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The communication of innovation: an empirical analysis of the advancement of innovation

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Philipps-University Marburg
Department of Technology and Innovation Management

Discussion Papers on Strategy and Innovation

Discussion Papers on Strategy and Innovation 13-02

Malte Ackermann

***The communication of Innovation – an
empirical analysis of the advancement
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Abstract

The notion that the word Innovation has been excessively used in various contexts has been stated numerous times, still there is no study which empirically examines this issue. This paper addresses this research gap by utilizing a quantitative content analysis on almost 4 billion documents in the News segment of the Database LexisNexis. The sample period ranges from 1980 to 2010 and altogether encompasses 2,013,143 documents containing the word Innovation. The Augmented Dickey-Fuller test indicates that the time-series data is non-stationary and has to be integrated in order-one. The results of the regression analysis illustrate that the documents containing Innovation of the preceding year significantly predict the next year, indicating past dependencies. The quantitative content analysis showed that the relevance of the word Innovation has progressed by 132.62% from the beginning of the sample period (1980) to the end of the sample period (2010). From 1980 to 1994 the indications of Innovation remained relatively constant around 0.003% of the documents. In 1995 the importance of Innovation apparently begins to rise to the year 2000 when it reaches its peak. In 2001 the indication of Innovation begins to decline slightly again, but advances towards the end of the sample period again. In general, these findings indicate that the word Innovation has been used quite more often within the last decades, reaching its peak of usage around the turn of the millennium.

Keywords:

Innovation, Communication, Quantitative Content Analysis,

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1 Introduction

Innovation is recurrently acknowledged as the source of growth and organizational renewal and regarded as a major source of an organisation's competitive advantage (Schumpeter, 1950; Porter, 1990). Although the literature on innovation as such is vast and covers countless articles on innovation regarding its analysis, its methods, best practices, perspectives, typologies or objectives (Freeman, 1994; John and Snelson, 1988; Rothwell, 1992; Lilien and Yoon, 1989; Van de Ven et al., 1999; Cooper, 1990; Barclay, 1992; von Hippel, 1988; Craig and Hart, 1992; Miles and Snow, 1978). One aspect of Innovation, though, has been studied just by a few authors and mainly in the German speaking literature (Zerfaß/Huck, 2007; Brem et al. 2010; Eberl, 2009, Vetter, 2007): The communication of Innovation. The communication of innovative products, services, technologies or the organization itself is supposed to encompass the innovation process and promote the diffusion of Innovation (Mast et al. 2005).

Still, the communication of Innovation cannot be considered unbiased, since the word Innovation is one of the most often used words in corporate communications as such (Berkun, 2007). It is even said that Innovation as such is one of the most overused words in business and management (Mast et al. 2005, Wall Street Journal, 2012; Pontefract, 2013; Business Week, 2008). Or as Andy Grove, former Chairman of Intel puts it (Jain et al., 2010, p.238):

"The word innovation has become overused, clichéd and meaningless".

But after a comprehensive literature review no empirical study into how the word Innovation has been used or how overused it really is, could be found. This paper therefore addresses this research gap by examining how the word innovation itself has progressed over the last decades and through which channels it was communicated.

This paper is constructed as follows. The literature section reviews the academic viewpoint on the communication of Innovation, the lexical properties as such and the content analysis as a research method in business & management. The methodology section elaborates on the quantitative content analysis as a research method and describes the sample collection. Afterwards the results of this study are displayed. The paper proceeds with a discussion of the results, provides some limitations and implications and comes to an end with a conclusion.

2 Literature Review

2.1 The Communication of Innovation

From a company perspective, the communication of the innovative performance or the innovativeness to internal and external stakeholders serves several functions (Zerfaß/Huck, 2007). To internal stakeholders the communication is supposed to create awareness for innovation matters (Mast et al. 2005), motivate staff (Greg, 2012), create an innovation culture (Benner/Tushman, 2003; Zahra et al. 2000) cross-pollinate ideas and knowledge during the research, development and application stages (Estrin, 2009) and to keep up the employee loyalty or retention (Scott, 2001). The external communication of Innovation aims at the creation of building an innovative image (Zboralski/Gemünden 2009) creating trust between individuals and trust between institutions and industries (Luoma-aho/ Halonen, 2010) to overcome possible fears and concerns regarding novelties or alterations (Zerfaß/Huck, 2007) and to diminish uncertainty among various stakeholders (Fidler/Johnson, 1984; Harri, 2012).

