse (2015), Chakareski (2012), Chakareski (2013), De Díaz, Lobo, and Geraldino (2013), Gregório and Velez Lapão (2012) and Hirschinger, Spickermann, Hartmann, Gracht, and Darkow (2015) address the use of prospective scenarios for strategic analysis in different sectors. Blois and Souza (2008), for example, intend to propose a form of systemic analysis of the footwear sector that integrates the Prospective Scenario approach to the System Dynamics. It was used the method described by Grumbach and the hard modeling of the System Dynamics. The results showed that the proposed approach can contribute to help in the strategic decisions of the studied footwear marketing. Hirschinger et al. (2015) search to formulate precise supply chain strategies for the future through a Delphi research and diffuse cluster application. Although there are extensive studies on prospective scenarios in emerging economies, the research largely neglected the future evolution of transportation and logistic. This study comprehends the multiple method research, considering the institutional theory and the competition theory of the factorial market to create scenarios of transportation and logistic developement in emerging economy countries up to 2030.

De Ruffray and Hamez (2009) address the social aspect of the territorial cohesion through acessibility examination of the public service. Based on the application of fuzzy sets, the method is applied in maternity hospitals of large region (a border area formed by Lorraine, Luxemburgo, Rheinland-Pfalz, Saarland and Valónia). The resulting map of the three prospective scenarios developed in EPSON 3.2 shows the consequences of politic decisions on planning and territories. Calais Siqueira, de Assis Mota and Toledo Moreira Mota (2016) also show a new general method to analyse Fuzzy, based on mathematic operations among arrays, that allow the development of simple and quick computational algorithms, for applications that can support the decision making in different processes of telecomunication network management. Gomes et al. (2017) show a hybrid modeling that match concepts and techniques to build scenarios, together with a multicriterium approach, due to existence of decision problems susceptible to the influence of scenarium variation. Another quantitative model was presented in Houet, Aguejdad, Doukari, Battaia, and Clarke (2016) and is derived from SLEUTH model, which was changed to incorporate an additional spatially explicit factor and to be used in a prediction mode totally controled. The aim is to spatially distribute the urban growth, its quantity and pattern, according to the pre-defined prospective scenarios and undertaking a non-trajectory dependency approach.

Moldrup, Traulsen, and Peck (2003) address the need of a continous methodological evolution within Medical Tehcnology Assessment (MTA) to catch and include the risks in relation to economic, political and ethical aspects of modern drugs. In this article, it was used a cross-cutting approach in prospective, in which it should be applied the MTA as an "early alert system" way, using the Delphi method in combination with prospective scenarios to remain with the changing characteristics of new medicaments. Lehoux et al. (2014) describe a three-year study that is based on a prospective method based on multimedia to support the public resolutions that allow a critical analysis of

social and ethics of the health technology use. Intervening earlier in the technological development can help to reduce the undesirable effects and inform the design and implementation of innovations more appropriate to health. Ma, Dibildox, Schultz, Regar, and van Walsum (2015) also study the coronary movement substitutes in health area which are related to the respiratory and heart movement.

Lassègue, Rosenthal, and Visetti (2009) in this study suggest a prospective scenario of language appearance and evolution that radically differs from the dominant neo-darwinian position. The aim is to explain the shared origin of practical and fictional dimensions of social life, in which the behavior ritualization goes hand in hand with the development of semiotic games and gender (especially the narrative type). Saleh et al. (2016) conduct researches on medical area in order to study the human behavior and reduce the error probability. Also considering the human behavior study, Schuessler (2016) assesses scenarios of prospective and retrospective resignation to understand problems related to the individual. Arias and Vásquez (2016) also aim through the study of scenarios the generation of a strategy to prioritize and reinforce the formation of human capital.

