Good Sources of Weak Signals: A Global Study of Where Futurists Look For Weak Signals[1]

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Abstract

Weak signals are valuable tools when anticipating the future changes. They mean today's information that can foretell the changes in the future. This article focuses on the good sources of weak signals. For this an international study was made where futurists were asked to list sources that they appreciate in finding weak signals. It appeared that futurist generally consider futurist, scientist and colleagues to be good sources for future oriented information. For spotting weak signals openness and dialogue is recommended.

Keywords: weak signals, future, futurist, sources of weak signals

Introduction

Weak signals and environmental scanning have been discussed diligently in the literature since the famous works of Aguilar (1967) and Ansoff (starting from 1970's). For example, many studies about different aspects of environmental scanning process have been accomplished. Weak signals, on the other hand, have not been considered in strategic literature in such depth. Specially, there is a lack of theoretical studies of how futurists scan and use weak signals, which here refer to signals of possible future change.

This article focuses on the sources for weak signals in anticipating future changes. The article summarizes a global study about sources of weak signals that was done at spring 2007. The main research question of this study was: *Where do future oriented people find weak signals about forthcoming changes?* The target groups of the study were futurists and future oriented people, who were

selected because their natural tendency to scan for weak signals of change in their work. Also, these people are considered by the researcher to be pioneers in looking at futures. An invitation to participate the research was sent to as many futurists and future-oriented people as possible by various channels like email lists and links in Internet pages. Responses were received from one hundred and twenty one futurists.

The results of this study show that ranking of good sources for weak signals varied according to the area of life. The top five good sources of weak signals (all areas of life included in order of superiority) in the study were: scientist/researchers, futurists, colleagues, academic and scientific journals and reports of research institutes. Human sources were the most appreciated in all areas of life. This supports the findings of previous studies.

Even though this study did not focus on the processing of the weak signals, some valuable comments were collected from the respondents' answers. Interaction, openness and discussion were emphasized in finding weak signals. More generally keeping eyes open, having sensitivity to change, creativity, receptiveness, intuition and a curious mind is needed to find weak signals of change.

Anticipating Changes by Using Weak Signals and Scanning the Environment

In anticipating future changes there are two key concepts that are related to this article: emerging issues and weak signals, which are the first things for us to see about forthcoming changes. Weak signals and emerging issues have been discussed by many researchers (see e.g. Ansoff, 1975, 1980, 1982, 1984, 1985; Webb 1987, Coffman, 1997 a-e, Blanco & Lesca 1997, Harris & Zeisler 2002, Day & Schoemaker 2005, Mannermaa 1999a, 1999b, 2000, Hiltunen 2000a, 2000b, 2001, 2005a, 2005b, 2006, 2007a, 2007b, Kuusi et al. 2000, Kuusi & Hiltunen 2007, Nikander 2002, Moijanen 2003, Ilmola & Kuusi 2006 , Uskali 2005, Brummer 2005, Kuosa 2005). Sometimes weak signals and emerging issues are considered as synonyms, but Hiltunen (2007b) has made a distinction between them by presenting the concept of *future sign*, in which weak signals are understood more as signals of the emerging issues. The future sign also includes a third dimension, the interpretation, which means the sense the observer makes out of weak signals and emerging issues in regard to the future.

For anticipating changes it is important to look for emerging issues and weak signals of them from all around of us. This activity is called environmental scanning. Aguilar (1967, p.1) defined environmental scanning as "an activity for acquiring information". He (1967, p. 18) continued that "...scanning involves simply an *exposure to* and *perception of* information. The activity could range from gathering data in the most deliberate fashion- as by an extensive market research program- to undirected conversation at the breakfast table or the chance observation of an irate housewife throwing your product into trash barrel." Choo (1999) stated that environmental scanning analyzes information about every sector of the external environment that can help management to plan the organization's future. Cook (1986) commented that "environmental scanning is the practice of searching a wide array of information sources on a

regular basis for symptoms of change." Neufeld (1995, p. 39), on the other hand, emphasized the usefulness of environmental scanning: "It can provide a view of future conditions in the context of what current events and changing conditions might mean for established assumptions. At best, environmental scanning is a heuristic tool providing information to decision-makers and analysts as stimulus to their imaginations."

