

The Importance of Social Media as Source of Information in the Technology Identification in Dependence of External and Internal Factors

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Abstract. Technologies are a key factor in gaining a competitive edge and in ensuring the profitability and survival of a company. Within the last decade a paradigm shift occurred that has placed external sources at the center of identifying technologies. Developments in information technologies have created new external sources of information such as social media, which have enlarged the organizational search field. Social media possess some characteristics which could make them a promising source for technology information. The importance of social media for companies in technology identification has, however, not been examined empirically. This study therefore analyses social media as a source for technological information. The findings of this study show that social media play in comparison to other external sources only a minor role for companies. Additionally, the evaluation of social media does not vary depending on internal or external factors

Keywords: social media, technology identification, sources of information

1 Introduction

Technologies are a key factor in gaining a competitive edge and in ensuring the profitability and survival of a company. Before a company is able to profit from a technology, however, it must become aware of its existence and evaluate its capabilities adequately. Attention to both elements is, however, not always equally and easily given, in particular when technologies are not the result of internal R&D activities but have their origin outside of the organization. Especially within the last decade, a major paradigm shift has occurred that imposes on companies the challenge to consider external sources of information to a greater extent [1]. Chesbrough [2] uses in this context the term open innovation to separate it from the former dominant approach. With the paradigm shift and along its gaining momentum, companies have opened their organizational boundaries (e.g., [1]; [2]; [3]). As a result, search processes and routines have been changed and developed to observe and examine external sources.

Simultaneously, developments in information and telecommunication technologies have created new types of sources. These sources have enlarged the organizational radar and provide relevant information for technologies and technological develop-

ments. Among these sources are social media, which have attracted attention among researchers and practitioners alike. Despite the popularity of social media, research has neglected such media as a source for the identification of technologies. This paper therefore examines the importance of social media in the context of technology identification via an explorative quantitative study.

The paper is structured as follows. A definition of social media is given in section 2. Then the research questions are developed (section 3). Following that, the data collection is described and the operationalization of variables is shown (both in section 4). In section 5, the sample is described. Section 6 contains the empirical findings of the study. The findings are then discussed in section 7, their implications are derived and possibilities for future research are indicated.

2 Social Media

Social media subsumes internet-based applications, platforms and other media which aim at enabling the creation and exchange of content, interactions and collaborations among users [4]. Different studies have proposed classification schemes to clarify the meaning of social media and contribute to a common understanding and definition. Kietzmann et al. [5] suggest, for example, that social media be classified according to identity, conversations, exchange, presence, relationships, reputation and groups. The BDW e.V. [6] developed new “Guidelines for Media Type Classification” in order to facilitate the characterization and categorization of social media types for monitoring and analysing purposes. Within these guidelines the essence of social media is defined by the given context and is dependent on the respective subject area. Kaplan and Haenlein [7] point nevertheless to a misunderstanding among researchers and practitioners with regard to what is included under the umbrella term social media. As a consequence, blogs, wikis, podcasts, pictures, video platforms and social bookmarking are seen as expressions of social media. Research on the use of social media has been conducted mainly in marketing and has examined the impact of social media on a company’s brand reputation ([8]; [9]). The role of social media as an external source of technology identification has not attracted the attention of scientific researchers.

3 Research Questions

In the context of technology identification, social media are just one possible source. Previous research has highlighted the importance of customers [1], suppliers [10], trade shows, patents [11], magazines, own market research [12], third-party market research, universities [13], blogs [14], trend scouts [12], competitors [15] and the internet. The importance of social media has thus to be examined individually and according to its position relative to these given and established sources. Research question 1 therefore asks:

Research question 1: How are social media evaluated as a source of information for technology identification in relation to other sources and individually?

The importance of social media can be influenced and determined by external and internal company-specific factors. Regarding external influences, research has pointed to the role of technology turbulence [16]. Technology turbulence mirrors the extent to which technology in an industry is in a state of flux and to which a technology offers the possibility to create a competitive advantage. Companies operating in a business environment that is characterized with high technology turbulence, have thus to cope with the necessity of exploring and exploiting technologies quickly. Social media is often associated with up-to-date information and with possibility to access this information without much temporal delay. The evaluation of social media could subsequently be different according to the level of technology turbulence a company is confronted with.

