A diagnose matrix for assessing organizational risk maturity: an empirical test in Brazilian companies

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Abstract
This paper presents a new maturity model approach, proposing a matrix to diagnose and measure the Organizational Risk Maturity in a simplified and friendly way. It was previously tested in three companies, and we will present in this paper the results of a research in fifty companies operating in Brazil.

Keywords: Risk Management, Risk Maturity Model, Enterprise Risk Management

INTRODUCTION

This paper presents an empirical research on a matrix of organizational risk maturity, compiled from traditional and contemporary risk maturity models found in the literature and rearranged into a new approach that considers four perspectives more relevant and adherent to the current business environment: operations and global supply chain, organizational, sustainability, and project management. These perspectives together are representative of the dynamic, complex and unstable reality of the contemporary market, covering the risk portfolio of the companies in a holistic process.

This matrix was designed with the purpose to be a comprehensive and simple to use tool to support the managers in the diagnose and measure of the organizational risk maturity, at a time when most companies do not have the necessary financial capital, human resources and IT systems to implement an enterprise risk management (McShane et al. 2011). It aims to help bring a new integrated view of the issue of corporate risk, and enable a wider measurement and analysis of how the company treats its risks in an interconnected world. It was tested previously in three companies in a multiple case study, proving that it could be applied in a bigger sample, which is the objective of this paper.

This study is organized in five sections: the first one consists of this introduction, presenting the theme and its relevance to the business practice. In the second section, it is presented the

matrix for assessing the organizational risk maturity. The third section presents the methodology, research of the fifty companies operating in Brazil and it is discussed the findings. And finally the fourth section brings the conclusion, limitations and contributions to business practice.

THEORETICAL FRAMEWORK

Risk management maturity reflects how an organization understands its risk portfolio and how it manages these risks (Zou et al. 2010), helping to obtain a vision of its current status, strengths and weaknesses (Zhao et al. 2013) and allowing to take measures to reduce risks. Models of risk maturity represent a tool that support risk management by providing a holistic approach, identifying current status and documenting the risk management evolution. We present in the next sections the risk maturity models used to compose the matrix.

Operations and Global Sourcing Risk Management Maturity Model (OGSR3M)

Risk analysis can not be applied only in the company, but must cover the enterprise risks beyond the boundaries of the company (Hahn and Kuhn, 2012). All the supply chain involved in its operation must be taken into account, considering that suppliers, customers and other members of the chain can bring risks to the company business. The establishment of global supply networks and their interdependence due to lean manufacturing programs have increased companies' exposure to different types of uncertainties and consequently to greater risk (Harland et al. 2003).

Fernando and De La Parra (2008) suggests seven main processes in operations and supply chain which are correlated with the risk analysis: subscription, emission, benefits, invoicing, investments, reinsurance, and signature authorizations, proposing a framework to diagnose the operational risks. The perspective Operations and Global Sourcing is adapted from them, considering four attributes of the company (culture, processes, practical application and experience) which can be marked on a scale of 1 to 5 according to the perceived level by the respondent. The levels indicate the progress of risk management in a gradual way, leading from the benchmarks of practices with lack of risk management to the mature practices (Wieczorek-Kosmala 2014).

Organizational Risk Management Maturity Model (OR3M)

Zou et al. (2010) developed, tested and validated a risk management maturity model using Australian constructions companies and risk management experts. The risk management maturity model contains five attributes: management perspective, risk culture, risk identification, risk analysis, and standardized risk management process. They concluded that risk analysis is the weakest attribute in the construction companies and in the industry.

The Risk Management Research & Development Program Collaboration (RMRDPC 2002) developed a risk management maturity model with the objective to offer to companies and projects a simplified way to assess their current level of risk maturity, making the own companies capable of discern its weaknesses and enhance its risk management.