Innovations, especially product Innovation, are sometimes highly complex with a strong degree of abstraction, leading to possible reluctance and constraints from its potential customers, which in turn hampers the diffusion of Innovation (Georgy/Mumenthaler, 2012). The goal of the communication of Innovation should be, to confront all stakeholders, for instance customers and suppliers, from an early stage with the alterations and changes of the innovation as such (Zerfaß/Mößlein, 2009). Mast et al. (2005, p.4) define Innovation Communication as:

“symbolic interactions between organizations and their stakeholders, dealing with new products, services, and technologies”.

Furthermore Zerfaß et al. (2004) state that the communication of Innovation is the systematically planned, executed and evaluated communication of Innovation with the aim to create empathy and trust in the innovation. Moreover, it is meant to position the organization itself as an Innovator. The link between Innovation and Communication has been established earlier though (Ruppel/Harrington, 2000). In general, communication is regarded as a central success factor for innovations (Moenaert et al. 2000; Sivastava/Moreland, 2012; Johnson/Chang, 2000). For these reasons, (corporate) communication serves as an overreaching function that needs to be considered throughout the whole innovation process (Moenart et al. 2000; Nordfors, 2006; Wells, 2008; Conway, 1995).

2.2 The lexical dimension

The development or usage of words as such has been studied intensively (Keil/Batterman, 1984; Metsala, 1997; Halberda, 2003; Rudell, 1993). For instance, frequently used words evolve at slower rates and infrequently used words progress more at a speed (Pagel et al. 2007). The development of words as such concerning its usage and definition has also been addressed by the literature. One example being Gest (2001), he studied the evolution of the word *photosynthesis*. Or for instance Neumann et al. (2010) examine the dynamics of certain buzzwords by analyzing their appearance in internet blogs. Since they cannot assess the true number of blogs, they try to approximate this figure by measuring the number of appearances of the word *the* in blogs across the sample period. They find that the growth rate of buzzwords is exponential and higher than those of the internet blogs, indicating that buzzwords grow faster than neologisms and well-established words. Certain words tend to become popular for a certain life span, therefore most words can be associated with a certain lifecycle (Davis, 2012). This holds especially true for certain concepts, paradigms or strategies within the business and management context (Ketchen et al. 2008; Chaharbaghi, 2007).

Within business and management literature, most research has been devoted to the development of terms or concepts, therefore these studies can be classified as epistemological studies. For instance, Bracker (1980), Evered (1983) or Barney (1997) examine the progression of the *strategy concept* based on varying definitions. Each one of these studies is concerned with regularities among the definitions and afterwards with providing a new synthetic definition. Furthermore, Ronda-Pupo and Guerras-Martin (2012) show how the lexical composition of *strategy* has changed over the period of 1962-2008. They show the growth of internal consistency, the centrality degree of the key terms, e.g. with the most often mentioned nouns being *firm*, *goals*, *process* and *actions*. Furthermore, they show that this development has fostered the emergence of new research topics. Keupp et al. (2011) remark that the state of knowledge or the lexical definition regarding the *strategic management of innovation* is conflicted with theoretical inconsistencies, contradictory predictions and persisting knowledge gaps. They utilize - among other research methods - co-word analysis, suggesting future theory developments and providing decision policies for practitioners.

