No Outstanding Surprises when Using Social Media as Source for Weak Signals?

First Attempt to Discuss the Impact of Social Media Sources to Detect Surprising Weak Signals

Robert Eckhoff, Mark Markus,
Markus Lassnig, and Sandra Schön
Innovation Lab
Salzburg Research Forschungsgesellschaft
Salzburg, Austria
markus.lassnig@salzburgresearch.at

***Abstract*—Enterprises as well as research institutions are interested to find very early signs for future trends, disruptions or other emerging big changes. Such "weak signals" may also be detected within user-generated social media content. Information technologies support searching, analyzing and interpreting social media data. According to our experiences with an approach called "innovation signals", none of our detected weak signals was an outstanding surprise for our industry partners. Within this paper, we try to validate these experiences with a look into weak signals theory, and whether similar experiences can be found in the extant literature. While we were not able to find conclusive evidence that our conclusions are common (or that they are not), we present a set of possible explanations of this phenomenon. Our paper has to be seen as a first discussion of the topic, which should be a first step to validate researchers' experiences and to initiate a potentially controversial discourse about it.**

Keywords-Weak signals; detection; innovation; surprise; criteria.

I. INTRODUCTION

Weblogs, discussion forums or mailing lists are seen as a worthy and relatively accessible source for trend research. At Salzburg Research, we developed an approach to detect "weak signals" [1]. Weak signals are find very early signs for future trends, disruptions or other emerging big changes. According to theory, weak signals may also be surprising. Our approach of weak signals detection is a combination of computer-supported analysis and social scientific interpretation that uses social media content as source of primary data. This approach, called "innovation signals", was used to get insights into three branches from industry partners [2] [3]. Whereas the feedback and customers' satisfaction was very good, the involved researchers still got the impression that their results were no big surprises for their customers respectively industry partners. Within this paper, we will analyze if other researchers in social media make similar experiences and how this phenomenon might be explained. If it is common that "weak signals" are not surprising, this should be influence theory of as well as counseling in weak signals detection.

Within this paper, we try to validate our experiences with a look into weak signals theory, and whether similar experiences can be found in the extant literature. Our paper has to be seen as a first discussion of the topic, which should be a first step to validate researchers' experiences and to initiate a potentially controversial discourse about it.

II. DETECTING WEAK SIGNALS WITH SOCIAL MEDIA

"Weak signals" are seen as potentially important signs for future developments with big impact on companies. According to Ansoff, weak signals are "imprecise early indications about impending impactful events" [1]. All that is known, he proceeds, "is that some threats and opportunities will undoubtedly arise, but their shape and nature and source are not yet known." Compared with other levels of knowledge about the future, weak signals are the vaguest and possibly earliest kind of information, especially compared with "drivers" or even "trends" [4]. Being able to recognize such weak signals for future trends and developments might be a chance: Organizations can use the time for management decisions concerning innovative adaptations or new developments within the firm, the product or any other impacted unit. The collection and detection of weak signals could "be a key to anticipating change in advance and avoid letting them cause surprise" [5], see Figure 1.

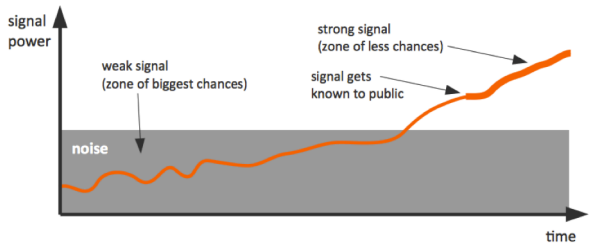

Figure 1. Evolution of a weak signal, building upon Coffman [7] and Steinmüller [20]

A very common approach towards weak signals detection is the use of social media content as a source. Social media are Web tools and services that allow to communicate, to collaborate, and to share information. For example, social networks, discussion forums, Wikis, Weblogs or mailing lists are such applications. Within social media customers, colleagues, experts and others discuss

 ISBN: 978-1-61208-381-0

brands, products and services, or related topics and issues. Therefore, social media is not only a way to share and discuss online, but also a good source for research and strategic planning. Information technologies support searching, analyzing and interpreting social media data. Typically, but not always, computer analysis supports the detection of weak signals [6]. This is especially illustrated in a comparison of about 20 social media monitoring tools with regard to their applicability for detecting weak signals [7].

In theory, relatively vague and new topics should pop up when detecting weak signals, but in our experience we did neither find surprising new trends nor previously unknown weak signals. Customers and experts within our search fields were satisfied with our results and were happy with facts, figures and illustrative content (e.g., citations), but we could not detect genuinely surprising weak signals for them.

