Organizational Improvisation and Product Innovation Performance: A Meta-analysis

Pengbin Gao

School of Management, Harbin Institute of Technology, Harbin 150001, Heilongjiang, China

Yiduo Song

School of Automotive Engineering, Harbin Institute of Technology, Weihai 264209, Shandong, China

Jianing MI

School of Management, Harbin Institute of Technology, Harbin 150001, Heilongjiang, China

Abstract

Despite a surge of studies examining the impact of organizational improvisation on product innovation performance, empirical researches showed the controversial results. To resolve this problem, this paper conducted a meta-analysis to restudy the relationship between organizational improvisation and product innovation performance based on the empirical research results of 25 independent samples. And this paper identified some moderators affecting this relationship. The research results indicated that the organizational improvisation—product innovation performance link was positive and significant. Results also showed that this relationship is context dependent. Factors such as the publication time, industrial characteristics, level of analysis, measuring dimensions affected the impact of organizational improvisation on product innovation performance to a large extent. In addition, publication bias, sensitive analysis and cumulative analysis were carried out. Based on these findings, we develop recommendations for future research.

Key words: ORGANIZATIONAL IMPROVISATION, NPD PERFORMANCE, META-ANALYSIS, HOMOGENEITY, SUB-GROUP ANALYSIS, SENSITIVE ANALYSIS, CUMULATIVE ANALYSIS, PUBLICATION BIAS

1. Introduction

The roots of improvisation come from the Latin derivative “proviso” which means to stipulate beforehand or to foresee. “im” means “not”, i.e., the negation. Hence, the word improvisation can be interpreted to mean

unforeseen or to take action in the moment. Improvisation is a common phenomenon in music and theater, which has been attracted attention in recent decades by the field of management scholars. A major milestone for research in improvisation occurred at the Academy of Management meeting held in 1995 in Vancouver. Hatch, Barrett and some other scholars explore the use of jazz as a metaphor for understanding organization and improvisation, these motivated several research studies which, in 1998, resulted in a special issue of Organization Science devoted to organizational improvisation. Since then, a stream of articles has poured into the literature on issues ranging from organization learning [1], strategy management [2], organizational change [3], entrepreneurship management [4], and project management [5] and so on, which indicates that the improvisation research has entered the mainstream filed of management.

In the course of nearly twenty years, the application of organization improvisation in the field of product innovation management has attracted a lot of attention, and its importance has been generally recognized by many scholars. Edvardsson et al. argued that complex processes like the development of new services cannot be formally planned altogether, and there must were some elements of improvisation [6]. Poolton and Ismail pointed out that NPD markets are increasingly subject to turbulence, it could be expected that the incidence of improvisation would grow significantly in the future. One argument is that improvisation provides a legitimate strategy enabling firms to be responsive in dynamic markets. Relaxing rules and procedures can provide an important means to promote innovation [7]. But the findings of scientific studies regarding the correlation between organizational improvisation and new product performance are conflicting.

Some empirical results show that organizational improvisation has a positive correlation with new product performance. Using the case study of globe computer industry, Brown and Eisenhardt found that successful NPD depends on the combination of limited structuring with extensive communication and design freedom to facilitate improvisation [8]. Similarly, basing on the case study of mold industry in Portugal, Cunha argued that improvisation can speed the development processes and decrease the cost [9].

By contrast, some empirical studies indicated a negative influence of improvisation on product. Salomo et al. suggested that planning process formality can promote the success of new product project compared to process improvisation [10].

In summary, there are contradictory findings in the literature regarding the relationship between the two variables. So it is necessary to conduct an in-depth study in a more comprehensive way based on even much newer sample to reach much more consistent findings. Meta-analysis is to dissect a literature using statistical procedures and econometric techniques that help to quantify key relationships. This enables valid inferences to be drawn, rather than relying on subjective interpretations that necessarily follow from traditional qualitative literature review. So meta-analysis will be used in this study to obtain more reasonable results.

2 Theory and hypotheses

2.1 Organizational improvisation and product innovation performance

The scholars have carried out many relevant statements to analyze the impact of organizational improvisation on NPD performance. Dhumal et al pointed out that improvisation behaviors can shorten the development time, improve performance and design features [11]. Song also believed that organizational improvisation increases the number of NPD projects because it promotes firms from deviating from inertia, rules, industry norms, and regulations, emphasizing the positive effects it may have no idea generation [12].

In addition, some scholars also indirectly showed the influence of non planned management on NPD performance. Lewis suggested that emergent activities help teams build technical knowledge by exploring novel scientific concepts and help them to achieve their commercial objectives by experimenting with alternative product designs [13].Formally, we hypothesize:

H1: The relationship between organizational improvisation and product innovation performance is positive.