Content analysis as a research method has been applied by several researchers to Business and Management literature. This study concentrates especially on literature with a technology, R&D or innovation focus, because otherwise it would go beyond the scope of discussion. Most studies that utilize content analysis in this context, examine papers regarding developments of theories and concepts. In this line of research are Papastathopoulou and Hultink (2012) or Page and Schirr (2008), who examine the *New Service Development*, Anderson et

al. (2004) explore the facilitators of *Innovation*, Bargheh et al. (2009) appraise a multidisciplinary definition of *Innovation*, Dahlander and Gann (2010) try to clarify the *openness* in open innovation.

Other researchers who employ content analysis are Droge et al. (2010), who examine the Blogs of lead users and early adopters concerning New Product Development, Gerhard et al. (2011) screen advertisements of high-technology products, Entwistle (1999) analyses the R&D disclosure in annual reports, Albino et al. (2012) study the influence of the adoption of environmental strategies on green product development, Pan and Zhang (2011) measure the innovativeness of product-specific reviews, Ceci and Iubatti (2012) examine the innovation diffusion in SME networks, Howell and Boies (2004) measure the creation and promotion of ideas in the innovation process, Wibon (2001) studies how technology management influences the initial public offering of high-technology firms.

A comprehensive literature review process and a subsequent bibliometric search has not revealed any empirical studies concerning the development of the word *Innovation*. The literature review included the following databases: Business Source Premier, JSTOR, Google Scholar, Microsoft Academic and the International Bibliography of the Social Sciences, Bibliography of Linguistic Literature and the Encyclopedia of Language and Linguistics, yet no similar research approach could be brought to light.

3 Research methodology

This study is supposed to examine a wide range of documents without any prior focus regarding the utilization of the word *Innovation*. Therefore LexisNexis seemed to be a suitable database, since it entails one of the world's largest electronic database for legal and public-records related information (LexisNexis, 2012). In 2013, more than 6 billion documents from more than 45,000 different sources were available. Moreover, LexisNexis provides the possibility of searching and ordering into various media categories.

3.1 Measurement

A quantitative content analysis of the documents concerning the exact citation of the word "Innovation" was conducted. Content analysis as a research method is a systematic and objective technique to describe and quantify phenomena in the social sciences (Downe-Wamboldt, 1992; Krippendorff, 1980; Sandelowski, 1995). Holsti (1969, p.14) provides one of the most mentioned definitions:

“Content analysis is any technique for making inferences by objectively and systematically identifying specified characteristics of messages”.

The quantitative part focuses on preset selected characteristics, such as word frequencies, to ensure a high degree of reproducibility (Neuendorf, 2002; Elo/Kyngäs, 2008). This implies that the method is a reductionist, with sampling and measurement procedures that condense information media to manageable data, from which conclusions may be drawn about phenomena themselves (Riffe et al., 2005). This is based upon the thought that the occurrence of certain words can be important indicators for the identification of hidden agendas and motives (Breton, 2009; Frazier et al., 1984; Landrum, 2008; Rutherford, 2005). Only documents which entailed the exact word “Innovation”, no abbreviation or other alteration were considered for this study.

The data collected represent time series data, which implies that any further analysis requires stationarity of the data (Woolridge, 2009; Lindner, 2009). Stationarity as such means that the joint distribution of a time series is invariant under time shifts (Tsay, 2010; Seddighi, 2000). Consequently, I apply an augmented Dickey–Fuller test, assessing possible stationarity of the data (Kennedy, 2003).

An interesting aspect of time series analysis is concerned with the temporal variation and the past dependencies of the data; in other words: if the data is influenced by data from the past (Turchin/Ellner, 2002; Yaffee/McGee, 2000). A linear regression is therefore executed to investigate if the specified data of one year is predisposed by the past year (Guess/Farnham, 2000). A major problem with times-series data is that the residuals are often correlated with nearby residuals, which is called autocorrelation (Albright et al. 2011; Brocklebank et al., 2003). For that reason, I test for the Durbin-Watson statistics, which controls for autocorrelation (Wang/Jain, 2003; Bajpai, 2010). It is scaled between 0 and 4, where values close to 2 indicate very little autocorrelation. Values below 2 indicate positive and above 2 indicate negative autocorrelation (Baltagi, 2011; Anderson et al. 2009;).