III. RESEARCH QUESTION AND DESIGN OF (FIRST) RESEARCH

Within this contribution, we are interested in whether the limitations we experienced are limited to our approach of detecting weak signals using social media or whether this is a more common phenomenon that we share with other researchers in the field, i.e. whether the problems we encountered are general problems of the research field. Additionally, we try to find explanations for this phenomenon and thus, we try to find answers to the following questions:

- Did others have similar experiences with no outstanding surprises when using social media as a source for the detection of weak signals?
- If this is the case, what are potential explanations for this phenomenon?

This contribution is not a comprehensive study but a first step into a topic that could influence the understanding and practice of weak signals detection in future, if others support our impressions and argumentation. Therefore, we aim to get feedback and to initiate further discussion.

In the following, we will give insights into our first desktop-based research and considerations about our experiences. To start with, we discuss if according to the theory weak signals should be surprising or not. Building on this, we will describe our own setting and the experiences we made with the detection of weak signals. Then, we will present our results of similar experiences we found in the literature. This is followed by a first set of explanations of this phenomenon. Our paper is meant as a first discussion of the topic, which might be of broader interest for researchers in the field.

IV. SHOULD WEAK SIGNALS SURPRISE? WHAT THE THEORY SAYS

According to Coffman [8] weak signals may also be surprising: They are "new and surprising from the signal receiver's vantage point (although others may already perceive it)". Additionally he wrote that weak signals are often "scoffed at by people who 'know'" [8]. Both citations can be seen as an explanation, that weak signal may be a surprise (or at least have to be for some), but that does not mean that experts should be surprised by every single detected weak signal. Also, Ilmola and Kuusi see the potential of surprise when they see its bounding to "surprise value": "We can define that the information content of a signal or new information produced by it depends besides on the relevance of the signal also on its surprise value to the actor" [9, p. 913]. The potential to surprise, "because they are new and even surprising" "can break our prevailing mental models and encourage us to think differently" [5, p. 7]. Kuosa even directly associates weak signals with surprises in his current summary of weak signal detection: "In contemporary futures studies the term weak signal refers to an observed anomaly in the known path of transformation that surprises us somehow" [10, p. 22].

Surprises are also mentioned in weak signals theory as argument why weak signals detection is important: "Collecting and analyzing weak signals could be a key to anticipating changes in advance and avoid letting them cause surprise" [7] [similar 11].

Nevertheless, this explanation does not give a ratio of surprising weak signals or their level of surprise for industry experts. But from the theoretical base it is clear that weak signals should at least have the potential to surprise.

V. THE CONTEXT OF OUR EXPERIENCES: INNOVATION SIGNALS WITHIN SOCIAL MEDIA

In this part, we introduce the background of our experiences, the research project "innovation signals" in order be able to compare it similar approaches [2] [3]. The approach of innovation signals and the technology was developed and used within the project "Innovation Signals – Development of a Social Web Innovation Signals Amplifier System", funded by Austrian Research Promotion Agency.

A. The approach of "innovation signals"

The concept called "Innovation Signals" exploits user-generated content for strategic innovation purposes by combining quantitative data mining [12] and qualitative methods. The Innovation Signals research approach does not rely on technology alone, but unfolds in the development of social media mining technology in unique combination with an interpretative methodology. The process is described as follows.

a) Set-up: The set-up of Innovation Signals research mimics the traditional research design of empirical social science. The main goal is to formulate research hypotheses and define conceptual search terms, which contain between 20 and 50 English and German keywords. Then, 40 to 50 publicly accessible social web sources (forums, communities, blogs, newsgroups) are identified and quickly assessed, according to a catalogue of criteria (e.g., quality of contents, length of contributions, intensity of contribution).

b) Detection and monitoring: The social media mining-based technology provides automatic detection of relevant keywords and topics of interest in sources selected beforehand. It first extracts a large amount of user posts

 ISBN: 978-1-61208-381-0

(e.g., 200,000 posts) and then, automatically detects emerging keywords, topics and sentiments from compiled discussions and users' publicly available opinions.

