

## SCIENTIFIC PRODUCTION ANALYSIS OF RESILIENT ENTERPRISES

TATIANA FONTES SOARES LIVRAMENTO

University of Taubaté - UNITAU, Master Program in Management and Regional Development, Brazil  
tatianalivramento@uol.com.br

EDSON A.A. QUERIDO DE OLIVEIRA

University of Taubaté - UNITAU, Master Program in Management and Regional Development, Brazil  
edsonquerido@terra.com.br

MARILSA S. RODRIGUES

University of Taubaté - UNITAU, Master Program in Management and Regional Development, Brazil  
marilsasarodrigues@outlook.com

MARCELA BARBOSA MORAES

University of Taubaté - UNITAU, Master Program in Management and Regional Development, Brazil  
marcelabmoraes@gmail.com.br

### ABSTRACT

The term resilient originates from physics and is used in most scientific areas, from psychology to environmental studies and information technology. In this Brazilian research paper the focus was the concept of resilience as applied to business administration. A resilient enterprise, the one that recovers itself from crisis before competitors take over, minimizes the impact on its clients through the use of flexibility, innovation and self-knowledge. Resilient enterprises aim to improve regional development. To ascertain how a resilient enterprise succeeds, the first proposition was to identify its scientific roots. What research has already been done on the topic? Who is currently studying it? Where are these researchers based? What exactly does the concept 'resilient' actually mean? This paper we will report on the results of scientific production analysis on resilient enterprises. In order to achieve the objective of this paper the methodology used was both qualitative and quantitative bibliographical and bibliometric exploratory research. Quantitative analysis was used to find out how many publications mentioned the term *resilient enterprise*, also we looked at where, when, and who wrote these publications. A qualitative approach was employed using the concept interpretation of the papers found. The data base used (Portal de Periódicos da Capes-MEC-Brasil) is academically recognized and brings productions from all countries in the world. According to expectations, we did not achieve many results with our search: just 274 in the general research, 143 after restricted by peer review, and only 33 papers matching the search goal. As a conclusion, academic production on resilient enterprise comes basically from USA (55%), but there are 12 countries on the list, what shows an incipient production. Considering chronological analysis, 82% was done after 2005, and 55% after 2010. The most frequently referred to author, writing about logistics and supply chain process was Yossi Sheffi, from MIT. The search results, indicate a straight relationship between resilience and innovation in business management.

**Key words:** Scientific Production Analysis. Resilient Enterprise. Regional Development.

## INTRODUCTION

The first reference to the concept of resilience was in 1807. This concept was attributed to the scientist, Thomas Young, who identified it while studying metal bars' deformation process and effects. Resilience came to be understood physically as the material capacity of return to its original condition after having been affected by some kind of straining. Over the years some other knowledge areas adopted the term that is now used

In the area of business administration, the concept has frequently been mentioned as a 'people attribute'. This seems to be correct when considering that a company is composed of people. However, it focusses only on people that can help the enterprise overcome its crisis. Nevertheless, in a real world it does not work exactly like that.

In 2005 Yossi Sheffi brought light to this issue when publishing the book "The Resilient eEnterprise: Overcoming Vulnerability for Competitive Advantage", not yet translated into Portuguese. The book results from a three year study at Massachusetts Institute of Technology (MIT) – Supply Chain Exchange Program – and shows the focus on process as the path for a resilient enterprise establishment.

Based on the analysis of the same drastic situation faced by two or more organizations at the same time, Sheffi tried to understand and explain what makes a company overcome a crisis faster and effectively whereas others take too much time to do it or even go bankrupt.

Developing the ability of quickly getting back to planned activities after a disruption and also ensuring minimum effects on clients is probably a good definition of a resilient enterprise.

The purpose of this research is better comprehension once everyone has this concept clearly into their minds.

A Brazilian author named David Menezes Lobato published on 2013 a book titled "Gestão Resiliente: um modelo eficaz para a cultura empresarial brasileira contemporânea", which can be translated into Resilient Management: an effective model for Brazilian contemporaneous corporate culture. He approaches the theme focusing on management process, which doubtless presents itself as an important pillar to achieve a resilient enterprise.

