The effects of technological turbulence on the balance of internal and external exploration

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ABSTRACT: This study investigates the main effects of technological turbulence on external exploration, relative to internal exploration. Many studies have focused on the relationship between exploitation and exploration, but have paid less attention to knowledge exploration and have not considered its division between external and internal exploration. It is therefore important to test the impact of knowledge exploration with an impactful independent variable that could be argued to have a neutral effect; technological turbulence. A study of 42 firms was conducted, all from different industries. The data suggests that technological turbulence has a more positive relationship with external exploration than it does with internal exploration. Furthermore, limitations pertaining to the data are taken into account but it is hoped to improve this in further study.

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1. INTRODUCTION

Due to the digital revolution and the information explosion of the past two decades, companies have changed the way they do business. The speed with which technology evolves and changes has made a big influence on the innovativeness of companies. Companies must consistently keep maintaining adaptability and flexibility in today's ever changing world (Tapscott, 1995). This stresses the importance of organizational learning. Zahra and George (2002) use the term 'absorptive capacity' and state that it can increase a firm's capability to sustain competitive advantage by reconfiguring its resource base and by adapting to changing market conditions. Lane (2006) stresses that an organization's capacity to learn is vital to their survival because absorptive capacity is a mechanism used to reinforce, complement or refocus a firm's knowledge base.

Organizational learning is the process of renewing a firm's competences by recognizing value of new information, assimilating it, and applying it (Cohen & Levinthal, 1990). Through the perspective of experiential learning, March (1991) conveys that organizations generate competence by dividing attention and other scarce resources between two broad kinds of activities: knowledge exploitation and knowledge exploration.

Exploitation refers to the application and examination of possible applications of knowledge that have been explored and retained in the firm. "Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution." (March, 1991)
Exploration is generating new knowledge in the firm through internal (invention) efforts and external (acquisition from external sources) acquisitions. Therefore, knowledge exploration can be divided between internal exploration and external exploration. "Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation" (March, 1991)
"Maintaining a balance between exploitation and exploration is complicated because both activities need to compete over the same finite resources." Both activities require alternative investments from each other and both activities have conflicting strategies (March, 1991).

Imbalances of exploration and exploitation within a firm might lead to either two of the following situations. A competency trap occurs when adaptive systems that engage in exploration, while excluding exploitation, suffer the costs of experimentation without gaining many of its benefits. "They create too many undeveloped novel ideas, but possess too little competence to bring them to fruition." (Liu, 2006)
Alternatively, organizations that engage solely in exploitation, while excluding exploration, likely find themselves trapped in a 'suboptimal stable equilibria' also referred to as a competency trap. This is when firms learn to do the same thing, while in the meantime conditions change. Thus, companies come to realize that knowledge that was useful to them in the past is no longer applicable. As a result; "maintaining an appropriate balance between exploration and exploitation is a primary factor in system survival and prosperity". (March, 1991)

Much study has been devoted to the balance of exploration and exploitation (for e.g. Kogut and Zander 1992, Cohen and Levinthal 1990, Visser and Faems 2015). And while more studies have insight on acquiring a good balance between these two main activities, less focus has been put on the dynamic of exploration in itself. This is where the problem lies.

Most studies have treated knowledge exploration as a whole and have rarely divided the variable between internal and external exploration, despite recent exceptions of studies in the last decade (for e.g. Tsai and Wong 2008, Grimpe and Kaiser 2010).
Marc Zaadnoordijk (2012) even indicated in his paper that the interplay between internal and external exploration is considered "unexplored". Some studies have tried acknowledging the relationship between the two exploring activity types (for e.g. 'internal exploration positively influences external exploration'). However, little has been researched when it comes to finding out the balance of both exploration activities when an important independent variable has an effect on them. This is the research gap that is being experienced and this study aims to address this. Cassiman & Veugelers (2006) claim that determining the research and development boundaries of the firm (the extent of in-house R&D and R&D outsourcing) have proven to attract much attention in the literature because of its central role in the management of innovative. This illustrates that knowing roughly how much to externally explore and how much to internally explore is also important besides knowing the appropriate balance between exploration and exploitation. Consequently, internal exploration and external exploration are chosen to be the dependent variables for this research.