The Dynamics of Change and Appearing of Issues

For finding out where to scan weak signals for anticipating the future it is important to understand the logic of change. Ferguson (1993) commented that few changes in the environment occur spontaneously: they start as ideas. These ideas eventually obtain public expression in the press, radio, television, university conferences, and scientific journals. Dator (2005, p. 205) described changes in the following way: "The world around [them] is emerged according to various kinds of 'S' curves of growth– from nothing but some crazy idea, to a frail and flimsy emergence, through a slow initial growth and then rapid middle growth, to a hard omnipresence, to steady prolonged 'commonsense' existence, and/or to eventual decay and death." Dator (2005, p. 205) continued that "many futurists attempt to look for what might later become trends in their earliest stage of development as emerging issues, while they are still weak, obscure and fragile, assessing how they might grow, and whether their growth should be encouraged, discouraged, or ignored."

According to Dill (1962, in Choo, 2006, p. 112) "from information perspective, every change or development in the external environment creates signals and messages that organizations may need to heed." Choo (2006, pp. 112-113) continued that some of the signals would be weak (difficult to detect), many would be confusing (difficult to analyze) and others would be spurious (not indicative of a true change).

There are some theories concerning the sources in which an issue appears at different stages of its existence. For example, Molitor (2003) has presented his forecasting model where he discusses patterns of change. This model has been studied carefully for example by Harris (1994). Molitor's earlier ideas about anticipating changes from 1970's have been represented and refined by Wygant and Markely (1988). Based on that, Choo (n.d.) has modified an information life cycle of emerging issues, which is seen in the Figure 1.

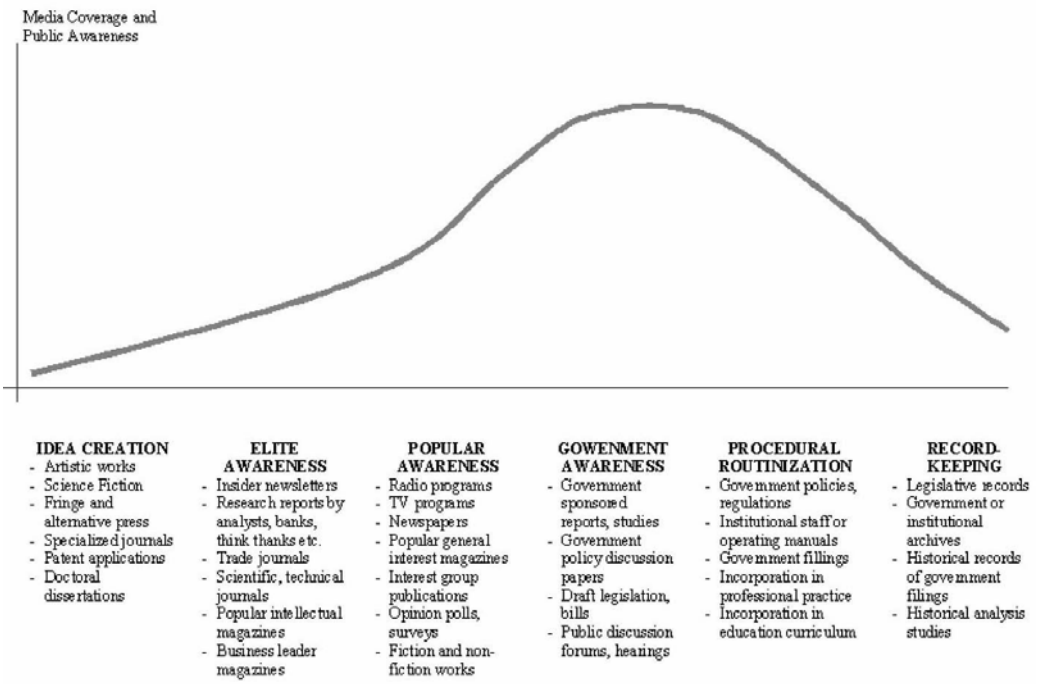

Figure 1. Information life-cycle of emerging issues by Choo (n.d.) adapted from Wygant and Markley (1988).[2]