Other articles, as Atherton (2005), Burlaka (2015), Bernard and Prieur (2007), Cañas (2017), Gonçalves, Mussi, and Del Corso (2016), Hooper et al. (2013), Le Dars and Loaec (2007), Littlewood, Wang, Turnbull, and Murphy (2013), Massara, Tetart, Lecarpentier, and Garzenne (2009), Meza, Seger Mercedes, and Sauer (2014), Neves, Nääs, do Vercellino, and de Moura (2010), Plumejeaud, Moisuc, Bimonte, Villanova, and Gensel (2009), Poullikkas, Zueter, and Dirar (2015), Suna and Resch (2016), Talavera, Ferrer-Rodríguez, Pérez-Higueras, Terrados, and Fernández (2016) and Vayssières, Guerrin, Paillat, and Lecomte (2009) are more focused on application of scenarios to promote cost reduction and economic development. Atherton (2005), for example, generates prospective scenarios on the basis of the incentive of activity levels of small companies and uses the counter-factual thinking to formulate the possible alternatives. Eight scenarios are developed based on the changing factors in the economic structure of business activity. The worldwide economy data are applied to test the scenarios. These generated scenarios try to observe which the implications for nature and economic activity are. Cañas (2017) assesses the more probable and desirable prospective scenarios in the assembly of motorcycle industry in Colombia, identifying the necessary actions for its economic development.

Ab Kadir, Rafeeu, and Adam (2010); Collet, Ruelland, Estupina, Dezetter, and Servat (2015); De Carvalho, Antunes, and Freire (2016), De Paula Dias, de Souza Vianna, and Felby (2016), Enault and Chatel-janvier (2017), Gallez (2002), Camacho-Sanabria, Juan-Pérez, and Pineda-Jaimes (2015), Ghysel et al. (2010), García and Manzini (2012), Gouveia, Seixas, Labriet, Fortes, and Gargiulo (2013), Houet et al. (2010), Loubet, Roux, Guérin-Schneider, and Bellon-Maurel (2016), Martins et al. (2008), Maestripieri et al. (2015), Miguez, Rezende, and Veról (2014), Pardo and Moya (2013), Santos, Snickars, and Mirra (2013), Scholes, Anderson, Cuthbertson, Stevens, and Kentish (2013), Schakel, Pfister, and Ramírez (2015), and Wu et al. (2016) study the application of prospective scenarios to assess possible impacts on the environment, as well as the use of cleaner technologies. Such spatialized scenarios and their implications allow societies to reduce the future uncertainty exploiting several change strategies regarding sustainability. Still based on the study of different environmental conditions, Silva and Teresa (2017) use the study of scenarios to check the influence of environmental changes in the community of fish organization and Benini and Mendiondo (2015) aim to compare urban occupation scenarios and their effects in the hydrological cycle of Bacia do Mineirinho, mainly in terms of flooding.

Belmeziti, Coutard, and De Gouvello (2014), Even and Billen et al. (2007), Even and Mouchel et al. (2007), Fabre, Ruelland, Dezetter, and Grouillet (2015), Grard, Everbecq, Magermans, Bourouag, and Deliège (2014), Lanna (2008), Shi et al. (2013), Sun, Lin, Jiang, Li, and Tao (2014), Thieu, Mayorga, Billen, and Garnier (2010) and Voorsluys et al. (2007) articles cover the prospective scenarios application in research related to water resources. Voorsluys et al. (2007), confirm that a good water management requires multidisciplinary competences, which address: climate, hydrological, social and economic aspects in the decision making process on water use. The article seeks to understand the trade-offs in the decision making on water allocation, considering the human experience, the data and the computing power. Belmeziti et al. (2014) are based on a prospective scenario to rainwater better use. As Fabre et al. (2015) show an integrative modeling scenario, whose purpose is to assess the balance between demand and water availability and its variation in periods. The modeling scenario developed and tested in this study will be used to assess the water balance under scenarios and study the efficacy of adaptation politics designed to keep the balance between demand and water availability.

The articles Cudennec, Sarraza, and Nasri (2004), Camargo et al. (2014), Fonderflick, Lepart, Caplat, Debussche, and Marty (2010), Moreau et al. (2013), Poussin, Pouget, and D'hont (2010), Paloma, Ciaian, Cristoiu, and Sammeth (2013) and Ryschawy, Joannon, Choisis, Gibon, and Le Gal (2014) cover the application of prospective scenarios in researches related to agricultural production. Cudennec et al. (2004) aim to assess the intensification of agricultural crop production with geomorphological modeling (GIUH) approach. The GIUH structure is based on the effective area of the basin and in the average speed of the estimated flow, allowing the barrages accountability. According to the results, the barrages do not have any impact when the reservoirs are full; the implementation spatially homogeneous of barrages changes the hydrograph of water basins according to the basin area; and the localized application can be studied through the modeling. Ryschawy et al. (2014) have as objectives to develop and assess technical innovations that could improve the agriculture sustainability in difficult conditions of less-favoured areas. The scenarios were assessed in two real farms, using an internal simulation tool. Then, they were matched with prospective scenarios on public politics and markets to assess the capacity of the farmers when dealing with changes in their economic environment.