Technological turbulent environment was chosen as the independent variable because firms in turbulent technological markets could argue for performing any of the two exploratory activities, instead of only having good arguments by performing one of them. For e.g. the rate of technological change could put pressure on the players involved in the market and would raise the competitive intensity, forcing firms to explore more externally to drive change and find more novel ways to gain a competitive advantage. On the other hand, companies in the market could choose to withstand these pressures by forming strategic alliances and thereby positioning themselves better to invest in internal resources. (Lavie, Stettner, & Tushman, 2010). Based on this notion, it deemed interesting to see if an independent variable such as this would have a neutral effect on the exploratory balance or if it prefers a certain exploratory activity.

Now that the independent & dependent variables have been established, the main research question of this study is represented as:

What are the effects of technological turbulence on the balance of internal and external exploration?

2. THEORETICAL BACKGROUND & HYPOTHESIS

2.1 Dependent variables

Internal exploration is defined as a firm's ability to generate new knowledge inside the firm. Internal exploration is determined by the effectiveness of the internal R&D processes. "Internal exploration activities are path dependent" (Kogut & Zander, 1992). Path dependence means that firms persist in making what they have made in the past. In this case, knowledge only goes further on the basis of prior research and it advances on the basis of its current information and ways of doing things within the firm.

Though internal exploration is a more costly alternative out of the two, it does however possess its 'first-mover advantages' (Rosenberg, 1990). The learning curves attained by the first movers can act as a barrier of entry for other firms. Certain findings in basic research are patentable, consolidating the market position of the first mover. Furthermore, high buyer switching costs can protect from competitors willing to enter the market. Lastly the first mover that develops their own technology internally has better authority over its distribution and how it plans to use the technology as a service (Jones, Lanctot, & Teegen, 2000). Shifting the focus more on internal learning will enable the firm to develop its own core competencies and appropriate more profits.

Internal exploration is more beneficial for the integrative capability of a firm than external exploration. 'Integrative capabilities' is a term that describes the capacity of a firm to assimilate and exploit new technology and integrating it into its business (Weigelt, 2009).

Lastly, "the larger the internal stock of firm-specific knowledge resources, the higher the likelihood that combinations with acquired external knowledge will be unique, less generic, and hence more valuable." (Grimpe & Kaiser, 2010)

External exploration is defined as the process of acquiring new technological knowledge from outside the firm. This activity only includes acquiring knowledge from an external source, not storing or utilizing it. An important attribute of external exploration is that external exploration is not restrained by an organization's existing knowledge base, making it possible to discover truly novel technological pathways for the company. (Zaadnoordijk, 2012)

According to Cohen and Levinthal (1990), the process of external knowledge acquisition is built on 3 characteristics: speed, intensity and direction. The speed and intensity decides the quality of the firm acquisition capabilities and will more quickly gather the knowledge that is required. Naturally, there is a limit to these attributes because learning cycles cannot be easily 'shortened'. The direction influences which knowledge path the firm takes to acquire resources.

External exploration is possible due to spillovers in the technology of firms, resulting from other firms who have internally invested to create knowledge. Knowledge and research that is not patentable or lacks property control allow competitors to 'free-ride', even though they have not contributed in the creation of the technology. Late movers can achieve the same knowledge at a lower cost in later stages (Rosenberg, 1990). On the other hand, "an abundance of external knowledge resources does not per se increase innovation performance as a strong reliance on external knowledge may lead to a situation where the resource base of the firm suffers from dilution, making it less unique and easier for competitors to imitate" (Grimpe & Kaiser, 2010). Nevertheless, Tsai and Wong's (2008) research stated that firms need to have external exploration as a complementary activity to their in-house research and that external knowledge increases the effectiveness of the internal R&D in achieving higher innovation performance (Cassiman & Veugelers , 2006).

2.2 Independent variable(s)

According to Lichtenthaler (2009), technological turbulence is a factor in the external environment of a firm, besides market turbulence and competitors' intensity. It is defined as "the rate of technological change in an industry" (Jaworksi & Kohli, 1993).