2.2 Contingency factors

2.2.1 Publication time

On the one hand, with the passage of time, more and more studies used the more

rigorous research methods to enable reduction of common method variance, which will affect the strength of association between variables [14]. On the other hand, facing the increase of the external environmental uncertainties, more and more organizations gave more attention to improvisation activities than before. Hence, we hypothesize:

H2: The effect of organizational improvisation on product innovation performance is stronger at later time than at early time.

2.2.2 Industry characteristics

The dynamism and uncertainty of the environment have already been identified as impacting upon the incidence of improvisation [15]. In practice, the organizations in different industries will face different market and technological environment. High-tech industries have more uncertainty and dynamism environment. This leads us to propose:

H3. The positive relationship between organizational improvisation and product innovation performance is stronger in high-tech industry than low-tech industry.

2.2.3 Level of analysis

Most researches on product innovation management were concentrated at the project level, and few were focused on the organizational level which is usually referred to as program analysis [16].Studies of the project level captured the characteristics of the product innovation management, and researches of the program level concealed the innovation unique. The analysis of project level gave more accurate results compared to the program level. This leads us to propose:

H4. The positive relationship between organizational improvisation and product innovation performance is stronger in project level than program level.

2.2.4 Improvisational measurement

Compared with the single dimension construct, multidimensional constructs can be more fully and truly reflect the complex psychological phenomenon, and researchers can explore the relationship in a broader scope [17]. This leads us to propose:

H5. The positive relationship between organizational improvisation and product innovation performance is stronger using the multidimensional measurement of organizational improvisation.

2.2.5 Product innovation performance measurement

Improvisation behavior reflected the characteristics of process, so it will have stronger impact on process performance than outcome performance. Formally, we hypothesize:

H6. The positive relationship between organizational improvisation and product innovation performance is stronger using the process performances measurement.

3 Data and methods

3.1 Search strategy and inclusion criteria

To identify relevant studies, we employed several search techniques. First, we consulted computerized databases (Emerald, EBSCO, Elsevier Science, John Wiley, SAGE Premier, Google Scholar, and CNKI) using the search terms including improvisation, improvisational, improvise and improvising in organization and management filed. No limitations were placed on the year of publication. To reduce publication bias, we also searched for unpublished studies. Second, we scanned reference lists of relevant articles. Altogether, these procedures resulted in the initial identification of 254 potentially eligible studies.

To be included in our meta-analysis, studies had to meet four criteria. First, we only considered studies examining the organizational improvisational behavior in product innovation management. Studies focusing on individual level and other management activities were thus excluded. Second, studies needed to be empirical research, in which dependent variables must be NPD performance indicators and independent variables must include organizational improvisation. Third, included studies had to report a Pearson correlation for organizational improvisation and NPD performance, or data from which a correlation could be derived, as well as sample size. Fourth, studies had to employ independent samples. If the same dataset was used more than once but included different variables, we maintained the effect sizes separately.

Applying these criteria, our final search resulted in 25 primary studies (of which 15 are journal articles, 7 are conference articles and 3 are thesis) with 25 independent samples involving a total of 4070 observations.

3.2. Coding and measures

Table 1 showed the main constructs

examined in the primary studies and the way we coded them. To improve coding reliability, the first and second author both coded the studies. In the few cases where there was disagreement, we resolved it through discussion.

3.2.1 Organizational improvisation

Multi-disciplinary scholars have described improvisation: improvisation is a convergence of composition and execution [43], improvisation is the spontaneous and creative process of attempting to achieve an objective in a new way [44], organizational improvisation is the conception of action as it unfolds, by an organization and/or its members, drawing on available material, cognitive, affective and social resources [45]. Although these definitions are discussed from different angles, but the main characteristics of improvisation have been defined. Accordingly, the scholars also measure the improvisation from one dimension to multi dimensions.

Table 1. Summary of samples and variables codes for studies included in the meta-analysis

Author	Year	Sample	Industry	Level	Improvisation	Performance	*r*
Eisenhardt [18]	1995	72	High-tech	Project	Multi	Development time	0.16
Moorman[19]	1998	107	Low-tech	Project	One	Design effectiveness Market effectiveness Cost efficiency Time efficiency	-0.08 -0.22 -0.08 0.01
Akgun [20]	2001	89	High-tech	Project	One	New product success	0.14
Vera [21]	2001	30	Low-tech	Program	Multi	Product innovative performance	0.55
Akgun [22]	2002	124	High-tech	Project	One	New product success	0.09
Akgun[23]	2002	354	High-tech	Project	One	Speed-to-market	0.11
Kyriakos[24]	2004	138	Low-tech	Program	One	Product novelty Financial performance Timeless	0.01 -0.08 0.10
Nunez [25]	2004	414	High-tech	Project	One	Speed-to-market Cost expectation New product success	0.01 -0.03 0.10
Samra[26]	2005	129	High-tech	Project	Multi	New product success	0.09
Vera[27]	2005	38	Low-tech	Program	Multi	Product innovative performance	0.16
Akgun[28]	2006	165	High-tech	Project	One	New product success	0.16
Akgun[29]	2007	197	High-tech	Project	One	New product success	0.10
Magni[30]	2008	53	High-tech	Project	Multi	New product success	0.30
Magni[31]	2008	71	High-tech	Project	Multi	New product success	0.28
Samra[32]	2008	55	Low-tech	Project	Multi	Speed-to-market New product success	0.04 0.01