Finally, the articles Baudelle and Poussard (1996), Barredo and Demicheli (2003), Barredo et al. (2004) and Team (2006) are related to the application of scenarios to study the development of different areas. Baudelle and Poussard (1996) state that prospective studies along the Atlantic coast are linked to political action, particularly through international networks development of regional associations, such as the Atlantic Arc. This article shows several prospective scenarios put together to handle with the future evolution of the Coast and its influence on several forms of politic action. Team (2006) investigates the long term growing of Europe in the worldwide aconomy, covering the first half of the twenty-first century. It was used a model that divides the world in ten large regions to create the prospective scenarios. A conservative basis scenario is built to outline the main macroeconomic characteristics of the extended regions. The beneficial effects on the Western Europe and the negative effects on the imigration regions are shown in the results.
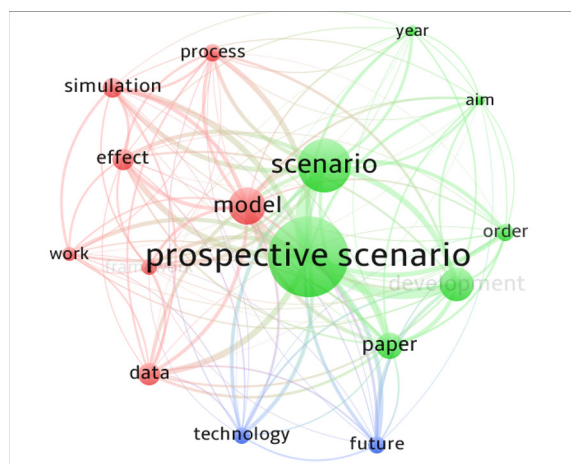
Fig. 1. Main clusters with the terms of the titles and abstracts.
Source: VOSviewer

4.2. Updated study in 2017

The study was updated in June 2017 and 87 articles were identified. Through the analysis of the Abstracts and Titles, it was possible to identify 16 words forming 3 clusters. From Fig. 1 one can conclude that most articles address prospective scenario models, listing models, processes and simulation.

The keywords were analyzed, and 33 words were identified forming 4 clusters. The words "prospective scenarios", "management", "carbon dioxide" and "article" stand out (Fig. 2).

The articles listed by this study are from different authors, and there is no great reference in the field. Most authors identified in the study have one article each.

Of the 319 authors, 23 meet the threshold for the minimum number of two articles per author. Some of the 23 items (nodes) in the author network are related among themselves. The largest number of connected items (authors) consists of eight items, as shown in Fig. 3. The author Ruelland, D has the largest cluster, followed by Dezetter, A.

The analysis of the authors listed in Table 2 shows the H-index of the authors with up to two published articles related to the prospective scenario subject.

This index lists the number of publications with the number of citations and creates a number that only has a tendency to rise if the quality of publications also goes up. The author with the highest H-index is Yu, Z with h = 24, i.e., 24 published articles, which received 24 or more citations.

Considering Table 2 – H-Index, and Fig. 3 – Clusters, one can see that the first 9 authors in Table 2 tend to be the most influential.

According to Fig. 4, the articles related to the prospective scenarios subject started in the year 1982. Several time gaps can be seen in the publications. One can see that the publications are taken up with greater frequency after 2001 despite some fluctuations, with only one negative point standing out: 2010.
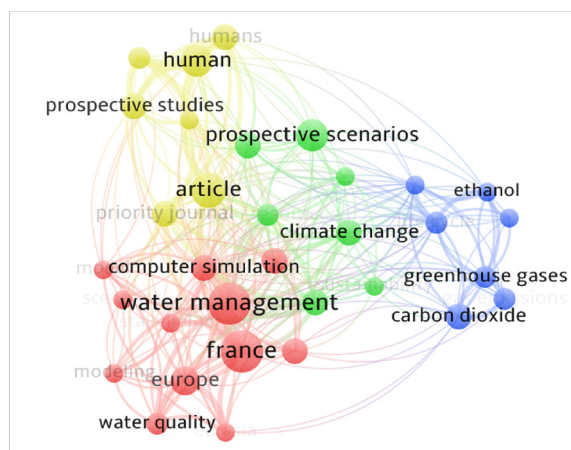