Schumpeter (1934) stated that technological innovation and entrepreneurship has long been recognized as the main driver of industrial growth as well as a major cause of social disruption through the obsolescence of existing technologies, businesses and economic systems, describing it as 'creative destruction'. Technological turbulence creates entrepreneurial opportunities, and present challenges to incumbent firm and established norms. In some cases, it can even present ethical dilemmas (Hall & Rosson, 2006). Innovative companies often find themselves in unstable environments. They situate in an environment that encourages actors to think in unusual and creative ways.

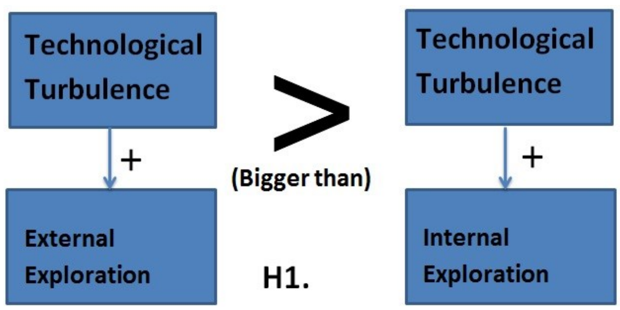
2.3 Hypothesis

Previous literature has made it possible to derive a specific expectation among these 3 variables.

Lichtenthaler (2009) states that the benefits from learning greatly depend on the degree of environmental turbulence. For e.g, internal learning has positive effects in stable environments and negative effects under dynamic conditions. Zahra and George (2002) consider that potential capacity (external exploration) has an advantage in dynamic markets and makes firms better able to adapt and evolve to fast changing environments.
According to Hall and Rosson (2006), turbulence creates an entrepreneurial opportunity. Cohen and Levinthal (1990) predict that an increase in technological opportunity will elicit more R&D knowledge and force firms to tap into its absorptive capacities in order to cope with difficult learning environments. In fact, "firms often acquire external knowledge specifically to respond to turbulent environments, and this strategic action underscores the importance of environmental influences' (Cassiman & Veugelers, 2006). All these studies imply that external exploration provides more value in a more active environment.

On the other hand, the following study views it from the point of view of performing internal exploration. "For knowledge areas that are fundamentally systemic, firms should focus more on internal learning than external learning so that they have more control over the development process and can better understand the tacit nature of the knowledge" (Bierly & Chakrabarti, 1996). This hints at the idea that in a more stable environment, internal exploration is preferred over external exploration. Meaning that in an environment where changes are organic and at a high rate, the opposite applies. It brings us to the same expectation of thinking that external exploration is wished upon when dealing with a high degree of technological turbulence.

This study aims to confirm empirically what many studies suspect and claim what the effects of technological turbulence are on external and internal exploration. Below, the hypothesis is depicted in a figure:



Hypothesis 1. : "Technological turbulence has a more positive relationship with external exploration, relative to the positive relationship with internal exploration."

3. METHODOLOGY

3.1 Survey development

The survey was developed based on an extensive literature review by Marc ZaadNoordijk. Most items were measured on a 7 point Likert scale. The items range from 1: "strongly disagree" to 7: "strongly agree". The questionnaire was administered through an online survey. Though an initial dataset was already provided from 4 years ago of approximately 56 respondents, it was attempted to collect more recent cases and to increase the sample size for the better.

3.2 Sample and data collection

In our bachelor circle of 4 students, it was decided to find 75 companies each that fit the requirements of an 'innovative' company. The companies were selected through using a free-trial of the 'company.info' database. Thereafter when the free-trial expired, the search continued on Linked-In. The criteria that were agreed upon were that the companies needed to have at least 100 FTE (Full-time employees) and it needed to possess an R&D department. The majority of firms selected were manufacturing firms in various types of industries (for e.g. chemical, pharmaceuticals, metals, electronics and computer devices). The initial sample amounted to exactly 300 companies. Afterwards, the sample was refined when making calls to the companies asking them for contact emails to the R&D manager of their respective R&D department. The final sample amounted to 264 companies. On the 12th of May, the survey was sent via email to the supervisor of this bachelor thesis, who would in turn send the survey to the list of companies. In the weeks that followed, 50 more cases were requested from one of the supervisors seeing as many of the contact details were info@ email addresses instead of actual email addresses of R&D managers themselves. And due to complications with the marketing department of the University of Twente, the survey was not sent out at the planned time.