3.2 Data collection

This study focused on the communication of Innovation in different media genres. For that reason, the News segment of LexisNexis was taken into further consideration. The search term was set on *Innovation*, while the option “All English Language News” was chosen. The sample period ranges from 1980 to 2010 and was determined by two factors. First, before 1980, only few articles containing *Innovation* were available. Second, the inquiry function in LexisNexis is limited to 3,000 documents and the smallest period in which the LexisNexis

News query can be set, is on a daily basis. For instance, on the 8th of March 2010, 1,264 documents, containing the word Innovation were in the database. On most days of 2011 there were more than 3,000 documents within the News Segment containing the word Innovation; therefore a comprehensive elevation was not no longer possible. After countless single inquiries, the numbers were aggregated on a yearly basis. Conclusions regarding the real importance or development of Innovation can only be made with the number of the entire documents within the News Segment in mind. Since these figures were not freely available through the inquiry function, the Support Chat was consulted. After sending out dozens of E-Mails only data for the years 1980 - 1997, 2000, 2005 and 2010 were provided by the Support Chat staff. Therefore the missing data concerning the entire documents, had to be approximated. One possibility of estimating missing data, represents the approximation via regression analysis (Karris, 2007; Liengme, 2009). For that reason, multiple regressions via different mathematical functions were applied to the existing data; selected functions and the associated R-squared values can be taken from table 1.

Table 1: Approximation of missing data

Functions	R-Squared Values
Linear	.7844
Exponential	.9836
Polynomial	.9795
Logarithmic	.4212
Power	.8719

The exponential function provided the highest R-squared value with 0.9836. This value is close to 1, which means it is a very close approximation to the actual values (Winston/Albright, 2009; Etheridge 2010). Therefore the missing values (the numbers of the entire documents in the years: 1998, 1999, 2001, 2002 2003, 2004, 2006, 2007, 2008, and 2009) which were calculated by using the exponential function, are suitable for further studies (Wolfram, 2003; Turchin/Ellner, 2002).

In a next step, the documents containing innovation were differentiated and classified into the subsequent media categories: Newspapers, Newswires & Press Releases, Industry Trade Press, Magazines & Journals, Newsletters, Webbased Publications and Blogs. These seven media categories account for over 80% of the entire documents within the news segment. Unfortunately, no figures concerning the distribution of the media categories could be found; therefore no assumption about the relevance or development of innovation within the media categories can be drawn. Only conclusion regarding the channels of communications can be made. The whole data set was compiled from September till December 2012.

4 Results

4.1 The evolution of Innovation

The number of the documents containing Innovation are displayed in the first row of table 2. The second row shows the entire documents within the News Segment, whereas the last row exhibits the percentage of documents within the News Segment encompassing the word *Innovation*.

First of all a huge increase over the entire sample period within the documents embodying *Innovation* and the entire documents becomes easily apparent. In 1980 2,342 documents embodied Innovation, whereas in 2010 this number rose sharply to 273,204 documents. This equals to a tremendous percentage rise of 11,565.41%. Accordingly, a rise within the total documents can be recognized as well. The numbers rise from 633,754 in 1980 to 48,140,865 in 2010, which equals a percentage rise of 7,496.14%. This implies that - regarding the entire sample period - the number of documents containing Innovation has risen much faster than the entire documents within the LexisNexis News Segment. Overall, the content analysis brought to light 2,013,143 documents containing the word Innovation, whereas the News segment entails approximately 3.7 billion documents. This implies that the mean percentage share of the entire content analysis is around 0.0054.

Regarding the relative values, some variations within the numbers can be observed, too. From 1980 to 1994 the numbers range around 0.003% with the lowest value in 1985 with 0.0030% and the highest value with 0.0037% in 1994. In 1995 (0.0051%) the numbers begin to rise constantly, with the minor exception in 1966 with 0.0044%, to 2000 when it reaches its peak with 0.0086%. This is more than double the average values in the years 1980 to 1994, representing a sharp increase. From 1980 to its peak in 2000, the relative importance of Innovation in the news segment has risen about 132.62%. After 2000 the percentage share of documents embodying the word Innovation begins to fall, slowly but constantly. In 2001 it is still high with 0.0083%, but after 2006 the values stabilize around 0.004%. Towards the end of the sample period the values begin to rise slightly again with 0.0057% in 2010.