Research question 2a: Do differences exist in the evaluation of social media with respect to technology turbulence?

Regarding internal company-specific factors, scanning and search alertness, number of employees, revenue, product range, range of main technologies and research intensity are examined in this study. Scanning and search alertness mirrors a company's vigilance towards new technologies and developments [17]. A higher alertness could thus result in a distinct evaluation of social media.

Social media are in general seen as a low-cost means of gathering relevant information. Small and medium-sized enterprises in particular could value social media higher than large companies do. The evaluation of social media could thus be influenced by the size of a company [18]. Number of employees and revenue generated are common features for classifying a company's size.

Products consist of a bundle of embedded technologies, of which the main technologies enable differentiation. These technologies can be seen as core capabilities [19]. The more a company has to cope with a broader product range and (subsequently with) different main technologies, the more search and scanning efforts have to be invested to ensure competitiveness. This higher necessity could result in a higher appreciation of social media, as it enlarges the search field and can offer cost-effective immediate access to new information.

The allocation of financial resources reflects the importance of specific functions for a company. Research intensity mirrors as a consequence the value of innovation activities for an organization. The more a budget is spent on R&D, the higher innovation is valued within an organization. Simultaneously, research intensity is seen as a proxy for the ability to evaluate the value of new information, integrate it into the company and commercialize it [3]. Research intensity could hence lead to a different evaluation of social media as a source of information. For these reasons, the level of research intensity could lead to a different evaluation of social media as source of information.

Taking these aspects into consideration, the following research questions are raised:

Research question 2b: Do differences exist among companies in the evaluation of social media with respect to scanning and search alertness?

Research question 2c: Do differences exist among companies in the evaluation of social media with respect to number of employees?

Research question 2d: Do differences exist among companies in the evaluation of social media with respect to revenue generated?

Research question 2e: Do differences exist among companies in the evaluation of social media with respect to the existing range of products offered?

Research question 2f: Do differences exist in among companies the evaluation of social media with respect to the spectrum of main embedded technologies?

Research question 2g: Do differences exist among companies in the evaluation of social media with respect to research intensity?

4 Data Collection and Operationalization

For the purpose of this study, a web survey was chosen as a research instrument. The compilation of the web survey was based on the requirements proposed by Schonlau et al. [20] in order to ensure a user-friendly design. The questionnaire was further-more designed to fulfill the criteria of clarity, clearness and simplicity. The questionnaire was pre-tested by two PhD candidates and one postdoctoral fellow. The survey was conducted between June and August of 2013. The selection of respondents was conducted in a manner to ensure that participants possessed the required knowledge. Additionally, a filter question was embedded in the questionnaire to improve further the selection of appropriate respondents after the survey was completed. As a result, 178 responses could be used for the analysis of this study.

The selection of topics covered and the formulation of questions were based on an extensive literature review and were orientated according to existing surveys in this field. As the role of social media as a source for technological information was examined in this study, several influential factors were included in the questionnaire: technological turbulence, scanning and search alertness, number of employees, revenue generated, product range, range of main technologies and research intensity.

Technology turbulence was measured with the five items of Jaworski and Kohli [16]. A 7-point scoring format (1=strongly agree to 7=strongly disagree) was employed for all items in the questionnaire, which was re-coded in the course of the evaluation (1=strongly disagree to 7=strongly agree). The Cronbach alpha of this construct is higher than 0.7. In order to allow a comparison of companies with respect to their technology turbulence, a new ordinal variable was created according to the level of agreement, categorizing technology turbulence into no technology turbulence (range: 1-1.49), low technology turbulence (range: 1.5-3.49), medium technology turbulence (range: 3.5-4.49), high technology turbulence (range: 4.5-6.49), and very high technology turbulence (range: 6.5-7).