The Innovation Signals technology provides answers to the questions in the context of product development and trend detection such as: How do users talk about existing products? What are critical issues? What issues are discussed very intensively? What are emerging topics? How do topics change over time? The technology enables experts to analyze and interpret detected innovation signals in an easy and intuitive way and also, to save the most important posts for additional manual analysis and coding.

c) Identification and contextualisation of innovation signals: The automated analysis of textual content enables an efficient information processing, but the machine-processed information still remains ambiguous. In order to enable effective research, the interactions in the social web must be structured additionally and analyzed with social science methodology. This means to associate user generated content with relevant statistics, trends and theories to amplify the meaning of the information and to understand the consumers' conversations better and in a broader context.

d) Translation into business opportunities: This phase of the research process utilizes user generated content (in close co-operation with customers/companies) as an additional information source for strategic decision making with regard to the kind of innovation (product, process, business models, strategic innovation fields) to be pursued in order to determine the focus of the product innovation and market strategies and/or to detect new markets and new ideas.

B. No outstanding surprises with"innovation signals"

Three bigger and some smaller practical use cases were delivered within the project "innovation signals" – for different branches and industry partners. Fields of application were the skiing industry, car mobility, and the energy sector.

The general feedback in all three use cases was that our customers said that the results do not surprise them, but rather support their hypotheses. For instance, the social media mining project for a large automobile service provider showed that drivers are increasingly dissatisfied with the costs of mobility. However, this observation did not qualify as groundbreaking news to our client. The analysis in the energy sector could after major contextualization deliver at least some food for thought as we could show that the customer journey towards a solar panel on the roof was paved with negative experiences that an energy provide could relatively easily provide its customers with. Finally, the analysis conducted in the realm of the skiing industry was able to identify some features that users would look for when reviewing new skiing products. However, even though this last analysis was by far the most specific, the results failed to surprise our customer.

Readers might wonder, when and why we came to the conclusion that our research did not result in outstanding surprises for our customers and partners. When we tried to develop guidelines for others that are interested in social media mining for innovation purposes, we quickly realized that in nearly all cases the expected surprise was not reached. One of our most important guidelines, delivered through an expert discussion, is: "Do not expect outstanding surprises" [13]. After writing the respective paper, we wanted to know more about this experience, resulting in this contribution.

VI. ARE OUR EXPERIENCES INDIVIDUAL OR COMMON?

Are we alone with our experiences? Might our impression be a fault, misinterpretation or artifact?

Within our analysis of approaches for the detection of weak signals we read all publications available to us on the topic. When reading them, we did not recognize any hints that detected weak signals produced surprising results. Moreover, we failed to find that detected weak signals were surprising at all. To validate this impression, we took a set of current papers with a concrete description of weak signals detection by social media mining [7] [14] and other methods [9] [15] [16]: None of them reported surprising results or surprises when presenting results to the final customer.

We searched within literature databases like Google Scholar and Sciencedirect for "weak signals" and "surprise" and found a long list of hits; most of them refer directly to the idea that the detection of weak signals is seen as a strategy to prevent surprises for enterprises. We scanned all abstracts and where possible (via open access), the papers as such for clues of finding surprising results from weak signals detection.

To sum up, our literature review did not find any statement or even study result that the detection of weak signals produced surprising results or respective surprising weak signals. Of course, this might not be sufficient evidence to argue our point, as "surprise" is not a typical criterion to measure research's quality. It would not be very common in a research paper to address customers' surprise about the research results.

Nevertheless, given that "finding surprising insights" is one of the hallmarks of weak signals detection, the lack thereof in the empirical literature is indeed surprising to us. After reflecting and discussing the issue and other contributions within the field, we decided to try and spark off the debate, even if at this point in time we cannot supply conclusive evidence that our impressions holds true for all other efforts to detect weak signals as well.

VII. POTENTIAL EXPLANATIONS FOR THIS PHENOMENON

We are not able to present a good empirical base or data about our impression of a very small (if any) rate for outstanding surprises when detecting weak signals within social media. Nevertheless, we try to collect some explanations for this phenomenon.

 ISBN: 978-1-61208-381-0

A. Characteristic of noisy social media and limits of current mining approaches

Per definition, weak signals are normally hidden in the "noise of the daily produced data" [7]. Typically, weak signals in social media are tricky to detect. Approaches from social media mining typically use combinations of clustering approaches as well as counting algorithms, eventually using semantic analysis, in addition. Following this, singular postings with differing content cannot be detected. Every new topic or issue must be mentioned and discussed from more people within a certain time span, before the approaches might be able to detect such signals. Therefore, even "weak signals" must surpass a threshold, measured as a certain amount of people or postings, to get recognized as "weak signals". Within other approaches and sources, where "weak signals" for example are collected manually as very astonishing or annoying stories of individuals, the potential to detect a single story is potentially given [17]. With data mining approaches and social media as source the probability to find a completely seldom or new incidence seems not possible due to the sheer amount of signals so detected.