Fig. 2. Clusters with the keywords.
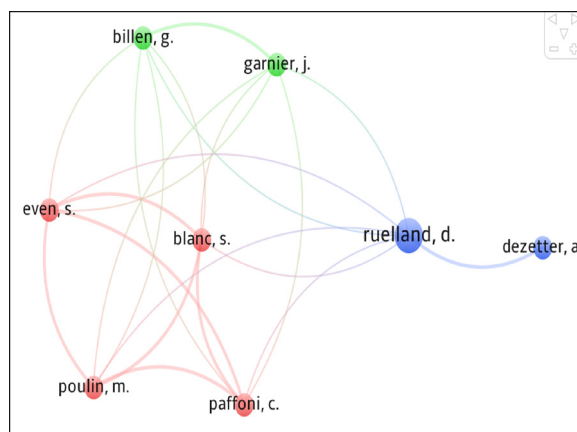Source: VOSviewer

Fig. 3. Main Clusters with the authors of the subject.
Source: VOSviewer

Table 2
H-index authors.
Source: Scopus 2017.

Authors	H-index
Yu, Z	24
Garnier, J	23
Even, S	19
Chakareski, J	17
Balenghien, T	16
Barredo, J.I	16
Ruelland, D	15
Vandeputte, S	15
Dezetter, A	14
Poulin, M	12
Durand, B	11
Houet, T	11
Paffoni, C	10
Gosset, C	8
Léonard, P	7
Seixas, J	5
Demicheli, L	4
Billen, G.	1
Blanc, S	1
Fecher-Bourgeois, F	1
Saegerman, C	1

Table 3 shows the institutions that have up to two publications related to prospective scenarios. The CNRS Centre National de la Recherche Scientifique stands out with eight publications followed by the Universite de Liege, Universidade de São Paulo (USP) and INRA Centre de Rennes with three publications each.

The publications are spread across several journals. Those with up to two articles published are highlighted. Among these, the journal Energy Policy stands out with four publications, as shown in Table 4.

When the amount of articles by country resulting from the search is considered, 29 countries were identified: The country with the greatest number of publications related to prospective scenarios is France, followed by Brazil and the United States (Table 5).

The fields of knowledge that stood out according to Fig. 5 are Environmental Sciences (32%), Social Sciences (25.8%) and Energy (16.9%).

Table 6 shows the areas of knowledge of the researched articles. The following authors stand out:

Table 7 shows the articles that establish number of scenarios. The following authors stand out:

5. Conclusion

The data presented in Figs. 1–5 were not found in articles that review the theme. Sections 2.1 and 2.2 update the existing review articles (including Table 1). The other tables present data not found in the review papers.

The Momentum method shows an integration of prospective with multicriteria, showing that it is not enough to study scenarios. It is necessary to identify investment alternatives that are robust to several scenarios. As future perspectives the integration of the
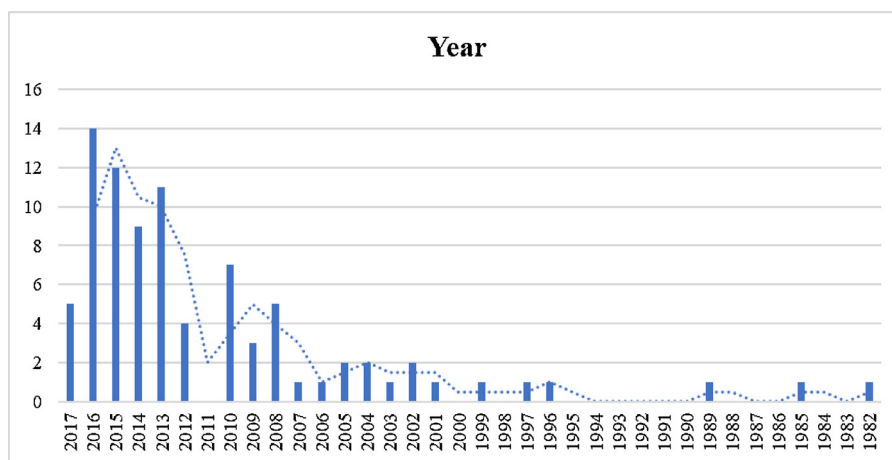
Fig. 4. Publication by year.
Source: Scopus 2017

Table 3
Documents by affiliation.
Source: Scopus 2017.