It is noteworthy that resilient enterprises are more flexible and tend to endure longer into their markets. Considering the preponderant need to improve regional development all around the world, this point of view directly contributes to it once the high index of premature mortality companies, especially in Brazil, brings serious economic and social problems to countries.

Inserted into this context, it presents itself as the objective of this paper to identify and analyse what the scientific community is producing about the resilient enterprise concept. To achieve this goal it is necessary to know how it has been conceptualized, its applicability to managerial process and how it chronologically and geographically evolves in the world.

In order to present a chosen theme beyond this introduction there is the bibliographic revision at section two, the adopted methodology is described in section three, the results and their relationship with bibliographic search is at section 4 and finally there is the paper conclusion.

## BUSINESS RESILIENCE

As a result of his analysis Sheffi declared in his 2007 preface edition that resilient enterprises are obsessed by communication. They do not do it because of an individual ability from those who compose it, but by the determination of tools, instructions and procedures that not only improve communication but also determine its standard.

Lobato (2013) affirms that resilient enterprises work on a participative approach, minimizing the classic organogram's importance. A decentralized and atomized management leads the organization to become a set of independent small units interacting all the time. The connection between the parts occurs through a strong communication system, where all information is equally shared by the small units.

Planning disruptions occur to all kinds of organization at any time. It is possible to list, for example, environment, is important and to be aware that there will always be a competitor, waiting for the opportunity to take your place. The longer it takes to get back to the game, the higher is the probability of losing it forever.

According to Sheffi (2007), enterprises' vulnerability to disruptions matches its probability and its consequence severity. These factors, identified in figure 1, are best evaluated by the questions: What could be wrong? What is the probability of it happens? What kind of consequences will it generate?

According to Sheffi (2007), enterprises' vulnerability to disruptions matches its probability and its severity consequence. Those factors may be evaluated by the questions: "What can go wrong? What is the likelihood of that happening? What are the consequences if it does happen?"

On figure 1, the vulnerabilities' dimensions are presented according to its intensity.

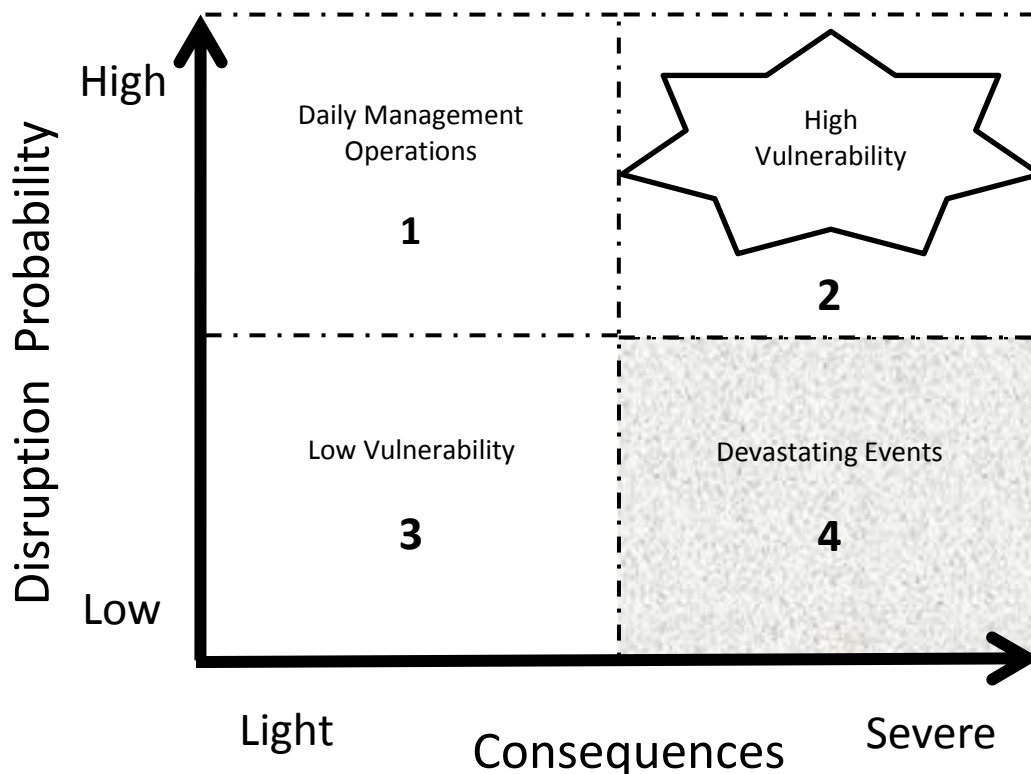


Figure 1: Dimensions of Vulnerability; Source: Yossi Sheffi (2007)