The 3 items for technological turbulence were adopted from Hofman (2010) seeing as there was no other study giving a clear operationalization of this construct. Var 106 to var 108 are the items for technological turbulence in the data set.

All 9 items that were operationalized for external exploration were derived from the article of Lichtenthaler (2009). Var 3 to var 11 are the items for external exploration in the data set.

For internal exploration, 9 items were taken from different articles: Rosenberg (1990), Cohen and Levinthal (1990), Nonaka et al., (2000) and Lichtenthaler and Lichtenthaler (2009) and Nayar 2014. Var 51 to Var 60 are the items for internal exploration in the dataset. It is important to note that var 58 is asked in a reversed manner. All items are measured ordinally.

3.3 Analysis of data

Data from the variables received are all on the ordinal measurement level. Before combining these items into singular variables and testing them against each other, it is first important to test the reliability and validity of these items.

Factor analysis was conducted in order to verify the structure of a set of observed variables. It is a useful for discovering clusters of interrelated variables. Researchers use this statistical test to dissect constructs that consist of many variables/items and reduce them to fewer underlying factors. Factor analysis is expressed in 'factor loadings' in which each factor accounts for a certain amount of variance to the overall latent variable (Berg & Kolk, 2014). A common cut-off value for factor loadings is above 0.5 and is considered acceptable.

Seeing as all the variables needed in the survey consisted of a 7-point Likert scale, a common way of testing the internal consistency (reliability) of my scale is to perform Cronbach's Alpha. Cronbach's alpha tests whether individual items in a survey all measure the same construct (latent variable) and if they are related to each other. It is important to know that you possess a variable that is generated from a set of questions and that it returns a stable response. In common practice, when the CR is above 0.7, it is considered acceptable and when it scores above 0.8 is considered optimal. (Huizingh, 2012)

Once these two tests are performed and it was known which items were appropriate to include, the next step was to recode the items into singular variables. New variables were computed by taking the average of all belonging items and forming them as one. It was chosen to take the average instead of the sum because that gives a better overall collective value of the latent variable.

After computing new variables, it is now time to test the correlation of the variables concerning the hypothesis. Correlation quantifies the degree to which variables are related with each other. Initially, a Pearson-correlation was suggested, but it assumes that the variables used are either interval or ratio. Therefore, since this assumption is not fulfilled, an alternative is to perform Kendall's tau. Kendall's tau is preferred in this case over Spearman's rho, for the reason that it is superior when dealing with a smaller dataset, giving a more accurate P-value.

Before doing this test, it is necessary to fulfill the assumptions of Kendall's Tau. The first assumption is that the variables measured should be on either an ordinal or continuous scale. The second assumption is that the two variables must have a monotonic relationship with one another. Meaning that as the value of one variable increases, the other does the same. Another scenario is when the value of one variables increases and the other decreases. This assumption can be investigated by creating a scatterplot between these two variables and graphically examining the relationship. (Dooley, 2009)

Lastly, a general linear model (GLM) is performed. It is a measure for the strength of the relationship between two variables and also gives the direction of this relationship (positive or negative). It is a useful technique to explore a relationship between interval or ratio variables. Though ordinal variables are used, it was allowed this time by our supervisor to treat them as continuous variables.

It is intended to click for the option of one-tailed because I have a prior expectation regarding a positive connection. Before this is performed, a number of four assumptions need to be fulfilled. Namely:

- Variables are normally distributed
- Linearity between the independent and dependent variable
- Homoscedasticity
- Statistical independence of the errors

(Osborne & Water, 2002).

Normality can be graphically represented by a histogram along with a normality line. To support if the normality of the data is significant or not, the Shapiro-Wilk and the KS test can be conducted to find this result. Homoscedasticity can be determined by looking at a standardized residual model. Linearity can be investigated by looking at the same scatterplot between variables and asking for linearity line to be drawn through the graph on SPSS. And statistical independence of errors depends on the initial research design.