Based on the study of Zou et al. (2010) and RMRDPC document (2002), it was developed the Organizational Risk Management Maturity Model (OR3M), considering five attributes of the company (management perspective, organizational risk culture, identifying risks, analyzing risks and standardized risk process) and five levels of progression.

Sustainability Risk Management Maturity Model (SR3M)

Sustainability is identified in the literature as a new competitive priority for the companies (Krause et al. 2009), adding to the quality, cost, delivery and flexibility (Wheelwright 1984), being an increasingly significant source of competitive advantage (Porter and Van der Linde, 1995).

Nidumolu et al. (2009) say that, in the future, only organizations that make sustainability a goal will achieve competitive advantage. So it is important to rethink business models, products, technologies and processes, developing competencies to be ahead of competition and becoming sustainable. Based on these authors, a maturity model for sustainability can be assessed by the companies as a tool to identify risks and enhance its performance. Our matrix was adapted from these authors, indicating three attributes (central challenge, competencies needed and innovation opportunity) that can be leveled in a scale 1 to 5.

Project Risk Management Maturity Model (PR3M)

According to the PMBOK® Guide (PMI 2013), Project Risk Management is a systematic process of identifying, analyzing, and responding to project risk. Risk can affect project life cycle, cost, market time and financial performance (Hillson 2000b; Loch et al. 2008). Risk does not affect all projects equally, depending on the effective action of the managers when dealing with contingencies (Thamhain 2013).

Successful projects are a result of an effectively deal with all types of risk, maximizing benefits while minimizing uncertainty. This perspective was developed based on RMRDPC (2002) and Thamhain (2013), assuming five attributes (definition, culture, process, experience and application).

The four perspectives of risk management maturity just presented are measured on a scale from 1 to 5. Calculation of total score is done by multiplying the scores obtained in each maturity model. Thus, in an extreme situation in which the company or industry practice is at level 1 in the four models evaluated, the total score will be 1 x 1 x 1 x 1 = 1 (minimum possible). On the other side, if the company or industry practice is at level 5 in the four models, the total score will be 5 x 5 x 5 x 5 = 625 (maximum possible). The obtained values can be displayed as a percentage.

METHODOLOGY

The survey was sent to 234 executives, targeting the main sectors of the Brazilian economy, which were reached through personal relation of the researchers and indications made by other executives. It was chosen executives that work not only specifically in the risk management area, but also in other areas that need to mitigate risks as supply chain, financial and marketing. The

survey was conducted in a three-month period (October to December'2015), contacting the executives through e-mail and business social networking (LinkedIn).

It were received 73 answers, and 23 were discarded due to incomplete answers or inconsistency of data, reaching 50 answers that were considered in this study (a response rate of 21.4%, considered reasonable due to no personnel contact). Companies will not be identified because several respondents requested confidentiality in relation to the company name. We motivated the respondents to answer by offering a summary of the results after the conclusion of the survey, which also helped to ensure a commitment of accurate data.

FINDINGS AND DISCUSSION

The sample companies are formed by multinationals with operation in Brazil (60%), local companies with international operations (18%) and local companies with operations only in Brazil (22%), in 22 different economic sectors (figure 1). 72% of these companies have more than 500 employees in Brazilian operations (named as big according IBGE), 20% have between 100 and 499 employees (medium), and 8% less than 100 employees (small).

	Category	Number of Companies		Category	Number of Companies	
Economy Sector	Aerospace Industry	1	2%	Infrastructure	1	2%
	Agribusiness	2	4%	Logistics	3	6%
	Aluminum Industry	1	2%	Mechanical Industry	2	4%
	Automotive Industry	1	2%	Medical Products	1	2%
	Communications	1	2%	Medical Services	1	2%
	Construction	3	6%	Paper and cellulose	1	2%
	Cosmetics Industry	1	2%	Pharmaceutical Industry	1	2%
	Electro-electronic Industry	3	6%	Services	5	10%
	Energy	3	6%	Steel Industry	1	2%
	Financial Services	4	8%	Textile Industry	1	2%
	Food Industry	1	2%			
	Information and Communications Technology	12	24%	Total	50	100%