B. Filters may avoid the detection of surprising weak signals

So far we did not succeed in automatically filtering those signals that are new and relevant to our context. It is not only complicated to detect such weak signals in the noise, but also to keep and amplify them (i.e. the "real weak signals") for use in a final conclusion to the client. Which of the hundreds of signals is the weak signal that anticipates a future trend? Presenting the client with all possible weak signals isn't a good option (we actually tried this), nor is picking a few that "look promising" good scientific practice. Already Coffman described the issue of "people who 'know'" that scoffed at weak signals [12].

Additionally, "cognitive filters" influence the final detection of what is coined as "weak signals" and which weak signals might be overseen. Ansoff named mental filters that influence the realization of weak signals within enterprises: The "surveillance filter" focuses on special parts of the environment which might deliver data and the "mentality filter" is responsible for the selection that comes to perception in a firm. The third filter, the "power filter" might be the influence of managers that purposely neglect information. As described and empirically shown in [1], such mental filters can be influenced by the setting. Filters can be opened by "virtual process, open question and anonymity" (p. 919). The filters can be deepened through "focused scope, close to the current strategy, strong requirement for plausibility and probability in the social interaction process" and others [1, p. 919].

C. Our customers are experts, not newbies

Typically, customers of weak signals detection are experts. Hence, they of course hear a lot around their key topics, they are aware of all the things going on in their main field of interest. Their wish to detect "weak signals" seems to be driven by their interest in getting more factual knowledge, deeper insights and first figures about the development of topics etc. They want to be the first to know. Of course, their expertise limits the potential of surprise.

Another point that might influence the impression, that customers are not surprised by the found weak signals, might also be explained by a cognitive bias: If I am an expert, I should already know everything (see hindsight bias [18]). Further work might be aware of such psychological influences.

D. Epistemological limits of surprising weak signals detection

On a more philosophical base, we can also argue the epistemological background of the detection of weak signals, especially if it concerns media and technology. "The current mediosphere strongly influences the thinking on media, and therefore the thinking of all, including experts in current study design without possibility to reflect this phenomenon" [19]. Of course, we are limited to what we are able to detect because we see it. Other developments might be blind spots, as we are not aware of them: "Blind spot means, we do not realise it", "it is a spot we cannot see" [19]. Such blind spots of thinking and knowing can be age specific, and related to our cultural techniques and the predominant medium of our society [20]. If someone would be able to imagine our blind spots, deep surprises might be possible. Building on such an argumentation, future hindsight projects might be able to see such early signs of development, which would be pretty surprising for us from today's perspective. But this will only be possible through future knowledge and awareness of a new human age and mediosphere.

VIII. DISCUSSION AND CONCLUSION

As described, our discussion paper is meant as a first step of deeper consideration of our experiences that are not necessarily common experiences for those using social media mining for the detection of weak innovation signals.

This first discussion might be a starting point for researchers' and practitioners' who made similar experiences – or even more interesting: other experiences. So we would be happy to hear your stories, if and when your detection of weak signals left surprised recipients behind. To manage expectations at our side as well as our customers' side, today, we do not emphasize the "originality" or "surprise-factor" our detection of weak signals might deliver, until we believe this to be the case after reviewing the first results.

Additionally, our starting point was the failure to find surprising weak signals, which might be related to the usage of social media as our data-mining source. Of course, social media might be additionally limiting for detecting surprises (see section VIII A), but after writing this discussion paper we are hesitating if the source is really of importance for missing surprises or if other factors show to be more important.

As research at weak signals seems to be a very vivid part of current innovation research and futurology, deeper investigations on the theoretically described characteristic of "surprise" should be taken into account.

 ISBN: 978-1-61208-381-0

ACKNOWLEDGMENT

Thanks to Kathrin Parson and Laurenz Giger for their support.

REFERENCES

[1] I. H. Ansoff, Implanting Strategic Management, Prentice/Hall International Inc, 1984.

[2] M. Markus, R. Eckhoff, and M. Lassnig, “Innovation Signals in Online-Communitys – ein komplementärer analytischer Ansatz”, in: M. Blattner, and A. Meier, Eds., Web Monitoring. HMD - Praxis der Wirtschaftsinformatik, 293, 10/2013, pp. 13–21.