4. RESULTS

The factor analysis showed that all variables scored above 0.5 except for one item, namely var58. It was not giving the appropriate amount of variance to the latent variable and was considered to be discarded. Table 1 displays the factor loadings for the items of internal exploration.

Component Matrix[a]

	Component	
	1	2
var51	.733	.089
var52	.865	-.018
var53	.629	-.029
var54	.609	.324
var55	.728	.255
var56	.687	-.522
var57	.768	-.109
var58	.218	.767
var59	.645	-.339
var60	.761	.104

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

Table 1: factor loadings for items of internal exploration

When performing Cronbach's alpha, all items belonging to their variables have come up with results above 0.7. Although when testing the items for internal exploration, item58 has a low correlation with the total of 0.171 and has therefore again given evidence to leave this item out. It was ultimately decided not to include it. Leaving the item out increased the Cronbach's alpha value from 0.86 to 0.88.

	Ext_Expl	Int_Expl	Tech_Turb
Cronbach's Alpha	0.927	0.88	0.729

Table 2: Cronbach's alpha of all variables.

After computing the items to one variable, descriptive statistics resulted in the following:

	Ext_Expl	Int_Expl	Tech_Turb
Number of cases	42	42	42
Minimum	1.33	1	1
Maximum	6.56	5.56	6.33
Mean	4.3915	3.8069	3.7619
Std. Deviation	1.37781	1.2258	1.25001

Table 3: Descriptive statistics for computed variables

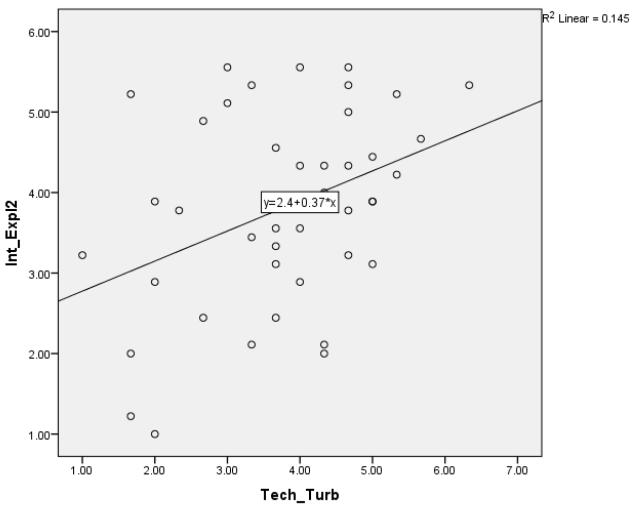
A boxplot in SPSS showed that external exploration was the only variable that possessed outliers (boxplot shown in appendix). Outliers in external exploration are suspected to be the reason why it raises complications with normality later on in the report.

In the next phase, the assumptions for Kendall's tau are tested. Assumption 1 is fulfilled because ordinal variables are used. The scatterplot also showed a slight monotonic relationship and it was decided to proceed with the test. Both scatterplots can be found in the appendix (figure 1 and 2).

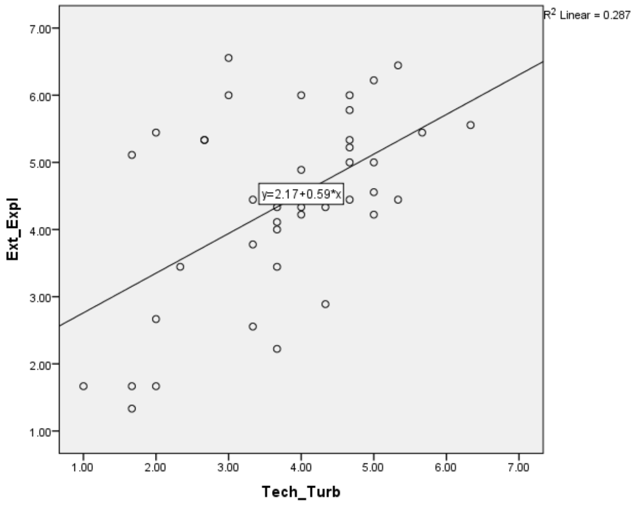
Kendall's tau correlation between technological turbulence and external exploration resulted in 0.375 and tested significantly. And between technological turbulence and internal exploration the correlation resulted in 0.25 and also tested significantly.