CNRS Centre National de la Recherche Scientifique	8	École des Ponts ParisTech	2
Universite de Liege	3	IRD Institut de Recherche pour le Developpement	2
Universidade de Sao Paulo − USP	3	Pontificia Universidade Catolica de Campinas	2
INRA Centre de Rennes	3	Universidade Estadual de Campinas	2
Agence de l'Eau Seine-Normandie	2	Mines ParisTech	2
SIAAP/DRD	2	CIRAD	2
Universite de Toulouse II − Le Mirail	2	Universidade Nova de Lisboa	2
Utrecht University	2	Universite de Rouen	2
Hohai University	2	Milieux Environnementaux, Transferts et Interactions dans les Hydrosystemes et les Sols	2
UC Davis	2	Centre de Geosciences	2
Chinese Academy of Sciences	2	Gestion de l'Eau, Acteurs et Usages	2
University of Surrey	2	Universite de Montpellier	2
IRD Centre de Montpellier	2	Hydro Sciences Montpellier	2
CIRAD Centre de Recherche de Montpellier	2		

Table 4
Documents per year by source.
Source: Scopus 2017.

Energy Policy	4
Espacios	3
Agricultural Systems	3
Futures	2
Science Of The Total Environment	2
Land Use Policy	2
Mappemonde	2
Revue Economique	2

decision-making process, individually or in group, with prospective.

The Environmental Science/Energy areas are the most contemplated with prospective studies, revealing the tendency of concern with the environment. Following are Social Sciences/Business, Management and Accounting indicating that these are the areas of future applications/scenarios research. The proposal of the Momentum method joining Foresight with Multicriteria presents a new research proposal.

Most of the studies contemplate three prospective scenarios. Studies with 1 to 4 scenarios represent more than 85% of the total.

The planning of scenarios has been a tool that has been increasingly used to test and improve the performance of organizations in dynamic environments. This literature review disclosed that the prospective scenarios technique is used by many organizations to predict the future, since planning has become a determining factor for their own survival.

Based on the bibliometric study performed in this work, a starting point for the research on prospective scenarios was generated, covering articles distributed over several years of scientific production on the studied subject, in order to obtain a more consistent and

Table 5
Documents by country/territory.
Source: Scopus 2017.

France	32	Colombia	2
Brazil	17	Denmark	2
United States	6	Germany	2
Netherlands	5	Mexico	2
Portugal	5	Argentina	1
United Kingdom	5	Bolivia	1
Australia	4	Cuba	1
China	4	Cyprus	1
Belgium	3	Czech Republic	1
Canada	3	Malaysia	1
Italy	3	Norway	1
Spain	3	Tunisia	1
Switzerland	3	Ukraine	1
Austria	2	United Arab Emirates	1
		Undefined	4

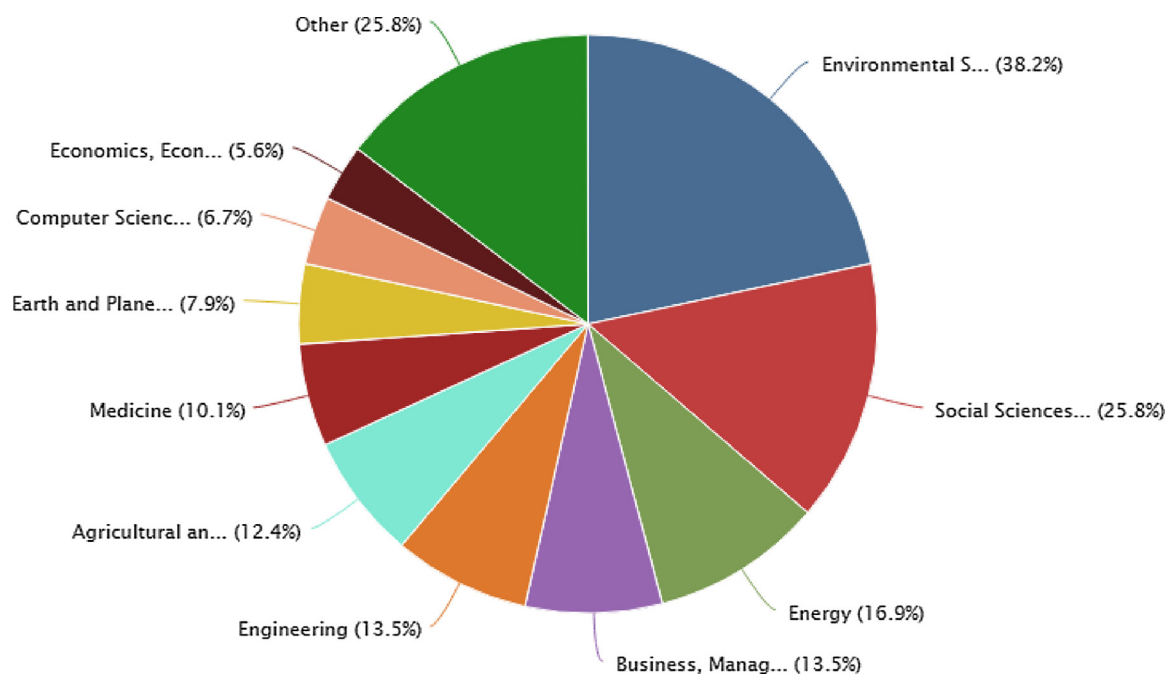**Fig. 5.** Documents by subject area.
Source: Scopus 2017