The above figure shows that as the company welcomes more vulnerable so grows the likelihood of a disruption and the more severe its consequences will be. Since the factors that frequently lead to that risk are normally well discussed during the strategic business plan process, the suggestion is to focus at quadrant 4, where the un-common but significant threats rest. Understanding this will develop a faster and effective reaction capacity needed to minimize the impact on clients.

Varella (2012) describes a resilient enterprise as the one with higher innovative capacity, versatility and flexibility, but assigns the development of this resilience to the criteria of recruitment, selection and human capital retention. He believes that to be resilient a company must count on resilient people.

In accordance with Varella, Cimbalista (2007) affirms in many different ways during his study that the resilience comes from people and reflects at organizations. He even mentions some basic human factors like fear, uncertainty and resignation as enterprises' resilience basis.

Whereas Sheffi (2007) focussed his approach on the processes affirming that they are able to raise the company to a high resilience level. Lobato (2013) Carmello (2008), Varella (2012) plus others believe that a resilient enterprise comes from human behaviour. The elevated complexity level inserted into this discussion requires deeper knowledge and research.

Turning back to psychologists, Pinheiro (2004) conceptualizes resilience as the human capacity of psychological recovery after facing adversity, violence or catastrophes and concludes that it comes from the sense that is individually attributed to the human existence.

This vision raises the question of the stability of personal resilience. People are not resilient all the time in any situation and some people face huge difficulties in private life. However they are not motivated to cope in the same way at work. This consideration reinforces the centre of attention of this paper on processes and management in order to find out what a resilient enterprise is.

Booz Allen Hamilton in its research classifies the resilient model as the healthier kind of organization and defines it as the one that has higher capacity of adaptability to market impositions. It is focused and aligned to a coherent business strategy (Harvard Business Review, 2005 as cited in Carmello, 2008).

Being a former large consulting company, Booz Allen Hamilton believes in the power of individual resilience, but does not ignore the process development that leads organizations to be resilient. A good example is the research they worked on in order to establish best practices on cybernetic resilience. In other words, they intended to figure out how to assure that a system will be promptly restored after suffering an attack on a company data centre or communication system.

In a speech given by Ralph Schrader - Booz Allen Chairman and CEO - in 2008, after a very difficult year for the company, Mr Schrader said: "Don't tell me the future – resilience, not prophecy, is the greatest gift." He believes it is extremely important being capable to live and survive crisis. Learning from troubles and mistakes has a huge value, even bigger than the result that strengthens and expands business vision.

Gifun and Karydas (2010) completed a very interesting review of existing pertinent organization models in order to propose the concept of what they called the Highly Reliable Complex Systems (HRCS). The result of that search is listed at Table 1, below. These discussed models "recognize the potentially devastating impact of hazards and threats to an organization but do so with levels of

detail and in areas of application that makes organization-wide implementation impractical without modification.”

Their analysis revealed important missing points in the models. Highly Reliable Organization, Disaster Resistant University, Resilient Enterprise, Business Continuity Planning and Enterprise Risk Management do not provide the means for implementation. Risk-based Process Safety is excessively comprehensive and provides so much detail that implementation would be unmanageable. Reactor Oversight Process is specifically applied to public health and safety, and Hearts and Minds provides a comprehensive view of an organization just in context of safety (Gifun & Karydas, 2010).