Figure 1 – Economy sectors of the companies surveyed

Executives of the risk area represent the main portion of the respondents (36%), followed by operations and supply chain (24%), finance and accounting (14%), marketing and sales (10%) and other areas (16%). The functions of the respondents were: general managers (6%), vice presidents (4%), directors (20%), managers (54%) and others (16%). When asked about the knowledge of the risk management system of his/her company, 44% of the respondents considered that have a high level of knowledge, 46% have a medium level of knowledge, and only 10% have a low level of knowledge.

Only 3 companies (6%) have the certification ISO31000:2009, all of them multinational companies, demonstrating that risk management is still an evolving process in the companies, especially in Brazil. Most of them developed its risk management systems internally, sometimes with the support of consulting companies specialized in risk. Multinational companies usually follow the rules of the headquarters.

The main reasons to implement a risk management system were indicated as a natural evolution of the own management system of the company (26%), board determination (26%) and an adequacy to the Sarbanes-Oxley Act (24%), this last one a motivation only for multinational and local companies with international exposure, being implemented by the leadership of the

finance area in half of the companies. It is an indication of the necessity to mitigate the financial risks after the corporate financial scandals occurred in the end of 1990s as Enron and Worldcom.

When asked about the types of risks covered by the risk management, the importance of the financial risks is evident: it was ranked with 74% of importance, followed by legal risks (63.2%), operational and supply chain risks (60.8%), market risks (45.6%) and economic risks (35.5%). 44% of the respondents assured that the financial risk has major importance over all the other risks, making it clear that in the Brazilian companies there is still a central concern for financial risk at the expense of other risks.

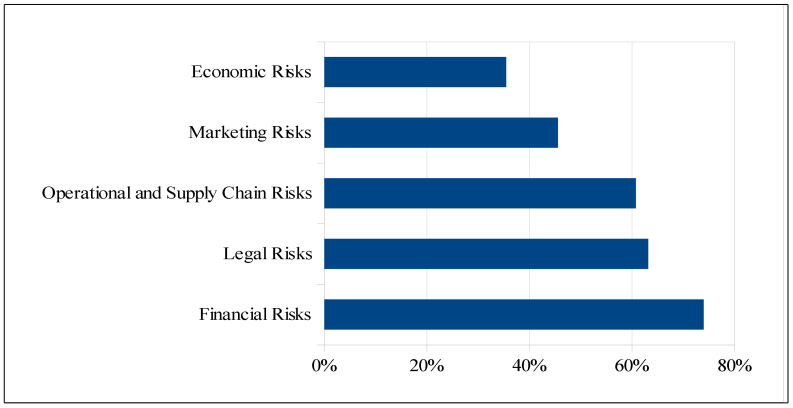

Figure 2 – Types of Risk and its importance in the surveyed companies

Only 8 companies had a Chief Risk Officer responsible for implementing the risk management: seven of them are multinationals and one is a large Brazilian bank, denoting that this position is still unusual in the Brazilian market. The most common situation is the implementation and management by the financial area (19 companies). Some companies establish a committee specifically to deal with risk (7 companies), or delegate to other areas: auditing (6), operations (5), strategic planning (3) and quality (2).

The risk maturity matrix was set up based on the participants answers to the questions related with the four perspectives, which results are compiled in the table 1 detailing each company and its main characteristics. From an analysis of the results, it can be concluded that:

- Considering the average of the fifty companies, the perspective with lower evaluation was project risk (3,16). There were 23 companies that chose this perspective as the weaker one, demonstrating that it needs to be prioritized in order to reduce risk involved with project management and increase the risk maturity.
- From the other side, the perspective with higher evaluation was sustainability risk (3,50). There were 23 companies that chose this perspective as the stronger one when compared with the others. Maybe it is a result of the regulation that was imposed to the companies in the last years (for example, National Solid Waste Policy Law in 2010), forcing them to improve its strategy and operations to attend the law.
- Local companies appears only from the position 19, which may be an indication that the theme of risk for companies that operate internally is not so important as for companies that operate outside the country.
- To be a multinational is not a direct relation to have a consistent risk management

process. There are a few multinationals with low risk maturity score. For example, the last one, a multinational from the services sector, had a score 1 in the sustainability perspective, indicating that there is no sustainability risk management, and a score 1.3 in the project perspective: analyzing it more deeply, there is no experience with risk procedures in the project management, and there is no resources dedicated to the risk management during the development of new projects.

- For cases of more than one company operating in the same industry sector, it was found no correlation between economic sector and maturity of risk management. Probably some economic sectors require a greater focus on risk management, but it could not be identified in this sample.
- The individual analysis of each company allows us to infer what are the perspectives that deserve more attention (those with lower scores), and then analyze each attribute of this perspective with more detail to understand what needs to be improved.

Table 1 – Results of the matrix

#	Economy Sector	Company size	Company Classif.	Operational & Supply Chain Risk	Organizational Risk	Sustainability Risk	Project Risk	Total Score	Total Score %
1	Financial Services	Big	Local with Intern. operation	5,0	4,8	5,0	5,0	594	95%
2	Information and Comm. Technology	Small	Multinational	5,0	5,0	5,0	4,7	583	93%
3	Financial Services	Big	Local with Intern. operation	4,3	4,8	5,0	5,0	505	81%
4	Financial Services	Small	Multinational	4,8	4,4	5,0	4,7	485	78%
5	Information and Comm. Technology	Big	Multinational	4,8	4,9	4,5	4,3	452	72%
6	Electro-electronic Industry	Big	Multinational	4,8	4,5	4,0	4,7	399	64%
7	Agribusiness	Big	Local with Intern. operation	4,0	4,6	5,0	4,0	370	59%
8	Paper and cellulose	Big	Local with Intern. operation	4,3	4,1	5,0	4,0	351	56%
9	Energy	Medium	Multinational	4,3	4,4	5,0	3,7	341	55%
10	Steel Industry	Big	Local with Intern. operation	3,8	4,3	4,0	5,0	319	51%
11	Services	Big	Multinational	4,8	4,0	4,0	4,0	304	49%
12	Services	Big	Multinational	4,0	4,1	5,0	3,3	275	44%
13	Logistics	Big	Multinational	4,0	3,0	4,0	5,0	240	38%
14	Medical Products	Medium	Multinational	4,0	4,5	3,0	4,3	234	37%
15	Information and Comm. Technology	Big	Multinational	3,3	4,5	3,0	5,0	219	35%
16	Pharmaceutical Industry	Big	Multinational	3,3	4,1	4,0	4,0	215	34%
17	Aerospace Industry	Big	Multinational	3,3	3,6	3,5	5,0	206	33%
18	Energy	Big	Multinational	3,3	4,0	4,0	3,0	156	25%
19	Infrastructure	Big	Local	3,5	3,5	4,0	3,0	147	24%
20	Agribusiness	Big	Local	3,0	3,1	5,0	3,0	141	23%
21	Information and Comm. Technology	Big	Local	3,0	3,8	4,0	3,0	135	22%
22	Services	Medium	Local	4,3	3,5	3,0	3,0	134	21%
23	Services	Small	Multinational	3,0	3,6	3,0	4,0	130	21%
24	Information and Comm. Technology	Big	Multinational	4,0	3,4	3,0	3,0	122	19%
25	Cosmetics Industry	Big	Multinational	3,5	2,8	3,0	4,0	116	18%
26	Medical Services	Big	Local	3,3	3,3	3,5	3,0	111	18%
27	Automotive Industry	Big	Multinational	2,8	4,3	3,5	2,3	95	15%
28	Information and Comm. Technology	Big	Local	2,0	3,8	4,0	3,0	90	14%
29	Aluminum Industry	Big	Multinational	3,5	3,1	3,0	2,7	88	14%
30	Construction	Big	Local with Intern. operation	3,5	2,3	3,5	2,7	74	12%
31	Information and Comm. Technology	Big	Multinational	2,8	3,6	2,0	3,7	73	12%
32	Information and Comm. Technology	Big	Local with Intern. operation	2,3	2,9	3,5	3,0	68	11%
33	Construction	Big	Local	3,3	3,4	2,0	3,0	66	11%
34	Mechanical Industry	Medium	Multinational	2,8	3,4	2,5	2,3	54	9%
35	Information and Comm. Technology	Medium	Multinational	1,8	2,8	4,0	2,3	45	7%