Samra[33]	2008	392	High-tech	Project	Multi	Speed-to-market New product success	0.42 0.52
Pavlou[34]	2009	180	Low-tech	Program	One	Competitive advantage	0.24
Samra[35]	2009	128	Low-tech	Project	Multi	Speed-to-market New product success	0.11 0.08
He[36]	2010	147	High-tech	Project	Multi	Product development performance	0.35
Kyriakos[37]	2011	132	Low-tech	Program	One	Cost efficiency Market success	-0.13 -0.19
Nunez[38]	2012	400	High-tech	Project	One	Cost expectation	-0.03
Tienne[39]	2012	192	Low-tech	Program	One	Product innovation performance	0.19
Magni[40]	2013	71	High-tech	Project	Multi	New product success	0.28
Ruan[41]	2013	209	High-tech	Firm	Multi	Product development success	0.17
Uwe[42]	2014	183	Low-tech	Program	One	New product success	-0.06

3.3.2 Product innovation performance

Although different scholars used different standards to measure the product innovation performance, they usually agreed to divide the product innovation performance from internal and external performance. The former reflected the effectiveness of the new product development process, the traditional project management indicators, such as time, cost and product advantage. The external performance represented the commercial success, which included the financial, customer satisfaction and acceptance.

3.3.3 Moderators

Publication time was divided into two parts according to the time of document collection. Sectors are classified as high-technology industries included biotechnology, Internet, software, electronics, computer equipment, and technology consulting services. Low-technology industries included food, restaurant, hotel, agriculture, manufacturing, construction, fashion, and retail.

We coded whether studies carried out on the project level or on the program level. Second, we classified studies into those using one dimension of improvisation or multi dimensions of improvisation to value variables. Third, we classified studies in cording to the measurement of product innovation performance.

3.3. Meta-analytic procedures

The current meta-analytic analysis has four main goals: (a) to provide an estimate of the effect size for the relationship between organizational improvisation and performance, (b) to examine any moderator variables that may be associated with differences in effect size noted across studies, (c) examine whether there is any evidence of publication bias in the research reviewed here, and (d) to implement the and analysis

This paper followed the widely used meta-analytic procedures, including data preparation, calculation and test of the effect size, moderating effects analysis, publication bias analysis and interpretation of results. Statistical analysis of the whole process was performed by the Comprehensive Meta-Analysis 2.0.

4 Research results

4.1 Main effects and homogeneity analysis

Table 2 and Figure 1 show the results of meta-analysis in this study. According to the results in Tab.2, the Q value of heterogeneity was 125.782($p<0.001$), which shows that the possibility is available that there is inconsistency among those data.

Generally there are two approaches for

meta-analysis: one is the fixed effect model, and the other is the random effect model. For judging which model should be applied in a specific study, it is a common method to the compare values of Q and S-1 (S is the number of studies to be synthesized). When $Q \leq S-1$, the result generated by the random effect model is similar to that by the fixed effect model; when Q>S-1, the random effect model should be used. In this study, Q=125.782while S-1=25-1=24, therefore, the random effect model should be used and we can choose random effect model to do meta-analysis aiming to correct these influences the heterogeneity brings.

According to the result of random model, organizational improvisation was positively linked to product innovation performance (r=0.152). A confidence interval not including zero indicated that this effect significantly differed from zero. Hypothesis 1 was supported.

Table 2. The result of meta-analysis

Method	r	95% CI	Z	Q	I^2	Tau^2
Fixed Model	0.148	[0.117, 0.178]	9.432^{***}	125.782^{***}	80.919%	0.027
Random Model	0.152	[0.079,0.224]	4.053^{***}			