*Table 1: Existing organization models attributes; Source: Prepared by the authors*

ORGANIZATION MODEL/ AUTHOR	ATTRIBUTES
Highly Reliable Organization (HRO)  Weick and Sutcliffe	<ul style="list-style-type: none"> <li>• Preoccupation with failure</li> <li>• Reluctance to simplify</li> <li>• Sensitive to operations</li> <li>• Commitment to resilience</li> <li>• Deference to expertise in the organization</li> </ul>
Disaster Resistant University (DRU)  Federal Emergency Management Agency	<ul style="list-style-type: none"> <li>• Risk awareness</li> <li>• Stakeholder engagement</li> <li>• Preemptive intervention</li> <li>• Training</li> <li>• Organizational learning</li> </ul>
Resilient Enterprise (RE)  Yossi Sheffi	<ul style="list-style-type: none"> <li>• Action based organization</li> <li>• Vulnerability assessment</li> <li>• Early detection</li> <li>• Collaborating and security</li> <li>• Redundancy</li> <li>• Resilient supply chain</li> <li>• Training</li> </ul>
Enterprise Risk Management (ERM)  Sarbanes and Oxley	<ul style="list-style-type: none"> <li>• Objectives</li> <li>• Components</li> <li>• Units</li> </ul>
Risk-based Process Safety (RBPS)  Center for Chemical Process Safety	<ul style="list-style-type: none"> <li>• Commitment to process safety</li> <li>• Risk awareness</li> <li>• Risk management</li> <li>• Organizational learning</li> </ul>
Reactor Oversight Process (ROP)  U.S. Nuclear Regulatory Commission	<ul style="list-style-type: none"> <li>• Reactor safety</li> <li>• Radiation Safety</li> <li>• Safeguards</li> </ul>
Hearts and Minds (H&M)  James T. Reason - Sponsored by Shell Exploration & production	<ul style="list-style-type: none"> <li>• Leadership and commitment</li> <li>• Policy and strategic objectives</li> <li>• Organization, responsibilities, resources, standards and documentation.</li> <li>• Hazards and effect management</li> <li>• Planning and procedures</li> <li>• Implementation and monitoring</li> <li>• Audit</li> <li>• Review</li> </ul>

Business Continuity Planning (BCP)  British Standards Institute	<ul style="list-style-type: none"><li>• Threat identification and consequence prediction</li><li>• Preemptive action for threat elimination or mitigation</li><li>• Resilience</li></ul>
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According to the authors, the proposed model derives from the study and it adapts their interpretation of how it should be. The HRRO model is composed of the concept of a complex system, analytic-deliberative process, multi-criteria decisions, and analytic hierarchy process. It is comprehensive enough to reflect reality and yet manageable within the operational systems of the organization and also ensures sustained use of the model. It provides better measures of organization attributes and is focused on reliability and disaster resistance, what is very close to a resilient enterprise proposal.

Realizing some differences in the concepts presented but fundamentally agreeing with those that understand business resilience as the ability developed by and for the company, the importance of research that indicates what has been academically produced about this concept.

## **METHODOLOGY**

For this research bibliographic and bibliometric methods were used. Manolita Lima (2008) explains that a bibliographic search is the exercise of looking for specific theme information in already published material. In an academic context, the searcher is encouraged to formulate and justify problems and hypotheses besides contributing to the analytic exercise on the search topic.

In order to address the theoretical contributions on a theme by deepening knowledge and providing the recognition of previous approaches to literature, bibliographic search can even serve as the exclusive basis for the development of theses, which gives you ample character and diversity of application (SANTOS; OLIVEIRA; MORAIS, 2010)

Guedes and Borchiver (2005) affirm that bibliometric research is a statistic tool that permits researchers to map and produce different treatment and management data indexes.

Thomson Reuters, the knowledge company that is a source of intelligent information for businesses and professionals, claims at its website that “with solid, objective information about production and impact, the university has a strong basis for setting goals, charting progress, making budgetary and hiring decisions, investing in facilities, and working with external agencies.” They also explain that as an evaluation method bibliometrics turns itself into a very relevant tool of science.

Understanding it as the application of quantitative analysis and statistics to diverse publications and their related citation counts, its importance to translate itself into a quantitative instrument allows minimize information subjectivity and generates knowledge. Evaluating scientific research performance with citation data helps to be selective and also to identify relevant areas for new research creating future comparison standards.

## **ANALYSIS OF RESULTS**

This paper’s objective was to identify quantitative and qualitative academic production about the concept of resilient enterprise whilst matching bibliography and bibliometric research techniques. Based on this, the search was done on CAPES database, the Brazilian most important international

scientific content search portal, in October 2014. CAPES is the Brazilian Ministry of Education foundation responsible for playing a key role in the expansion and consolidation of the strict sense graduate in all states of Brazil. The proxy system was available through University of Taubaté (UNITAU) whose usage is restricted to its own students.