Table 2: Innovation in LexisNexis – News Segment

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Innovation	2,342	3,007	3,057	3,538	4,392	4,912	5,847	7,111	8,398
Entire Documents	633,754	800,737	894,520	1,132,264	1,185,844	1,614,806	1,812,920	2,186,636	2,453,564
Percentage share	0.0037	0.0038	0.0034	0.0031	0.0037	0.0030	0.0032	0.0033	0.0034

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Innovation	9,300	10,353	12,105	16,356	18,421	23,089	32,000	38,731	52,872	68,123	82,848
Entire Documents	2,832,132	3,469,030	3,735,342	4,664,032	5,190,730	6,293,122	6,234,976	8,790,723	9,867,216	9,267,665	10,631,608
Percentage share	0.0033	0.0030	0.0032	0.0035	0.0035	0.0037	0.0051	0.0044	0.0054	0.0074	0.0078

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Innovation	104,844	116,815	114,249	113,007	128,371	125,382	123,679	144,144	166,888	195,758	273,204
Entire Documents	12,196,285	13,991,240	16,050,362	18,412,530	21,122,343	24,230,966	27,797,092	31,888,052	36,581,089	41,964,810	48,140,865
Percentage share	0.0086	0.0083	0.0071	0.0061	0.0061	0.0052	0.0044	0.0045	0.0046	0.0047	0.0057

In regard to the postulation of stationarity, I have executed an augmented Dickey–Fuller with the Akaike criterion being the default. The results are not able to reject the null hypothesis, the time series is non-stationary. A way to treat this problem is to apply the Dickey-Fuller test on first-difference, which means the data is integrated in order 1 (Woolridge, 2009; Verbeek, 2008). The lag length according to the Akaike criterion was zero, with a maxlag of 10, the results are pictured in table 3.

Table 3: Augmented Dickey-Fuller Unit Root Test

		t-statistic	Prob*	Durbin-Watson
Augmented Dickey-Fuller Test statistic		-3.985	0.004	1.966
Test critical values	1% level	-3.678		
	5% level	-2.968		
	10% level	-2.622		