36	Textile Industry	Big	Local with Intern. operation	2,8	2,4	4,0	1,7	44	7%
37	Financial Services	Big	Local	2,8	2,4	2,5	2,7	44	7%
38	Information and Comm. Technology	Medium	Multinational	2,3	2,3	3,0	2,7	41	6%
39	Construction	Big	Local with Intern. operation	3,8	1,8	3,0	2,0	39	6%
40	Energy	Big	Multinational	2,0	3,6	4,0	1,3	39	6%
41	Logistics	Medium	Multinational	1,8	2,4	3,0	3,0	37	6%
42	Electro-electronic Industry	Big	Multinational	1,5	3,4	3,0	2,3	35	6%
43	Information and Comm. Technology	Big	Multinational	3,5	2,8	2,0	1,7	32	5%
44	Mechanical Industry	Medium	Multinational	2,5	2,3	2,0	2,3	26	4%
45	Logistics	Big	Multinational	2,3	2,9	2,0	2,0	26	4%
46	Information and Comm. Technology	Small	Local	2,3	3,1	2,5	1,3	23	4%
47	Communications	Big	Local	3,0	3,6	1,5	1,3	22	3%
48	Electro-electronic Industry	Big	Local	1,3	2,0	3,5	1,7	15	2%
49	Food Industry	Medium	Multinational	1,8	2,0	3,5	1,0	12	2%
50	Services	Medium	Multinational	2,0	3,3	1,0	1,3	9	1%
	Total Average			3,24	3,47	3,50	3,16	124	20%

CONCLUSION, LIMITATIONS AND CONTRIBUTIONS

This paper presents a new maturity model approach, a matrix to diagnose and measure the Organizational Risk Maturity. It is a result of the efforts in literature research, which allowed identify, interpret, compile and adapt the risk maturity models more aligned with the current business environment, combined with the interest of the authors to propose a simplified and friendly way of measuring the risk maturity in the practice of the organizations, mainly the medium and small ones located in emerging countries. Using a survey, the proposal model was applied in fifty companies operating in Brazil, being able to guide a diagnosis in a detailed and thorough manner.

This study contributes to business practice, formulating a friendly and easy to use risk maturity model that can be applied by managers in the diagnose and measure of the organizational risk maturity. It contributes to the practice by providing a means of risk maturity assessment without requiring investment in information technology and human resources, which helps small and medium enterprises, especially in emerging countries. They may have a directly and easily self-assessment tool, allowing to understand the risks in each of the four perspectives and invest in their improvement.

There are limitations to our work, and our results should be interpreted with an awareness of these limitations. First, the sample considered is small and may not be representative of the current situation in Brazil. We continue looking for new respondents to our research, in order to build a robust database. It is important to also look outside the Southeastern region: although it concentrates about 70% of the country's wealth, it does not represent the reality of companies from the other regions of the country. Second, the attributes defined for each of the four perspectives may have different importance for companies from different economy sectors. This may result that the comparison is not valid. For example, service sector companies can not develop projects in such an intense way as in the industrial sector, requiring a study to validate this situation.