As a prolific database, CAPES portal permits searching by subject, article, book or author, classifying whether it's peer reviewed or not, also permitting chronological treatment, and language restriction. Regarding the job specific goal the adopted criteria indicate *resilient enterprise* as the key words, with no other filter besides peer reviewed.

The key words were in English because scientific literature is mostly produced in this language and also because there is a recommendation at CAPES portal indicating this practice to get the more embracing search result.

The first search resulted in the discovery of 274 papers. By refining the search to peer-reviewed papers it located 143 publications. After analysing each abstract, taking note of publication year, country of origin and authors, it was identified that only 33 could be considered pertinent to the research goal. The other 110 mentioned the term resilient only as an adjective, not necessarily bound to enterprises' characteristics.

Qualitative criteria to the selection of those 33 articles restrict the presentation of the resilient enterprise concept as the organization's condition. Even if the text does not explain the concept *per se* it does mention it as a company's attribute, which reveals its acceptance by the author. This can be understood as a breakthrough in the studied concept.

The analysis of those 33 articles shows that they were produced in thirteen countries: South Africa; Australia; Canada; United States; Greece; Holland; Mexico; New Zealand; United Kingdom; Serbia; Singapore; Sweden; There is also a publication resulting from a partnership between Portuguese and American searchers that is counted among *others*. There is no Brazilian reference.

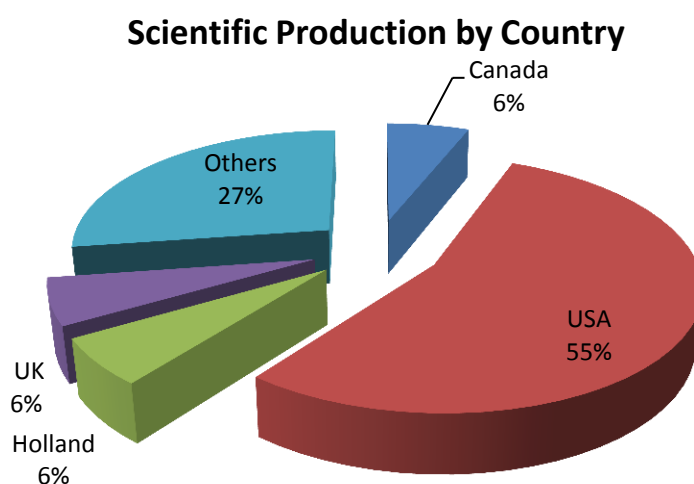


Figure 2: Scientific production share about enterprise resilience; Source: Prepared by the author

To keep the above graphic easy to comprehend, the nine countries with just one publication were grouped and named as *others*, totaling 27% of papers. Canada, United Kingdom and Holland have two papers each one corresponds individually to 6% of the total result. With a wide margin over others, the United States produces 55% of the world's production about company's resilience, leading with eighteen papers.

Another interesting review refers to chronological evolution of publications, which presents a significant rise after 2006. Actually, 79% of publications occur after that year as can be seen on Figure 3.

### Scientific Production by Publication Year

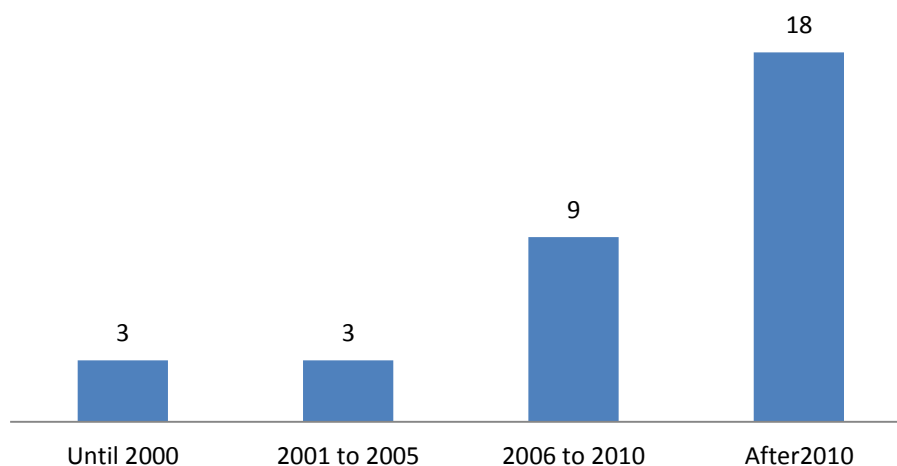


Figure 3: Chronological distribution of scientific production about enterprise resilience;  
Source: Prepared by the author

It is also observed that there is no significant authors' repetition and that the titles are very diverse, covering a wide range of themes.