*MacKinnon (1996) one-sided p-values

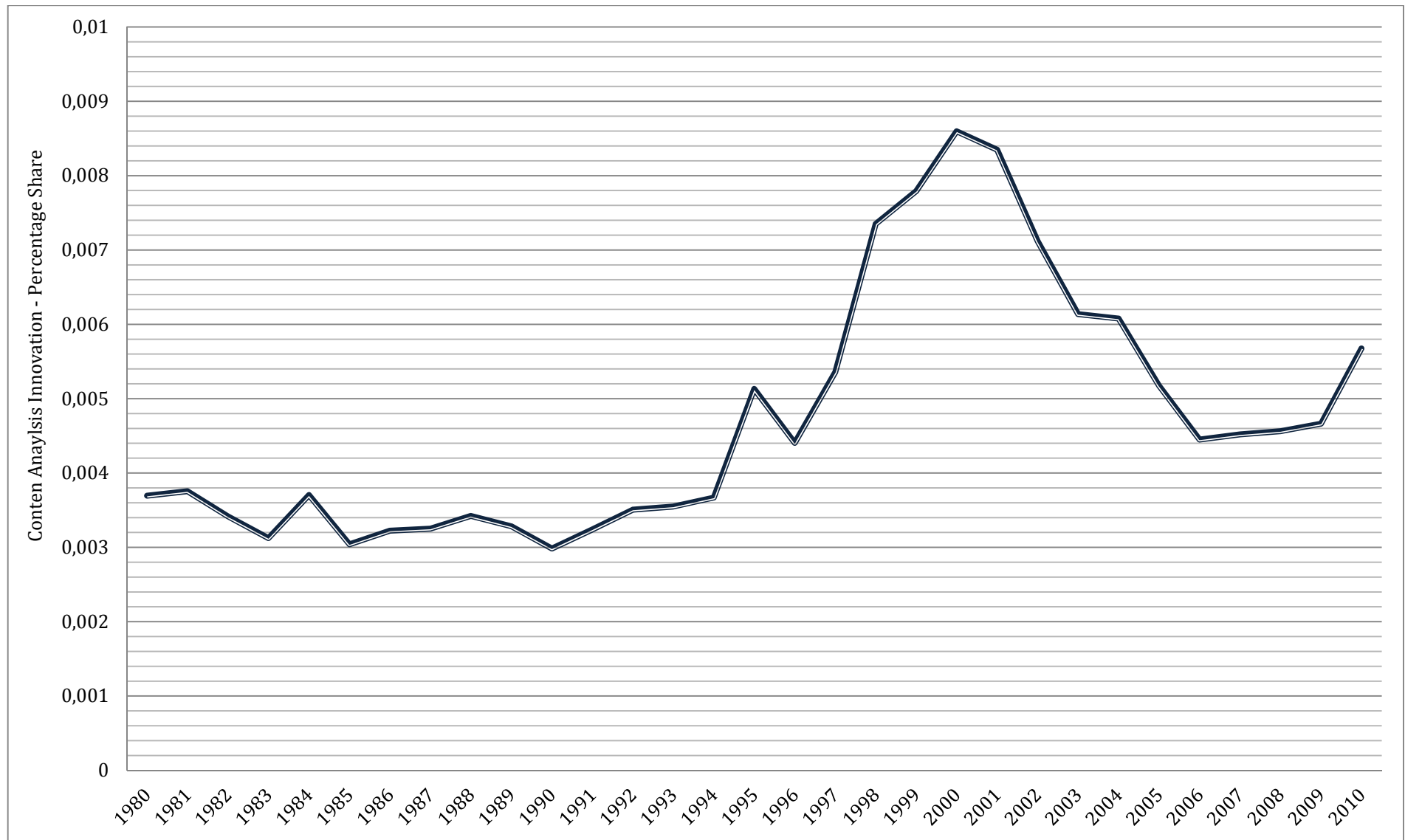
The results ($t = -3.985$; 1% level = -3.678 ; 5% level = -2.968) are sufficient enough to reject the null hypothesis of the Dickey-Fuller test that the times series has a unit root. The results indicate that the first difference of the non-stationary variable is stationary, which means that the variable *per_sh* is integrated of order one. Accordingly, further regressions have to be carried out on variables of the same order of integration (Mukherjee, 1998). Regarding the autocorrelation, the Durbin-Watson statistic (1.966) is close to 2, which indicates that the successive residuals are slightly positively correlated, but are no cause for any concern (Field, 2009; Stamatis, 2012). Regarding the past dependencies of data, I executed a linear regression; the results can be taken from table 4. The dependent variable is *per_sh*, which entails the percentage-share of documents containing Innovation in one year, the independent variable is *per_sh_{t-1}* the percentage-share of documents containing Innovation in the previous year.

Table 4: Model Summary, N = 30; DV = *per_sh*; IV = *per_sh_{t-1}*

R-Square	β	F-Value	T	Sign.
.832	.911	138.743	11.779	.001

The results of the regression indicate that the percentage share of Documents containing Innovation of one year explain 83,2% of the variance of the percentage share of Documents containing Innovation of the next year ($R^2 = .832$, $F(1,29) = 138.743$, $p < .01$). It was found that the percentage share of the preceding year significantly predict the percentage share of the current year ($\beta = .911$, $p < .01$).

The evolution of the communication of Innovation can be comprehended in Figure 1; it easily shows that the usage of the word Innovation reaches its peak around the millennium.