Bibliography

ADAMS, G., CAMPBELL, M. 2007. Where are you in the journey to ERM? *Risk Management Magazine* – Spotlight Issue, vol. 54, pp. 32-36.

AKRAM, J.-L. 2013. Leveraging enterprise risk management (ERM) for boosting competitive business advantages in Bahrain. *World Journal of Entrepreneurship, Management and Sustainable Development*, **9**(1), pp.65-75.

ALBU, E., PANZAR, C. 2010. A new tool for assessing maturity alignment: the enterprise maturity matrix. *Performance Improvement* **49**(9). Available at www.ispi.org DOI: 10.1002/pfi (accessed August 30, 2015).

BERNSTEIN, P. L. 1996. *Against the Gods: the remarkable story of risk*. New York: John Wiley & Sons. 383p.

BUSMAN, E., ZUIDEN, P. 1998. The challenge ahead: adopting an enterprise-wide approach to risk. *Risk Management*, **45**(1).

CHAPMAN, R.J. 2006. *Simple Tools and Techniques for Enterprise Risk Management*. Chinchester: John Wiley & Sons.

CHRISTOPHER, M. & LEE, H. 2004. Mitigating supply chain risk through improved confidence. *International Journal of Physical Distribution & Logistics Management*, **34**(5): 388-396.

COSO - The Committee of Sponsoring Organizations of the Treadway Commission. Enterprise Risk Management. Available at: http://www.coso.org/documents/COSO_ERM_ExecutiveSummary.pdf. (accessed June 14, 2015).

DELOACH, J. W. 2000. *Enterprise-wide Risk Management: Strategies for Linking Risk and Opportunities*. Financial Times/Prentice-Hall, London.

DI SERIO, L.C., OLIVEIRA, L.H., SCHUCH, L.M.S. 2011. Organizational Risk Management – A Case Study in Companies that Have Won the Brazilian Quatity Award Prize. Journal of Technology Management & Innovation, **6**(2): 230-243.

FAGAN, M.L. 1991. A guide to global sourcing. *Journal of Business Strategy,* **12**(2): 21-29.

FERRANDO, A. & DE LA PARRA, C. (2008) Operational Risk Management Maturity Model. BDO Audiberia. *Congreso Iberico de Actuarios.* Lisboa.

GATES, S., HEXTER, E. 2006. The Strategic Benefits of Managing Risk. MIT. Sloan Management Review. 47(3), Spring.

GLOBAL RISK 2015 REPORT. Available at: http://reports.weforum.org/global-risks-2015. (accessed Aug 26, 2015).

HAHN, G. J., KUHN, H. 2012. Value-based performance and risk management in supply chains: A robust optimization approach. *International Journal of Production Economics*, 139, pp. 135-144.

HARLAND, C., BRENCHLEY, R., WALKER, H. 2003. Risk in supply networks. *Journal of Purchasing & Supply Management*, **9**: 51-62.

HILLSON, D. 2000a. Benchmarking Risk Management Capability. *PMI Europe 2000 Symposium Proceedings*, January.

HILLSON, D. 2000b. Project risks: Identifying causes, risks and effects. PM Network, **14**(9), 48–51.

HILLSON, D. 1997. Towards a Risk Maturity Model. *International Journal of Project & Business Risk Management,* **1**(1): 35-45.

IBGE – Instituto Brasileiro de Geografia e Estatística. 2009. Demografia das empresas. Available at: http://www.ibge.gov.br/home/estatistica/economia/demografiaempresa/2009/demoemp2009.pdf/. (accessed August 30, 2015).

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. ISO 31000 – Risk Management. Available at: http://www.iso.org/iso/home/standards/iso31000.htm. (accessed August 26, 2015).

JÜTTNER, U., PECK, H., CHRISTOPHER, M. 2003. Supply chain Risk Management: outlining an agenda for future research. *International Journal of Logistics: Research and Applications*, **6**(4): 197-210.