Notes: ***p < 0.001

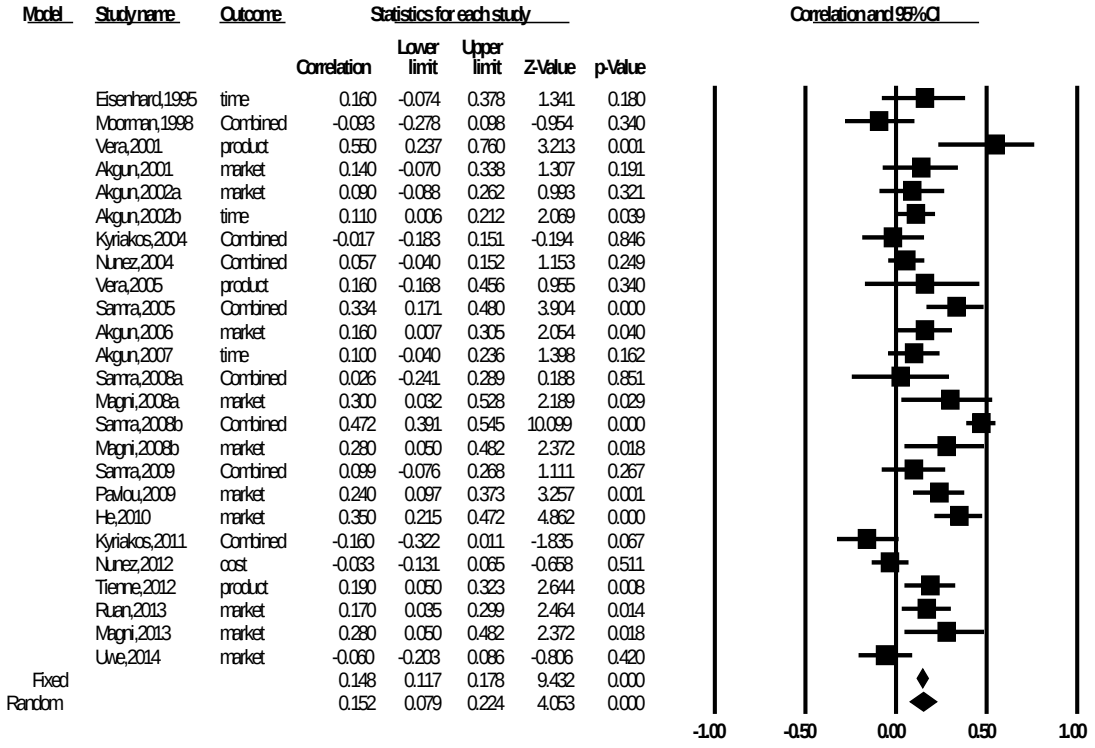

Figure 1. Forest plot of meta-analysis

4.2 Sub-group analysis

Given that evidence from the tests of homogeneity suggests the presence of moderator variables, several potential moderator variables were tested. In order to carry out an initial test, we applied sub-group analysis.

According to the results of Table 3, studies based on data from 2005 to 2014 obtained more positive value (r=0.175) than studies based on data from 1995 to 2004 (r=0.077). Hence, the data supported Hypothesis 2.The homogeneity for the time of 2005-2014 (102.48) was larger than the time of 1995-2004 (13.55), and the value of former (Fail-safe N=332) was more stable than the later (Fail-safe N=13).

Results of sub-group analyses demonstrated that industry characteristics affected the organizational improvisation–

product innovation performance relationship significantly. The correlation was higher in high-tech industry (r=0.199) than in low-tech industry(r=0.071). Hence, the data strongly didn't support Hypothesis 3. The homogeneity for the high-tech industry (83.26) was larger than the low-tech industry (29.81), and the value of former (Fail-safe N=363) was more stable than the later (Fail-safe N=5).

With regard to level of analysis, the hypothesis was strongly supported. The results suggested that organizational improvisation had a higher impact on NPD performance in project level (r=0.170) than in program level (r=0.105). Thus, we found support for Hypothesis 4. The homogeneity for the project level (92.68) was larger than the program level (25.75), and the value of former (Fail-safe N=364) was more stable than the later (Fail-safe N=7).

As for measurement of organizational improvisation, Table 3 showed that effect size were larger for studies employing multi-dimensions (r=0.265) than for studies using one-dimension (r=0.047). This result provided support for Hypothesis 5. The homogeneity for the multi dimension (37.78) was larger than the one dimension (24.85), and the value of former (Fail-safe N=358) was more stable than the later (Fail-safe N=4).

In examining the possible moderating influence of performance type, we found a difference in effect sizes between studies that employ internal performance and studies using external performance (r=0.120, r=0.104, respectively), which supported Hypothesis 6. The homogeneity for the external performance (123.045) was similar with the internal performance (121.309), and the value of former (Fail-safe N=110) was similar stability with the later (Fail-safe N=196).

Table 3. The result of sub-group analysis

Moderator	K	r	95% CI	Q-value	I^2	Tau^2	Z-value	Fail-safe N
Publication time								
1995-2005	8	0.077	[0.023,0.131]	13.55	48.32%	0.006	2.018^{**}	13
2006-2014	17	0.175	[0.077,0.269]	102.48^{***}	84.39%	0.035	3.498^{***}	332
Industry								
Low-tech	10	0.071	[-0.039,0.178]	29.81^{***}	69.81%	0.020	1.267	5
High-tech	15	0.199	[0.107,0.287]	83.26^{***}	83.19%	0.027	4.205^{***}	363
Level								
Project	18	0.170	[0.085,0.251]	92.68^{***}	81.66%	0.026	3.923^{**}	364
Program	7	0.105	[-0.045,0.251]	25.75^{***}	78.23%	0.030	1.371	7
Improvisation								
One-dimension	12	0.047	[-0.015,0.109]	24.85^{***}	55.73%	0.006	1.494	4
Multi-dimension	13	0.265	[0.175,0.351]	37.78^{***}	68.23%	0.019	5.631^{***}	358
Performance								
Internal	19	0.120	[0.030,0.209]	121.309^{***}	85.16%	0.032	2.602^{**}	196
External	16	0.104	[-0.014,0.220]	123.045^{***}	87.81%	0.050	1.731	110