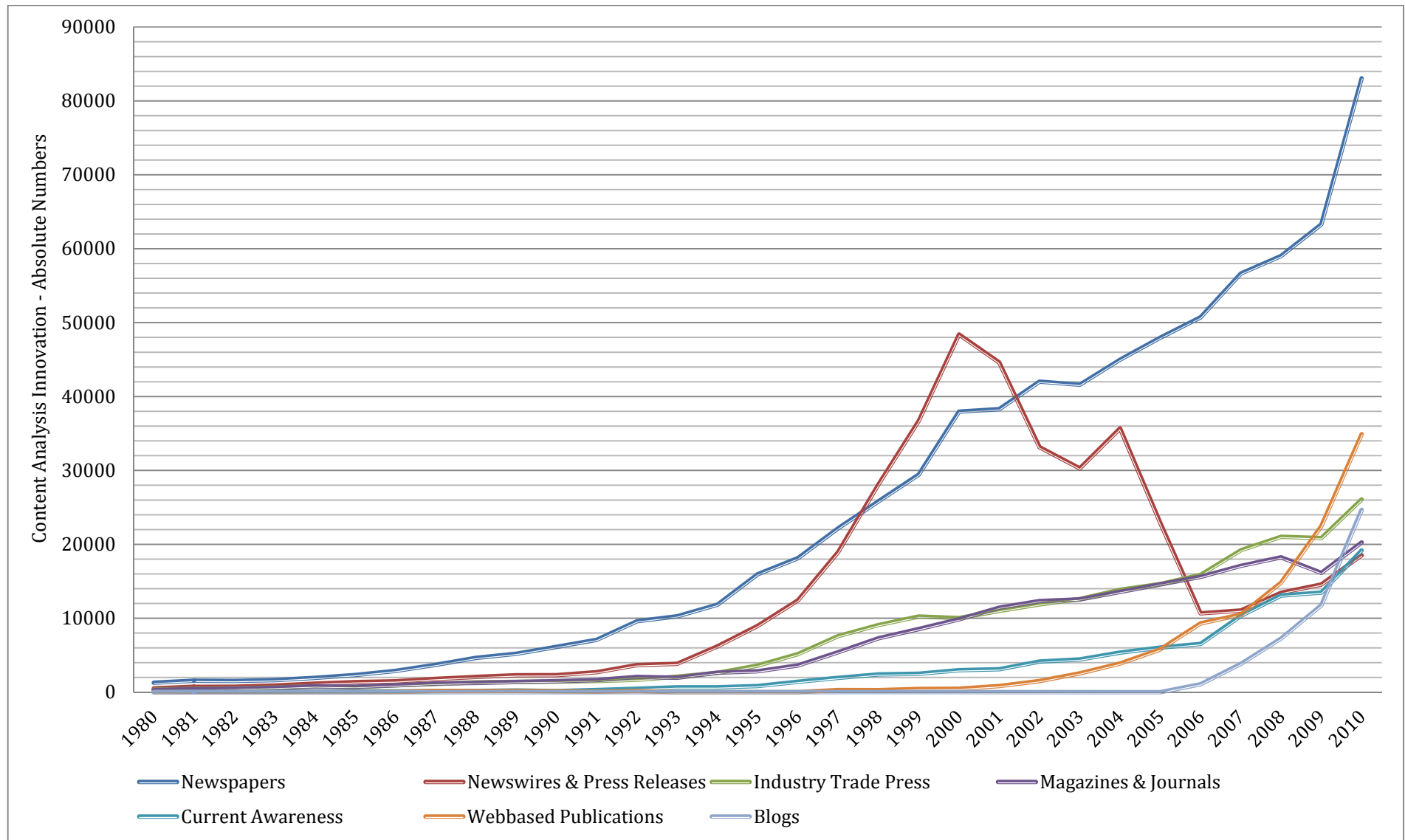
Figure 1: The evolution of Innovation from a lexical perspective