Scanning and search alertness was measured with an adjusted scale which was originally developed by Tang et al. [17]. A 7-point scoring format (1=strongly agree to 7=strongly disagree) was employed for all items in the questionnaire, which was re-coded in the course of the evaluation (1=strongly disagree to 7=strongly agree). Afterwards, the items were summed up and this result averaged to obtain the mean value of the construct. The Cronbach alpha of this construct is higher than 0.7. Based on the calculation, a new ordinal variable was created, categorizing scanning and

search alertness into none (range: 1-1.49), low (range: 1.5-3.49), medium (range: 3.5-4.49), high (range: 4.5-6.49), and very high (range: 6.5-7).

Number of employees and annual revenue were measured with closed-ended questions and afterwards grouped together under the following categories: fewer than 50 employees, 50 to fewer than 250 employees, 250 to fewer than 1,000 employees, 1,000 to fewer than 10,000 employees and 10,000 and more employees. Regarding revenue, the following categories were constructed: less than 5 million EUR, 5 to less than 50 million EUR, 50 to less than 250 million EUR, 250 million to less than 1 billion EUR, 1 to less than 10 billion EUR and more than 10 billion EUR.

Research intensity was measured via the average amount spent annually for research in relation to revenue. Accordingly, respondents had to answer the question “What percentage of annual revenues does your company spend on average per year on R&D?” Three reply options were given: less than 3.5%, more than 3.5% but less than 8.5% and more than 8.5%.

Range of products was measured originally with a semantic differential using a single-product company (1) and a multiple-products company (7) as the ends of the continuum. In the course of the evaluation, the responses were grouped as follows: single product (answer option 1), small product range (answer options 2 and 3), middle product range (answer options 4 and 5) and big product range (answer options 6 and 7).

Similarly, respondents could choose within a semantic differential between one main technology (1) and many equally important main technologies (7). Answers were also grouped afterwards into the following categories: one main technology (1), small technology range (answer options 2 and 3), middle technology range (answer options 4 and 5) and big technology range (answer options 6 and 7).

Social media illustrates one possible source of technological information in technology recognition. To gain insight into the research behavior of companies, a list of potential sources was presented to respondents. Participants were asked “Please indicate the importance of the following sources in technology identification” and could evaluate 14 pre-defined sources and add two additional sources if appropriate. Suppliers, professional magazines, trade shows, customers, consulting agencies, patents, social media, a company’s own market research, third-party market research, universities, blogs, trend scouts, competitors and the internet comprised the given sources. A 7-point scoring format (1=very high importance to 7=without importance) was employed for all items. To ease the interpretation of the findings, the responses were recoded in the course of the evaluation (1=without importance to 7=very high importance).

In order to identify possible differences in the evaluation of social media as a source of information in technology identification, the non-parametric Kruskal–Wallis test, in which more than two independent group variables can be compared.

5 Description of the Sample

The largest group of companies operates in the sector of mechanical engineering (27.7%), followed by companies focusing on IT, electronics and optics (22.6%),

automotive industry(9%), plant engineering (7.7%) and other industries (33%). Companies considered in this study are maneuvering through a competitive environment which is characterized by the majority of respondents as one with a high level of technology turbulence. Companies face as a consequence a high necessity to develop new technologies to ensure competitiveness and increase their competitive advantage. Simultaneously, scanning and search alertness is evaluated generally as high. Only a minority of companies rate their alertness as low or medium. Participating companies have on average 250 to less than 1,000 employees with a mode of more than 10,000 employees. They generate on average revenue of 250 million to less than 1 billion EUR. The mode is from 5 to less than 50 million EUR and the expenditure on average is between 3.5% to less than 8.5% of revenue for R&D.

Regarding product and technology range, companies have on average a medium spectrum of products and main technologies. The numeral biggest group among the participating companies has a high product and technology range (see Figure 1).

6 Findings

Research question 1 examines the importance of social media as a source of information in identifying technologies. Therein, it is necessary to examine the importance of social media both individually and in relation to other sources.