Notes: $^{**}p < 0.05, ^{***}p < 0.001$

4.3 Sensitivity analysis and cumulative meta-analysis

As shown in Fig.2, the pooled effect sizes were similar before and after individual studies were excluded and the 95 % CI of the pooled effect sizes (Fig. 3) were narrowed along with the growing number of studies under the allelic model indicating the moderate

of the current results.

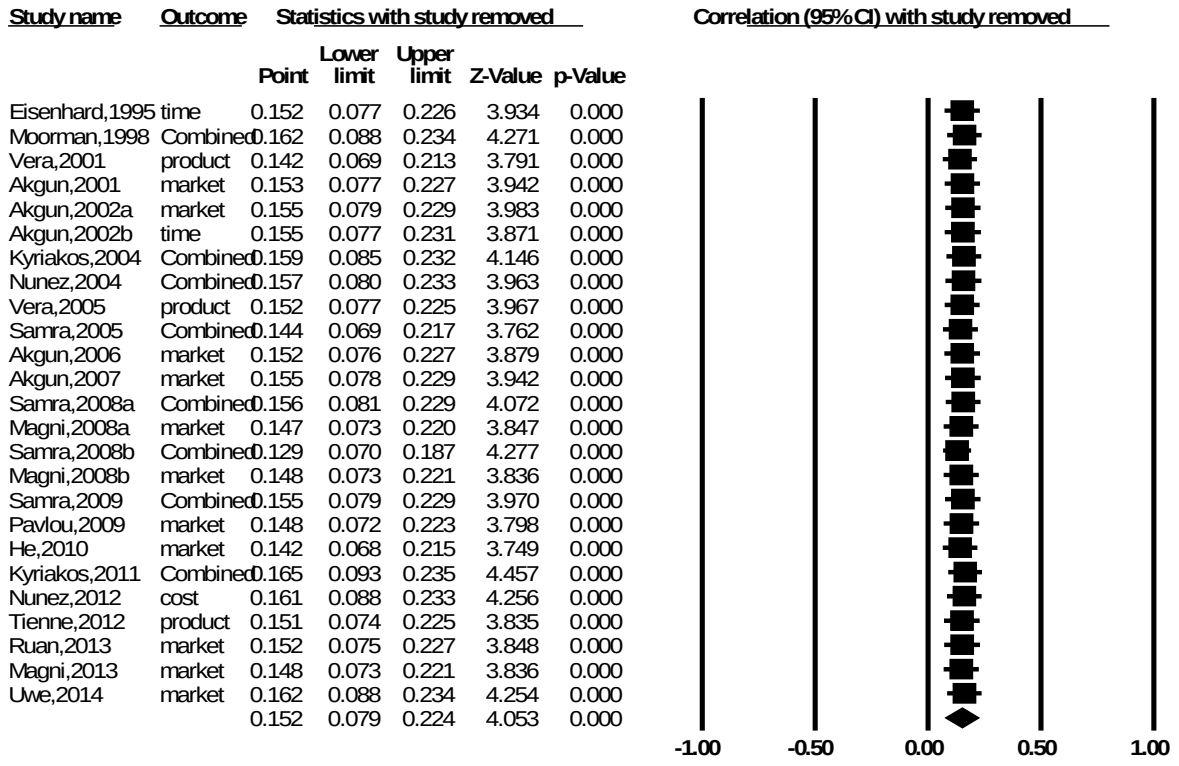

Figure 2. The sensitivity analysis

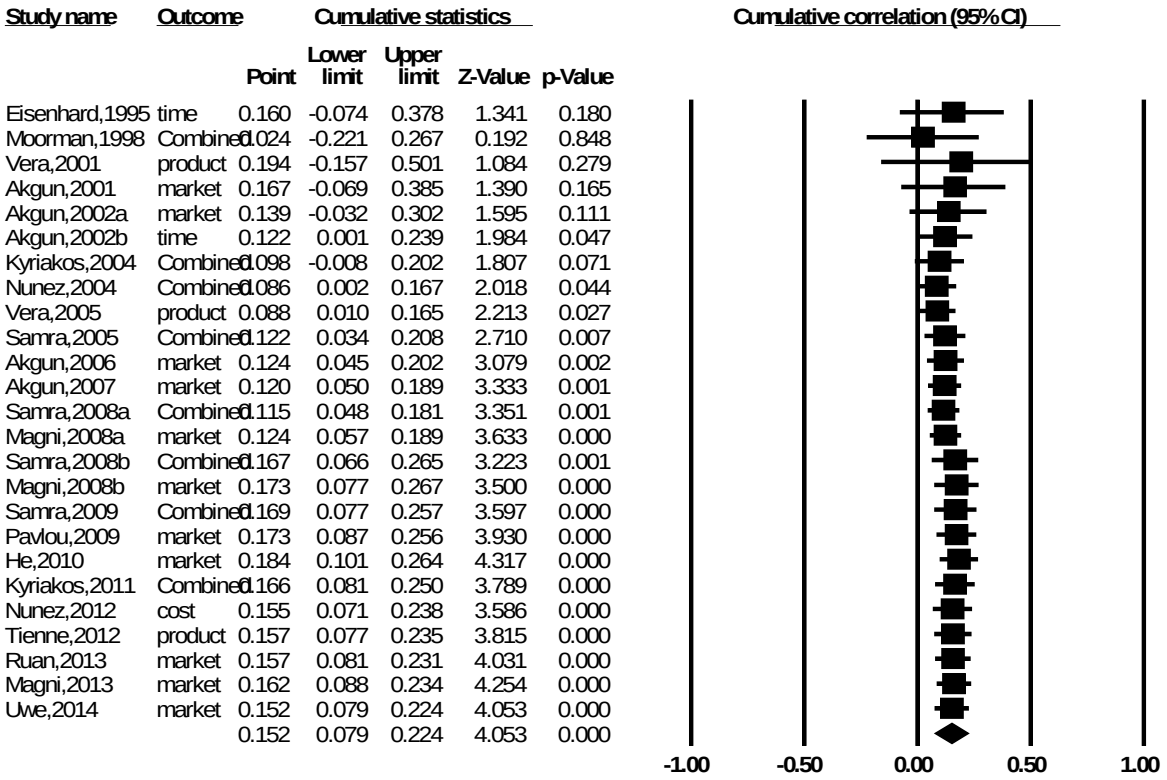

Figure 3. The cumulative analysis

4.4 Publication bias analysis

Publication bias is the term for what occurs whenever the research that appears in the published literature is systematically unrepresentative of the population of completed studies. There is no perfect means

of estimating publication bias and there are several methods for estimating publication bias. These methods include visual examination of a funnel plot, the Fail-safe N, Begg rank correlation test and Egger's Regression. In this study, we used these methods.