The table below shows the 33 titles, its authorship, and publication year.

Table 2: Related titles sorted by relevance; Source: Prepared by the author

Title	Authorship	Date
1 - Capture, Governance, and Resilience: strategy implications from the history of Rome	Abraham Carmeli, Gideon d. Markman	2010
2 - Organizational attributes of Highly Reliable Complex Systems	J. F. Gifuna, D. M. Karydas	2010
3 - Modeling approaches for the design of resilient supply networks under disruptions	Walid Klibi, Alain Martel	2011
4 - Michael Beer: higher ambition leadership	Brian Leavy	2012
5 - The Identification of Potential Resilient Estuary-based Enterprises to Encourage Economic Empowerment in South Africa: a Toolkit Approach	Rebecca Bowd, Nevil Quinn, Donovan C. Kotze, Duncan G. Hay, Myles Mander	2012
6 - CFOs need to be at the center of the risk	Jeffrey Burchill	2013
7 - Decision support for resilient enterprises	Pavan Kumar	2009



	Naraharisetti, Arief Adhitya, I.A. Karimia, Rajagopalan Srinivasan	
8 - Stability, resilience and sustainability in pasture-based grazing systems	G.W. Kaine, P.R. Tozer	2004
9 - Supply chain optimization of petroleum organization under uncertainty in market demands and prices	Wafa B.E. Al-Othman, Haitham M.S. Lababidi, Imad M. Alatiqi, Khawla Al-Shayji	2008
10 - State enterprise and resource based industry in oil exporting countries	Richard M. Auty	1987
11 – Antecedents of organizational resilience in economic crisis—an empirical study of Swedish textile and clothing SMEs	Rudrajeet Pal , Håkan Torstensson, Heikki Mattila	2013
12 - Resilience: Continuous renewal of competitive Advantages	Eduardo de Oliveira Teixeira, William B. Werther Jr.	2013
13 - Developing a capacity for organizational resilience through strategic human resource management	Cynthia A. Lengnick-Hall, Tammy E. Beck, Mark L. Lengnick-Hall	2011
14 - An assessment of organizational resilience potential in SMEs of the process industry, a fuzzy approach	Aleksandar Alekski, Miladin Stefanovi, Slavko Arsovski, Danijela Tadi_	2013
15 - The Resilience Architecture Framework: Four organizational archetypes	Elena Alexandra Mamouni Limnios, Tim Mazzarol, Anas Ghadouani, Steven G.M. Schilizzi	2014
16 - Factors Impacting Marketplace Success of Community Forest Enterprises: The Case of TIP Muebles, Oaxaca, México	Gabriela Villavicencio Valdez, Eric Hansen, John Bliss	2012
17 - Resilience of Family Firms: An Introduction	James J. Chrisman, Jess H. Chua, Lloyd P. Steier	2011
18 - Antecedents of organizational resilience in economic crisis - An empirical study of Swedish textile and clothing SMEs	Rudrajeet Pala, Håkan Torstenssona, Heikki Mattilaa	2014
19 - Shedding fresh light on food industry's role: the recession's aftermath	Konstadinos Mattas, Efthimia Tsakiridou	2010
20 - Contingency planning: always be prepared. The resilience of financial operators	Maria Bruno Britz	2008
21 - Supply chain disruption are inevitable	Terry P. Harison, P.J. Houm, Douglas J. Thomas, Christopher W. Craighead	2013
22 - Characteristics of High Performance Organizations	André de Waal	2012
23 - Leveraging the Strengths of your Extended Enterprise to Continue Operations during an Information Warfare	Perry Luzwick	2002