A clear hierarchy is revealed in the evaluation of sources. Respondents assess nine sources as highly important or at least medium important. Customers are seen as the most valuable source for identifying new technologies, followed by competitors and own market research. Trade shows, suppliers, universities, Internet, magazines and patents are also evaluated in average as important. Five sources have a value below four and are subsequently perceived as less or even as unimportant. Social media belongs with a value of 2.9 to group at the bottom of the list together with consulting agencies, 3rd party market research, social media, trend scouts and blogs (see Figure 2).

Other sources, which have been added by respondents are seen in average as important. Respondents mention here for example venture capital, contingencies, economic development schemes, or contact to new ventures.

Research questions 2a–2g examine whether differences related to external and internal factors exist among companies in the evaluation of social media as a source of information in technology identification.

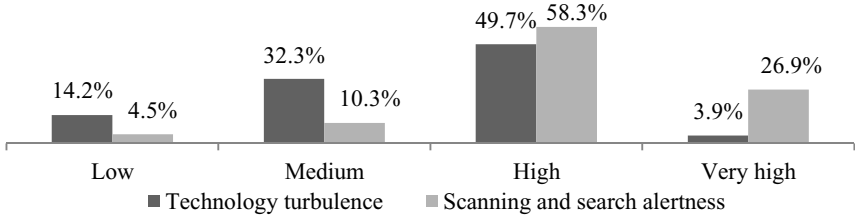
Research question 2a focuses on technology turbulence as an external factor. The Kruskal-Wallis test showed that no difference among companies exists depending on the degree of technology turbulence they experience.

Scanning and search alertness describes the first internal factor, which is examined in research question 2b. The evaluation of social media as a source of information is not dependent on general scanning and search alertness. All companies considered in this study evaluated social media similarly irrespective of their alertness.

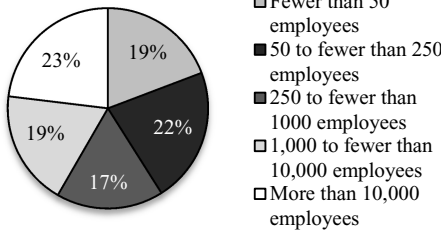
Research question 2c examines whether the number of employees affects a company's perception of social media as a valuable tool. The Kruskal–Wallis test also identified no differences among companies in this respect.

Revenue generated describes the third internal factor that could have an influence (research question 2d). Similar to technological turbulence and number of employees no significant difference can be identified.

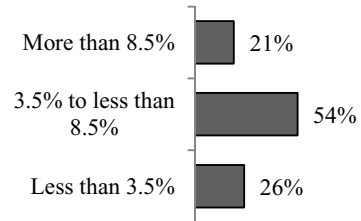
Technology turbulence (n=155) and scanning and search alertness (n=156)



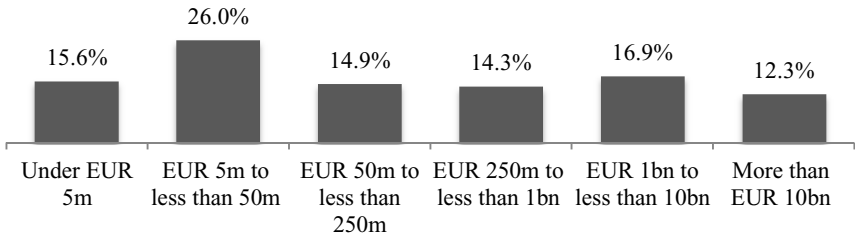
No. of employees (n=156)



Research intensity (n=132)



Revenues (n=154)