4.2 Communication channels

The results of the quantitative content analysis can also be grouped into seven different media categories: Newspapers, Newswires & Press Releases, Industry Trade Press, Magazines & Journals, Newsletters, Web based Publications and Blogs. According to LexisNexis (2013) the Section Newspaper entails the publishing of mostly daily broadsheet and tabloid newspapers, for instance the London-based *The Daily Telegraph*. Newswires & Press Releases include news agencies which supply or report news to other form of news organization. One example for this category is *Business Wire*. The Industry Trade Press provides information and services especially designed for business, for instance *Reed Business Information*. Magazines & Journals are usually published on a regular schedule such as the weekly *New York*. Newsletters are regularly distributed publications by profit and non-profit organizations, one example being the *Washington Drug Letter* of the US-Food and Drug Administration. Whereas the former media categories described account for the classical offline media, the latter represent the online media content. Web based Publications explicate solely the online appearances of any media, such as *cnn.com*. Blogs consist of online journals and web applications that provide an area for the posting of individual comments and replies.

Figure 2 displays the results of the quantitative content analysis grouped into the above described media categories. The figure contains only absolute numbers, no assertion concerning the progression of the word Innovation can be made, only the distribution of the results are depicted. The curves for all media categories start up very slowly, due to the fact that compared to later years just very few documents could be found in LexisNexis. The major curves represent the Newspapers and Newswires & Press Releases. Most documents can be found in these two categories. Between 1980 and 1984 the curves for all categories are almost nonexistent. In 1985 the curves for Newspapers and to a minor extent Newswires and Press Releases begin to take off. Between 1985 and 1996 most Innovation-related Documents could be found within the Newspapers category. In the years between 1997 and 2001 most documents were identified in the Newswires and Press Releases category. In 2002 this curve sharply declines, receives a little hike in 2004, then declines again and constantly progresses after 2006 constantly. The curves for Industry Trade Press, Magazines & Journals, Newsletters play only minor roles, from 1980 to 1994. In 1995 they begin to rise slowly but steadily, towards the end of the sample period. Concerning the online publications, the Webbased Publications curve begins to rise in 2001, whereas the Blogs begin to gain relevance in 2006 and constantly progress towards the end of the sample period.

Figure 2: The communication channels of Innovation



5 Discussion and Conclusion

This paper studied the utilization and therefore the progression of the word Innovation within the News Segment of the database LexisNexis in the years 1980 to 2010. Furthermore it showed the different communication channels regarding news containing Innovation. It is the first study that empirically investigated the usage and development of (the word) Innovation as such. I showed that there was an enormous increase in communicating Innovation between 1980 and 2010. The utilization of Innovation reaches its peak around the millennium and declines afterwards, just to rise again in 2010.

Literature states that certain concepts, paradigms or buzzwords have a certain lifespan and that their usage varies over time (Ketchen et al. 2008; Chaharbaghi, 2007). Furthermore the word Innovation has been cited as overly used (Pontefract, 2013; Jain et al., 2010). This study showed that this assumption holds true to a certain extent for the late 1990s and early 2000s. But for the 1980s and between 2002 to 2009 Innovation appears to be not as over-used as it has been stated within popular media or academia. Especially in the year 2000 Innovation apparently seems to be a highly prominent word. This finding might be attributed to the fact that around the turn of the century a lot of the media was focused on the millennium itself and was reporting about possible future innovation that were expected in the years to come. Interestingly in the last year of this study, Innovation was gaining momentum again. Unfortunately, the database of LexisNexis is unable to provide searches that could capture the further development, e.g. after 2010.

One constraint of this study represents the focus on LexisNexis, which might bias the findings. Another limitation of this study represents the research design, only the exact match of Innovation was considered; possible variations or abbreviations such as *innovativeness* were not considered. Furthermore, the lack of a comparable benchmark or results from prior studies might impede the possible implications for (corporate) communications.

Future research should evaluate the development of Innovation to other business and managements words, paradigms or concepts, for instance *leadership*, *cost reduction* or *transparency*. Moreover, the current results could be examined with regard to other sources, such as the development of Innovation in for example annual reports or academic journals.

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