The assumptions for GLM were not all fulfilled. Normality was tested by using a Shapiro-Wilk test, rather than a KS-test because it is more suitable when dealing with a sample of smaller than 2000 cases. It resulted 2 of the 3 variables testing insignificant, meaning 2 of 3 are assumed to be normally distributed. External exploration was the variable that tested significant and that possibly has to do with having outlier(s). The standardized residual plot has given reason to assume that the data is not fully homoscedastic. When looking at the graph it seems that at the beginning, it is constantly spread. However, the bigger the values get the less vertical they spread, showing a slight pattern. For the assumption of linearity, the previously used scatterplot gave an unclear linear model. The independence of residuals is fulfilled because the observed companies were not dependent on each other in any when filling out the survey.

R^2 of technological turbulence as an independent variable and external exploration as a dependent variable resulted in 0.287 which means that 28.7% of the variance of external exploration is explained by technological turbulence. R^2 between technological turbulence and internal exploration resulted in a lower result, which is 0.145. In the following two scatterplots, the regression of both relationships are shown and displayed with a linear line. Notice that the bottom graph's line has a steeper climb.



Graph 1: Regression between technological turbulence and internal exploration



Graph 2: Regression between technological turbulence and external exploration

5. DISCUSSION

Despite the fact that the end result of R^2 was rather weak for both relationships, it supports the main hypothesis by proving that technological turbulence has more of a positive influence on external exploration, than it has on internal exploration. Furthermore, seeing that technological turbulence almost explains twice as much as variance in external exploration than internal exploration also shows a satisfactory result when considering the hypothesis.

The finding that technological turbulence positively influences external exploration is in accordance with that external exploration makes firms more prepared for high velocity environments, because it takes less competence for firms to be able to react and deal with the changing situation. (Grimpe & Kaiser, 2010)

The positive influence of technological turbulence on internal exploration is possibly due to the phenomenon when firms are forced to think of first-mover innovations on their own while the industry changes so rapidly (Rosenberg, 1990). Furthermore, it can also be explained by the proposition of Cassiman and Veugelers (2006), stating that besides acquiring external knowledge, it is at the same time important to practice internal R&D and that it should be considered that external and internal exploration are complementary activities. Hence, firms do not solely perform in one of these activities and do nothing about the other. Also, if one activity increases, firms tend to think that is important to also work on the other.

The finding that technological turbulence positively influences external more than internal exploration is in line with Zahra and George (2002).They state that in a dynamic environment, the activity of externally exploring is more useful and more of an advantage than to internally explore due to firms needing to adapt and keep up with relevant and modern technology currently in the market. This is because external exploration is not bound by previous knowledge in the firm like with the case in internal exploration (Garad & Nayyar, 1994). External exploration also presents more flexibility for firms to react faster to change than internal exploration (Ahuja & Lampert, 2001). Lastly, knowledge from internal exploration weighs heavier and is harder to acquire than in external exploration.

6. MANAGERIAL IMPLICATIONS

The results imply the following for managers:
The study proved that the rate of technological change in an industry on its own has quite an effect on the harmony of external vs. internal exploration. When companies find themselves in rapidly changing markets where the products and services constantly renew themselves, they tend to put a focus on external exploration in order to react on time and gain short term benefits. However, when companies are engaged in slow-moving environments, the pressure is lesser and they consider internal exploration the priority and aim for long terms gains. Besides, organizations in mature/stable markets are relatively poorly positioned to use technology for gaining a competitive advantage (Jaworksi & Kohli, 1993).

7. LIMITATIONS & FUTURE RESEARCH

Most complications faced in this study were concerning the data that was used. Due to time-constraints and not receiving the new data on time, it was decided to use the old data set belonging to Marc Zaadnoordijk. Our sample size of only 42 firms represents low statistical power. It becomes difficult to distinguish between a true-effect and just a random variation.