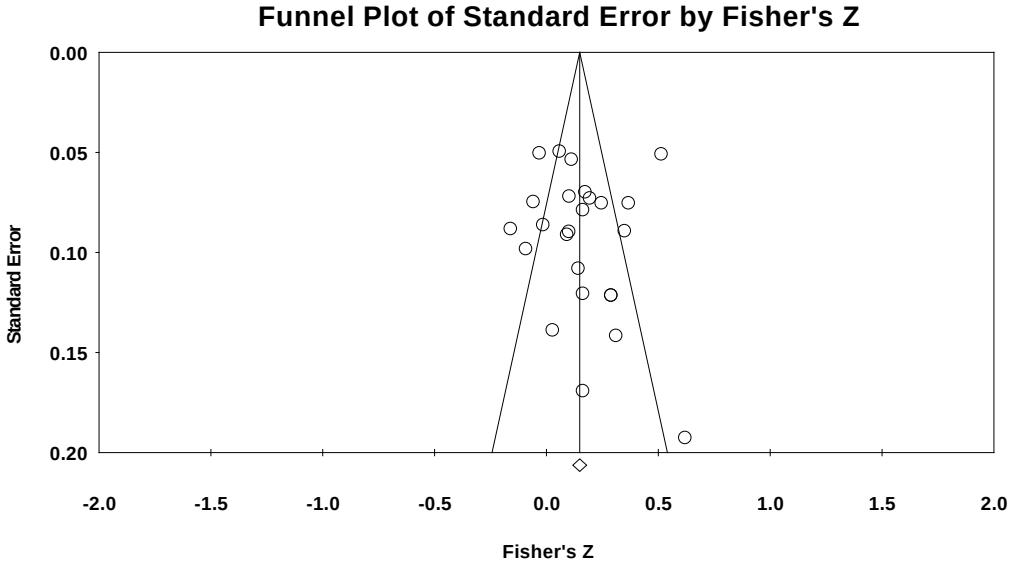

Figure 4. The funnel plot of the meta-analysis

As shown in Fig.4, the funnel plot is asymmetric, which suggests that there is publication bias in this study. In addition, the classic fail-safe N was 514. The results of Begg's rank-correlation test showed that the Z-value (continuity corrected) is 1.144 and the p-value is 0.252(continuity corrected), which indicate that no publication bias at the 0.05 level. The results of Egger's Regression showed that the p-value of corresponding slope is 0.800(>0.05), indicating that there isn't significant difference between the intercept and 0, which means the intercept can't be deemed as 0 and the regression line isn't through the point of origin. Therefore, there isn't publication bias in this study.