Attack		
24 - Impact of disasters on firms in different sectors: implications for supply chains	Nezih Altay, Andres Ramirez	2010
25 - "Man plans, God laughs": Canada's national strategy for protecting critical infrastructure	Kevin Quigley	2013
26 - Staying ahead of storm: strong corporate culture and supply chain flexibility are the ingredients of disruption management	William Inman	2006
27 - Making sense of supply disruption risk research	Scott C. Ellis, Jeff Shocley, Raymond M. Henry	2011
28 - Mitigating Supply Risk: Dual Sourcing or Process Improvement?	Yimin Wang, Wendell Gilland, Brian Tomlin	2010
29 - Achieving information resiliency	Paul Zavidiniac, Dr. Anita D'Amico, Dennis H. McCallam	1999
30 - Evergreens of excellence	André A. de Waal	2013
31 - Expansive leadership in the age of digital technology	Thomas Diamante	2002
32 - Reflections on international marketing: destructive regeneration and multinational firms.	S.T. Cavusgil	2012
33 - Manufacturing Strategies in the Eighteenth Century: Subcontracting for Growth among Papermakers in the Auvergne	Pierre Reynard	1998

## CONCLUSION

Although it is not simple to identify the subject covered by articles just by looking at their titles, it is possible to recognize the recurrence of some terms related to the concept of searched key words, underlying business resilience: strategies, mitigation, breaks, impacts, excellence, performance, risk, social networks, protection and many others.

Since the search shows that 82% of scientific production on company's resilience occurs after 2006 it is possible to connect here with Yossi Sheffi's first edition book publication in 2005.

Despite the fact of there is no Yossi Sheffi paper listed on the search result, his book "The Resilient Enterprise" is mentioned by 100% of authors who, exactly like him, address the logistic as the basis for business resilience, and he is further quoted by many others researchers working on different knowledge areas who accept the concept presented by him.

Sheffi's book is the result of a three-year Massachusetts Institute of Technology (MIT) research effort, born with rising concerns about terrorist disruptions. As the research progressed, it became clear to expand it to include other kinds of ruptures. By the analysis of daily companies' processes, Sheffi noticed that the same disruption that affects two similar enterprises at the same time is frequently treated in a different way, leading to different results. Sometimes one is able survive, and the other becomes bankrupt.

The book shows why some organizations lead better and faster with ruptures than others and that is why this book became the key reference on business resilience, stimulating new searches around the world.

Despite the huge rise of academic papers written after Sheffi's approach was revealed, it is still not many when considering absolute numbers.

Revealing an intriguing subject, enterprise resilience has been treated in the past decade as a challenge both in their understanding and as in application.

The proposal is not to assess the reaction capacity itself but to understand what has to be done before crisis occurs. Being prepared for the crisis requires a previous and deep analysis of internal and external factors, recognizing and paying attention even to rare events. These can be devastating and that is why organizations must be prepared for unforeseen but drastic events.

The fact that the majority of production is located in the USA may also represent its major preoccupation with terrorist attacks, fraud scandals, natural disasters or other kinds of disruption; yet these are what lead them to continuously seek innovation on process, resources and management.

Identifying organizations' vulnerabilities and developing adequate tools in order to mitigate its effect is the principal challenge to be drawn from researched articles when mentioning the resilience concept applied to companies.

Although the focus of the principal articles deal with operational and logistic matters as the basis to achieve a resilient enterprise, some authors address others processes that should also be treated like human resources, technology development, and management, which will contribute to a more flexible company. Therefore it is believed that the theme is relevant and also requires more research efforts in order to have its concept structured and spread around the world, not only at academia but also to enhance business ambience.

It is understood that the research objective was achieved as it became clear that business resilience is still an incipient concept and this suggests different new approaches in order to facilitate comprehension.

Reflecting on the results many questions can be raised. Why is worldwide academia not interested in this theme yet? Is it a real worry in the countries where huge threats like terrorism, typhoons, tsunamis or earthquakes are present? Isn't it possible to develop a parallel from these immense threats with others that are daily prowling all business initiatives? Are developing countries not prepared to study this new concept? Why is there no searcher r dedicated to that subject to be used as an academic reference to others?

Each of these questions may serve as a guide to future research that will bring a higher knowledge about enterprise resilience, an important concept that could be applied in order to minimize the premature death of so many companies after being hit by an internal or external disruption.

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