Table 6
Shows the areas of knowledge of the researched articles.

Areas	Authors
Environmental Science/Energy	Fouquet et al. (2015), Fabre et al. (2015), Poullikkas et al. (2015), Sun et al. (2014), Grard et al. (2014), Scholes et al. (2013), Shi et al. (2013), Gouveia et al. (2013), Pardo and Moya (2013), Ab Kadir et al. (2010), Bernard and Prieur (2007), Gomes et al. (2017)
Social Sciences/Business, Management and Accounting	Santos et al. (2013), Atherton (2005), Barredo and Demicheli (2003), Gallez (2002), Sili (1999), Baudelle and Poussard (1996)
Engineering/Computer Science	Chakareski (2012), Moldrup et al. (2003), Massara et al. (2009), Plumejeaud et al. (2009)
Agricultural Systems/Agricultural and Biological Sciences	Vayssières et al. (2009), Poussin et al. (2010)
Medicine	Gregório and Velez Lapão (2012), Dudley et al. (1989)

Table 7
Shows the articles that establish number of scenarios.

Number of Scenarios	Authors	Percentage of the total
1	García and Manzini (2012), Neves et al. (2010), Lassègue et al. (2009), Team (2006), Sili (1999), Loubet et al. (2016), Gonçalves et al. (2016)	17.50%
2	Fabre et al. (2015), Scholes et al. (2013), Chakareski (2012), Valença et al. (2010), Poussin et al. (2010), Massara et al. (2009), Humblet et al. (2016), Miguez et al. (2014)	20.00%
3	Poullikkas et al. (2015), Lehoux et al. (2014), Meza et al. (2014), Maria Emilia et al. (2014), Ryschawy et al. (2014), Pardo and Moya (2013), Moreau et al. (2013), Gregório and Velez Lapão (2012), Houet et al. (2010), De Ruffray and Hamez (2009), Rallet (2001), Calais Siqueira et al. (2016), Gomes et al. (2017)	32.50%
4	Da Silva et al. (2014), Fonderflick et al. (2010), Lanna (2008), Martins et al. (2008), Cañas (2017), Benini and Mendiondo (2015)	15.00%
5	Le Dars and Loaec (2007)	2.50%
6	Fouquet et al. (2015)	2.50%
8	Atherton (2005), Saleh et al. (2016), Andreas Poullikkasa et al. (2016)	7.50%
10	Blois and Souza (2007)	2.50%

wide coverage.

The obtained results permit the inference that there are indications of a still quite incipient number of publications on the prospective scenarios subject in Brazil (17 articles), especially when compared to France, with 32 articles.

This article therefore met its proposed objective of presenting a compilation of the information on prospective scenarios found in the literature, and of contributing to establishing a bibliographic reference, forming a starting point to study the subject.

As suggestion for future work, a similar study including other databases, such as Science Direct and ISI (Web of Science), can provide other information and extend our knowledge about the use of tools for the prospecting of scenarios.

One observed limitation of the study was that it was not possible to obtain a general classification in relation to other databases, since the bibliometric method considered only one database (Scopus).

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