Product and technology range

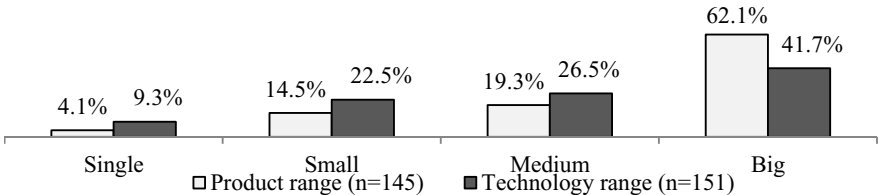


Fig. 1. Characteristics of participating companies

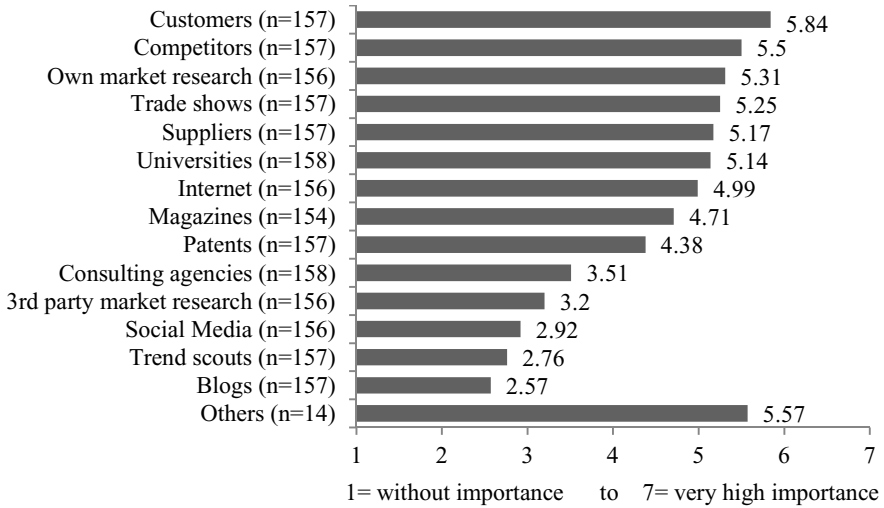


Fig. 2. Relative importance of social media as source for the technology identification

Research question 2e focuses on the possible effect of a company’s range of products on the value of social media as a source of technological information. Within this study no significant difference can be found.

The range of main technologies used by companies could also influence the assessment of social media (research question 2f). The findings of this study indicate, however, no differences that are statistically significant.

Research question 2g places differences with respect to research intensity into the center of analysis. According to the Kruskal-Wallis test no significant difference exists among participating companies with respect to the research budget (see Table 1).

Table 1. Statistical findings to differences among companies

Kruskal-Wallis test results				
	Technology turbulence	Alertness	No. of employees	Revenue
χ^2 value	5.972	3.840	5.472	4.813
p.	.113	.279	.242	.439
df	3	3	4	5
	Range of products	Range of technologies	Research intensity	
χ^2 value	2.632	1.949	1.091	
p.	.452	.583	.580	
df	3	3	2	

7 Discussion, Implications, and Future Research

The findings of this study demonstrate that social media play only a minor role in technology identification and that companies share this evaluation irrespective of external and internal factors. These results can be interpreted in three ways. The first explanation focuses on the stage of development of social media. Sources undergo in general an evolutionary process in which dominant and acknowledged sources emerge over time. Bearing in mind the newness of social media, they could still be in a state of development in which some sources are missing or have not reached a sophisticated level yet. Companies should therefore monitor the development of social media. Future research could examine the state of development of social media and could help companies identify streams in social media which seem to be especially promising for technology identification.

The second explanation is closely linked to the first. When sources are new and still in the early phase of development, the credibility of existing sources is low, or is perhaps evaluated as low, even if the available information is highly accurate [21]. Schmitt and Klein [21] point also to the uncertainty of complex information. In cases where different facets of data have to be integrated, people could be overstrained by or not prepared to cope with the available and perhaps fragmented data. Future research could examine whether and to what extent these aspects are present with respect to social media.

While the first two explanations concentrate on the source of information, the third draws attention to established routines in companies. Companies gain experience and knowledge over time of how to identify technology in external sources. This leads to the improvement of search procedures and processes [22]. At the same time, the spectrum of potential activities can be reduced and can lead to inertia in the exploration of new sources [23]. Companies have to examine whether and to what extent this situation is present and initiate processes that enable them to overcome hindering routines. Future research could examine the level of existing impeding routines in companies with respect to social media and could identify approaches to overcome these hindrances.

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