5 Conclusion and future work

According to synthetic result we obtain through analyzing relevant studies, organizational improvisation indeed had a positive weak impact on product innovation performance, that is, organizational improvisation can bring the positive outcomes in product innovation management. Furthermore, we found that the relationship between organizational improvisation and product innovation performance was affected by some moderators.

The results of theoretical moderators' analysis showed that publication time and industry characteristics have a positive impact on the relationship between two variables. In the future, organizational improvisation will play an important role in promoting innovation performance. The value of organizational improvisation in high-tech industry will make managers pursuing more non-planning activities to obtain benefits.

The results of methodological moderators' analysis showed the level of analysis and the measurement of variables have a positive impact on the relationship between two variables. Organizational improvisation should be used in the project level, and the autonomy of project management gave the flexibility to deviate the prior plan.

Our analysis also indicated that the organizational improvisation-product innovation performance link was stronger for multi dimensions of improvisation than for one dimension of improvisation. The result suggests that if studies only consider improvisational some characteristics and disregard its other main characteristics, they may risk understanding the true value of organizational improvisation. A direct implication is that future research will benefit from adopting more refined measures of improvisation.

In examining the influence of performance type, we found that organizational

improvisation can yield more positive impact on internal performance. The results suggested that improvisational behavior is process oriented, so it will play an important role in speeding the process and improving the product novelty.

This study is subject to the limitations typically associated with meta-analysis. First, although we made efforts to avoid selection bias in the process of gathering relevant empirical research papers, it is quite possible that relevant studies yielding different results were not included in the sample, such as unpublished papers and other languages papers except English. Second, the moderating analysis only included several variables, and future research can further explore other moderators, such as respondents' characteristics, countries and firm type of studies, and so on.

Acknowledgements

This work was supported by University Scientific Research Project of Bureau of Education of Shandong Province (J14WG69).

References

1. Miner A S, Bassof P, Moorman C. (2001) Organizational improvisation and learning: A field study. *Administrative Science Quarterly*, 46(2), p.p. 304-337.
2. Kanter R. M. (2002) Strategy as improvisational theatre. *Sloan Management Review*, 43, p.p. 76-81.
3. Cunha M P E, Cunha D J V. (2003) Organizational improvisation and change: two syntheses and a filled gap. *Journal of Organizational Change Management*, 16(2), p.p. 169-185.
4. Hmieleski K M, Corbett A C. (2008) The contrasting interaction effects of improvisational behavior with entrepreneurial self-efficacy on new venture performance and entrepreneur work satisfaction. *Journal of Business Venturing*, 23(4), p.p. 482-496.
5. Leybourne S. (2010) Project management and high‐value superyacht projects: An improvisational and temporal perspective. *Project Management Journal*, 41(1), p.p. 17-27.
6. Edvardsson B, Haglund L, MattssoN J. (1995) Analysis, planning, improvisation and control in the development of new services. *International Journal of Service Industry Management*, 6(2), p.p. 24-35.
7. Pooton J, Ismail H. (2000) New developments in innovation. *Journal of Managerial Psychology*, 5(8), p.p. 795-811.
8. Brown S L, Eisenhardt K M. (1997) The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations. *Administrative science quarterly*, 42(1), p.p. 1-34.
9. Cunha D J V, Kamoche K, Cunha M P. (2003) Organizational improvisation: a contextual approach. *International Review of Sociology*, 13(3), p.p. 567-589.
10. Salomo S, Weise J, Gemünden H G. (2007) NPD planning activities and innovation performance: the mediating role of process management and the moderating effect of product innovativeness. *Journal of product innovation management*, 24(4), p.p. 285-302.
11. Dhumal, P, Muhammed, S. (2008) Temporal Considerations in the Impact of Organizational Improvisation on New Product Development Process. *Review of Business Research*, 8 (1), p.p. 110-119
12. Song M, IM S, BIJ H. (2011) Does Strategic Planning Enhance or Impede Innovation and Firm Performance? . *Journal of Product Innovation Management*, 28(4), p.p. 503-520.
13. Levis MW, Welsh MA, Dehler GE. (2002) Product development tensions: Exploring contrasting styles of project management. *Academy of Management Journal*, 45(3), p.p.546-564.
14. Gilboa S, Shirom A, Fried Y. (2008) A meta-analysis of work demand stressors and job performance: examining main and moderating effects. *Personnel Psychology*, 61(2), p.p.227-271.
15. Chelariu C, Johnston W J, Young L. (2002) Learning to improvise, improvises to learn: a process of responding to complex environments. *Journal of Business Research*, 55(2), p.p. 141-147.
16. Kessler E H, Chakrabarti A K. (1996) Innovation speed: a conceptual model of context, antecedents, and outcomes. *Academy of Management Review*, 21(4), p.p. 1143-1191.
17. Gu H L,Wen Z L,Fang J. (2014) Bi-factor Models: A New Measurement Perspective of Multidimensional