[3] M. Lassnig, M. Markus, R. Eckhoff, and K. Wrussnig, “Prospects of technology-enhanced Social Media Analysis for Open Innovation in the Leisure Industries”, in: R. Egger, I. Gula, and D. Walcher, Eds., Open Tourism – Open Innovation, Crowdsourcing and Collaborative Consumption challenging the Tourism Industry. Salzburg, 2013.

[4] T. Kuosa, “Futures signals sense-making framework (FSSF): A start-up tool to analyse and categorise weak signals, wild cards, drivers, trends and other types of information”. In: Futures, Volume 42, Issue 1, February 2010, pp. 42–48.

[5] E. Hiltunen, Weak Signals in Organisational Futures, Aalto University School of Economics, Aalto 2010.

[6] R. Eckhoff, M. Markus, M. Lassnig, and S. Schön, „Detecting Weak Signals with Technologies. Overview of current technology-enhanced approaches for the detection of weak signals“,International Journal of Trends in Economics Management & Technology (IJTEMT), volume III issue V, October 2014.

[7] K. Welz, L. Brecht, J. Kauffeldt, and D. Schallmo, “Weak signals detection: Criteria for social media monitoring tools”, in: Proceedings of the 5th ISPIM Innovation Symposium: "Stimulating Innovation: Challenges for Management, Science & Technology", 09-12 December, 2012; Seoul, Korea.

[8] B. Coffman, “Weak Signal Research”, MG Taylor Cooperation, online available http://www.mgtaylor.com/mgtaylor/jotm/winter97/wsrintro.htm.htm, 1997, downloaded at 31.08.2014.

[9] L. Ilmola and O. Kuusi, “Filters of weak signals hinder foresight: Monitoring weak signals efficiently in corporate decision-making”, Futures, Volume 38, Issue 8, 2006, pp. 908–924.

[10] T. Kuosa, Toward Strategic Intelligence. Foresight, Intelligence and Policy Making, Helsinki, Dynamic Futures 2014.

[11] I. H. Ansoff, “Managing strategic surprise by response to weak signals”, California Management Review XVIII 2, 1975.

[12] R. Zafarani, M. Abbasi, and H. Liu, Social Media Mining. An Introduction, 2014, Cambridge University Press.

[13] R. Eckhoff, M. Markus, M. Lassnig, and S. Schön, “Guidelines for social media mining for innovation purposes. Experiences and recommendations from literature and practice”, Proceedings of eKNOW 2015, The Seventh International Conference on Information, Process, and Knowledge Management, February 22 - 27, 2015 - Lisbon, Portugal.

[14] R. Rohrbeck, N. Thom, and H. Arnold, IT tools for foresight: “The integrated insight and response system of Deutsche Telekom Innovation Laboratories”, Technological Forecasting and Social Change, September 28, 2013.

[15] S. Kim et al., „NEST: A quantitative model for detecting emerging trends using a global monitoring expert network and Bayesian network“, Futures, Volume 52, August 2013, pp. 59–73.

[16] J. Keller and H. A. von der Gracht, “The influence of information and communication technology (ICT) on future foresight processes — Results from a Delphi survey”, Technological Forecasting and Social Change, Volume 85, June 2014, pp. 81–92.

[17] L. Ilmola, and O. Kuusi, “Filters of weak signals hinder foresight: Monitoring weak signals efficiently in corporate decision-making”, Futures 38 (8) (2006), pp. 908–924.

[18] B. Fischhoff and R. Beyth “'I knew it would happen': Remembered probabilities of once-future things.” Organizational Behaviour and Human Performance, 13 (1975), 1-16.

[19] S. Schaffert and C. Schwalbe, “Future Media Adoption in Learning and Teaching: Current Study Design from the Perspective of Cultural Studies”, in: M. Ebner & M. Schiefner (eds.). Looking Toward the Future of Technology Enhanced Education: Ubiquitous Learning and the Digital Native. Hershey: IGI Global, 2009, pp. 1-11.

[20] T. Meyer, “Zwischen Kanal und Lebens-Mittel: pädagogisches Medium und mediologisches Milieu”, in: J. Fromme and W. Sesink (eds.), Pädagogische Medientheorie. Wiesbaden: VS Verlag für Sozialwissenschaften, 2008, pp. 71-94.

[21] K. Steinmüller, “Wild Cards, Schwache Signale und Web-Seismografen. Vom Umgang der Zukunftsforschung mit dem Unvorhersagbaren”, in: Wolfgang J. Koschnick (eds.), FOCUS-Jahrbuch 2012. Prognosen, Trend- und Zukunftsforschung, Focus Verlag München, 2012, pp. 215-240.

 ISBN: 978-1-61208-381-0