Other issues derived from the data being too little. The size was the reason for some variables not being normally distributed. If there were more cases, they would even out and there would be a bigger possibility that the data would turn out normal. Also, the data did not fulfill all assumptions having to do with correlation or regression. A few examples are that a variable did not display clear linearity or that it was not apparent there was homoscedasticity when looking at the data in a graph. Even though at times assumptions were overlooked and performed anyway, it can give inaccurate data. The one time where assumptions were not overlooked is when it was decided to settle for a non-parametric test. It was preferred to use Pearson’s correlation, but it was not possible due to the measurement level.

Data used for the analysis of the study is data received in 2012. Meaning that in a gap of 4 years, circumstances could have changed which makes the result less true and less relevant for the modern situation. Marc Zaadnoordijk (2012) also mentioned that during and before the time he was conducting his study and collecting his data, an economic crisis was present. This could cause different results in the present tense, seeing as the Netherlands has recovered much from it.

Another problem is the diversity of organizations that make up the sample. First of all, the only requirements were for firms to have an R&D department and more than 100 full time employees (FTE’s). This has made the entry barrier for firms to participate to be quite easy and general. Furthermore, all these firms come from different respective industries and not one fixed industry, making results more random. An example can be that an organization from one industry scores high on one variable and another organization belonging to another industry scores low for the other variable. This evens out the result; however the true result is actually that these firms in different industries are affected differently. The logical action would be to subdivide the sample and different industries. However, the problem still remains that when dividing this small sample, it will result in making even smaller groups that are not worth testing.

Future research should consist of further validating these results with a much larger sample size. This will lead to more accurate results for the study. It is also suggested to conduct similar research, but with different control variables acting as independent variables. In this case, technological turbulence was chosen as an independent variable because it was expected to have a great impact. The variance that it contributed can be considered substantial. However, Marc Zaadnoordijk (2012) found out that in his study, munificence also had a large impact when testing something else. This could be the same if munificence took the place of technological turbulence. The question is then asked: 'What would the effects be of munificence on external and internal exploration?' It would be interesting to see how the other control variables would affect the dependent variables.

8. CONCLUSION

This paper has investigated the effects of technological turbulence on external and internal exploration. It started by acknowledging that the research gap was identified as not much study paying attention to the distinction of external and internal counterparts of knowledge exploration. Thus, technological turbulence was taken as a predictor of the outcome of exploration as it was expected to be influential. The analysis began with testing for reliability and validity and after testing the two separate relationships with regression. Results gave two positive relationships and both tested 'significantly'. It showed a stronger positive relationship between technological turbulence and external exploration, than the relationship between technological turbulence and internal exploration. This was in line with most of the literature and was in agreement with the expected hypothesis. All in all, a richer understanding has been achieved on the topic of knowledge exploration and how the balance of the two types of exploration can be influenced.