Constructs. *Journal of Psychological Science*, 37(4), p.p. 973-979
18. Eisenhardt K M, Tabrizi B N. (1995) Accelerating adaptive processes: Product innovation in the global computer industry. *Administrative science quarterly*, 40(1), p.p. 84-110.
19. Moorman C, Miner A S. (1998) The convergence of planning and execution: improvisation in new product development. *Journal of Marketing*, 62(3), p.p. 1-20.
20. Akgün A E. (2001) Learning Typology For New Product Development Teams: A Socio-Cognitive Perspective. Stevens Institute of Technology
21. Vera D, Crossan M. (2001) Improvisation and its impact on group performance: Insights from the municipal context.
22. Akgun A E, Lynn G S, Reilly R. (2002) Multi-dimensionality of learning in new product development teams. *European Journal of Innovation Management*, 5(2), p.p. 57-72.
23. Akgün A E, Lynn G S. (2002) New product development team improvisation and speed-to-market: an extended model. *European Journal of Innovation Management*, 5(3), p.p. 117-129.
24. Kyriakopoulos K. (2004) Improvisation in new product development: The contingent role of memory and information flows.
25. Nunez E. (2004) Integrated new product development for turbulent and uncertain environments. Stevens Institute of Technology
26. Samra Y M. (2005) Is new product development the solution to a crisis or is crisis the solution to new product development? Stevens Institute of Technology
27. Vera D, Crossan M. (2005) Improvisation and innovative performance in teams. *Organization Science*, 16(3), p.p. 203-224.
28. Akgün A E, Lynn G S, Yılmaz C. (2006) Learning process in new product development teams and effects on product success: A socio-cognitive perspective. *Industrial Marketing Management*, 35(2), p.p. 210-224.
29. Akgün A E, Byrne J C, Lynn G S, et al. (2007) New product development in turbulent environments: Impact of improvisation and unlearning on new product performance. *Journal of Engineering and technology Management*, 24(3), p.p. 203-230.
30. Magni M, Maruping L, Hoegl M. (2008) Improvisation and Performance in Software Development Teams: The Role of Geographic Dispersion. *Proc. Conf. On information system*, United States, p.p.154-172
31. Magni M, Provera B, PROSERPIO L. (2008) Improvisation in geographically dispersed teams: does distance matter.
32. Samra Y M, Hartman J B, Lynn G S, et al. (2008) Effect of An Improvisational Approach to New Product Development during a Crisis: An Empirical Study of Npd Teams in the Field of Chemistry and Chemical Engineering.
33. Samra Y M, Lynn G, Reilly R R. (2008) Effect of improvisation on product cycle time and product success: A study of new product development (NPD) teams in the United States. *International Journal of Management*, 25(1), p.p. 175-192
34. Pavlou P A, El Sawy O A. (2010) The "third hand": IT-enabled competitive advantage in turbulence through improvisational capabilities. *Information Systems Research*, 21(3), p.p. 443-471.
35. Samra Y M, Hartman J B. (2009) Crisis management: An empirical investigation of improvisation effects on new product development in the services sector.
36. Liu Q H, Wang T. (2010) Why companies improvise: a test on the strategic decision-making manners of Chinese companies [J]. *Journal of Business Economics*, 222(4), p.p. 25-32
37. Kyriakopoulos K. (2011) Improvisation in product innovation: the contingent role of market information sources and memory types. *Organization Studies*, 32(8), p.p. 1051-1078.
38. Lynn G, Nunez E. (2012) The impact of adding improvisation to sequential NPD processes on cost: the moderating effects of turbulence. *Academy of Marketing Studies Journal*,16(1), p.p.1-10
39. De Tienne D, Mallette P. (2012) Antecedents and outcomes of innovation-oriented cultures. *International Journal of Business and Management*, 7(18), p.p.1-12
40. Magni M, Maruping L M, Hoegl M, et al.

(2013) Managing the unexpected across space: Improvisation, dispersion, and performance in NPD teams. *Journal of Product Innovation Management*, 30(5), p.p. 1009-1026.
41. Guoxiang R, Zhangliang C. (2013) SMEs' organization improvisation and NPD performance under turbulent environment: The moderating role of absorptive capacity. *Proc. Conf. On Information Management, Innovation Management and Industrial Engineering*. Xi'an China, p.p. 604-606.
42. Gross U. (2014) Fighting the fire: improvisational behavior during the production launch of new products. *International Journal of Operations & Production Management*, 34(6), p.p. 722-74
43. Moorman C, Miner A S. (1998) Organizational improvisation and organizational memory [J]. *Academy of management Review*, 23(4), p.p. 698-723.
44. Vera D, Crossan M. (2004) Theatrical improvisation: Lessons for organizations [J]. *Organization Studies*, 25(5), p.p. 727-749.
45. Cunha M P, Cunha D V J, Kamoche K. (1999) Organizational improvisation: What, when, how and why. *International Journal of Management Reviews*, 1(3), p.p. 299-341.