KRAUSE, D.R., VACHON, S., KLASSEN, R.D. 2009. Special topic forum on sustainable supply chain management: introduction and reflections on the role of purchasing management. *Journal of Supply Chain Management*, **45**(4),18–25.

KLEINDORFER, P., SAAD, G. 2005. Managing disruption risks in supply chain. *Production and Operations Management*, **14**(1): 53-68.

LIEBENBEG, A., HOYT, R. 2003. The determinants of enterprise risk management: evidence from the appointment of Chief Risk Officers. *Risk Management and Insurance Review*, **6**(1): 37-52.

LIEBENBEG, A., HOYT, R. 2011. The value of enterprise risk management. *The Journal of Risk and Insurance*, **78**(4): 795-822.

LOCH, C. H., SOLT, M. E., BAILEY, E. M. 2008. Diagnosing unforeseeable uncertainty in a new venture. *Journal of Product Innovation Management*, **25**(1): 28–46.

McSHANE, M. K., NAIR, A., RUSTAMBEKOV, E. 2011. Does Enterprise Risk Management Increase Firm Value?, *Journal of Accounting, Auditing & Finance*, **16**(4): 641-658.

MONETTI, E., DA SILVA, S. A.R., ROCHA, R. M. 2006. The practice of project risk management in government projects: A case study in Sao Paulo City. *Construction in developing economics: new issues and challenges*. Available at http://realestate.br/images/File/arquivosPDF/Eliane_CIBW107.pdf (accessed June 22, 2015).

NIDUMOLU, R., PHAHALAD, C.K. & RANGASWAMI, M.R.(2009) Why sustainability is now the key driver of innovation. *Harvard Business Review.* Sep, pp.57-64.

PECK, H. & JUTTNER, U. (2002) Risk management in the supply-chain. *Logistics & Transport Focus*, **4**(10): 17-21.

PMI. Project Management Institute. 2013. A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Edition. Newtown Square, PA. e-book, 5th ed.

PORTER, M.E., VAN DER LINDE, C. 1995. Green and competitive: ending the stalemate. Harvard Business Review, 73: 120-138.

RMRDPC - Risk Management Research & Development Program Collaboration. 2002. *Risk management maturity level development.*

SCHUCH, L.M.S. 2009. Fatores motivadores, fatores intervenientes e impactos da gestão dos riscos organizacionais – um estudo com empresas vencedoras do PNQ. Dissertação: EAESP-FGV.

SLACK, N., LEWIS, M. 2002. *Operations Strategy.* Prentice Hall, 2002.

SPEKMAN, R.E. 2003. *Extended enterprise: creating competitive advantage through collaborative supply chain*. Upper Saddle River, NJ: Prentice Hall.

SPEKMAN, R.E., DAVIS, E.W. 2004. Risky business: expanding the discussion on risk and the extended enterprise. *International Journal of Physical Distribution & Logistics Management*, **34**(5): 414-433.

THAMHAIN, H. 2013. Managing Risks in Complex Projects. *Project Management Journal*, **44**(2): 20–35.

WHEELWRIGHT, S.C. 1984. Manufacturing Strategy: defining the missing link. Strategic Management Journal, vol. 5, 77-91.

WIECZOREK-KOSMALA, M. 2014. Risk management practices from risk maturity models perspective. *Journal for East European Management Studies*, **19**(2): 133-159.

YIN, R. 2009. *Case study research: design and methods*. Applied social research methods series. 4rd ed. Sage Publications, Thousand Oaks, USA.

ZHAO, X.B.; HWANG, B.G.; LOW, S.P. 2013. Developing Fuzzy Enterprise Risk Management Maturity Model for Construction Firms. *Journal of Construction Engineering and Management*, **139**(9): 1179-1189.

ZOU, P.X.W., CHEN, Y. & CHAN, T. 2010. Understanding and improving your risk management capability: assessment model for construction organizations. *Journal of Construction Engineering & Management*, **136**(8): 854-863.