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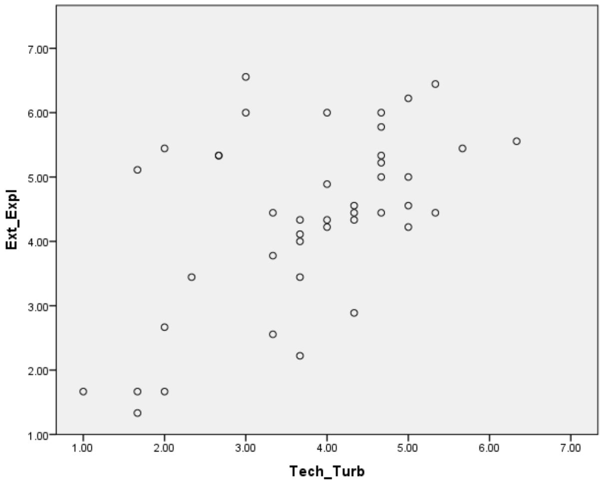
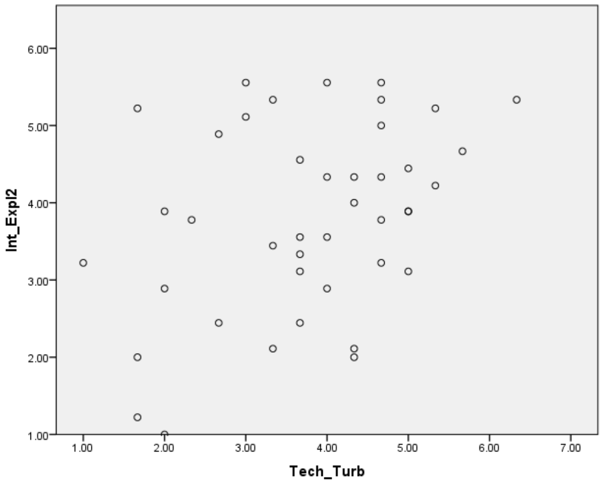
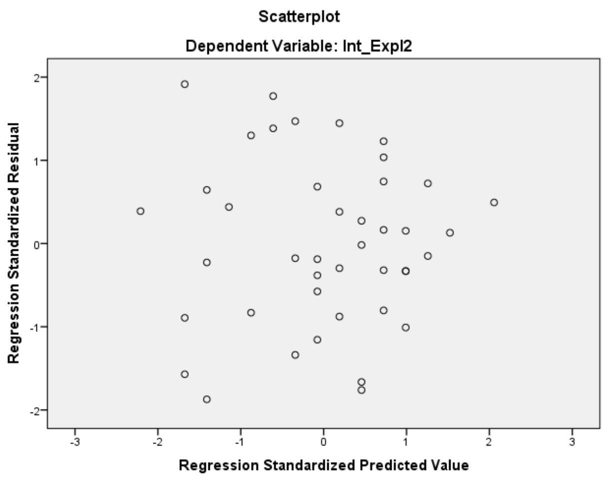
10. APPENDIX



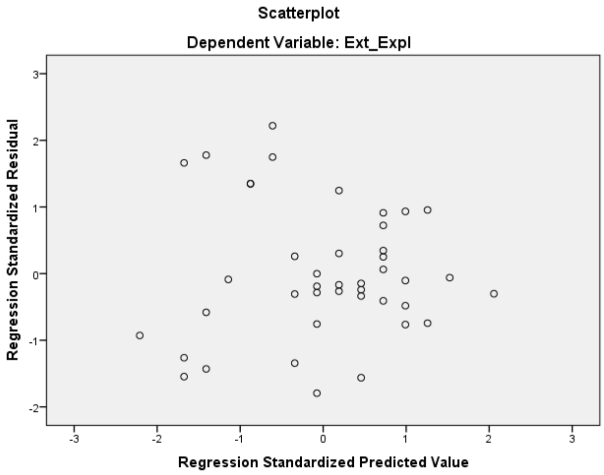
Appendix figure 1: Monotonic relationship between technological turbulence and external exploration



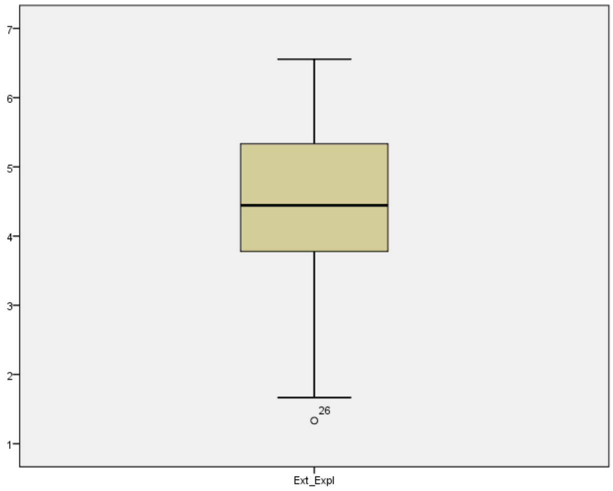
Appendix figure 2: Monotonic relationship between technological turbulence and internal exploration



Appendix figure 3: Standardized residual plot between technological turbulence and internal exploration



Appendix figure 4: Standardized residual plot between technological turbulence and external exploration



Appendix figure 5: Boxplot of external exploration showing outliers

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Tech_Turb	.112	42	.200*	.966	42	.250
Int_Expl2	.077	42	.200*	.958	42	.123
Ext_Expl	.142	42	.034	.938	42	.025

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Appendix figure 6: Normality test Shapiro-Wilk