From the figure it is possible to see different stages in the public awareness/media coverage when the issue is emerging. The first two stages are named by Wygant and Markely (1988) *idea creation* and *elite awareness* phases. In these stages the idea appears in public for the first time. Thus, sources like artistic works, science fiction, fringe and alternative press etc. are identified as this stage as good for finding weak signals of emerging issues. An important update for these results is mentioned by Day and Shoemaker (2006), who underlined the periphery as a source of weak signals for the future. They (2006, pp. 56-59) emphasized the potentiality of Internet and blogs as good sources for scanning the periphery.

Besides of the categorization discussed above, there are other ways to categorize the sources of information presented, for example, by Aguilar (1967, p.66), Neufeld (1985, p.48), Webb (1987, p.107) and Keegan (1974). In the empirical part of this paper, however, Choo's (1995, p.139) division of sources of information into three categories is used. These categories are: *human sources* (internal sources and external sources), *textual sources* (published sources and internal documents) and *online sources* (on-line databases and cd-roms and Internet).

It can be assumed that the importance of online sources has increased in recent years, and this have changed the "patterns of change" and sources of emerging issues identified by Molitor (2003), Wygant and Markely (1988) and Choo (n.d.). However, many of the documents that have been available previously only in paper form are now also available electronically via Internet. In that way Internet is only offering an extra channel for spreading information.

Characteristics of Sources Used For Environmental Scanning

According to literature, there are some elements and types of sources that are more appreciated in anticipating changes than other. Aguilar (1967, p.68) found in his study that managers relied almost as much on inside sources as on outside sources for important external information. Personal sources greatly exceed impersonal ones in importance. Aguilar (1967, p. 68-69) drew conclusions that scanning processes for important external information appears to rely heavily on the manager's personal network of communications. Similar conclusions about the importance of managers' personal network was also found out by Heikell (1986) who has analyzed a few books and some 40 articles of sources on scanning activities. Choo's (1994), Sawy's (1985) and Keegan's (1974) results are also pointing to this direction. Choo (1999) has specified that information from human sources may be preferred when dealing with ambiguous, unstructured problem situations.

Other characteristics too affect to the use of a source in environmental scanning. O'Reilly (1982) has found that the quality and accessibility of a source affect its use in scanning. Saunders and Jones (1990, pp. 32-33) summarized some of the characteristics that have been cited in literature as a reason for selecting information sources. These characteristics are: urgency, accessibility, cost, feedback, channel capacity, symmetry of channel capacity, time, speed of message handling, information richness, and "social presence".

The literature reviewed above was a starting point for this empirical component of this research. Based on the literature and previous research reviewed here, there arose some questions to which this study aims to provide answers. The research questions are presented in the following section.

Empirical Study of Sources of Weak Signals

The aim of this study was to collect information about the sources that futurists and future-oriented people use in their work to spot weak signals for anticipating changes in the future. Weak signals themselves are a very interesting research topic because they can anticipate changes in the future. When a futurist is working with future issues and making, for example, scenarios, his/her work is to scan the environment to spot the possible changes in the future.

This study aimed to find answers to questions that arise from going through previous studies in this area. In addition, the experience of author's in this field has raised some questions that this study seeks to answer. The research questions were the following:

RQ1: What are the sources futurists or future-oriented people consider good for finding weak signals?

RQ2: What sources are considered good in different areas of life?

RQ3: What categories of sources are preferred in finding weak signals?

This study of weak signals was accomplished during spring 2007 by using an Internet-based questionnaire provided by Webropol (www.webropol.com). A request for future-oriented people to answer the questionnaire was sent via different channels (email lists and links in Internet pages). Because of this, it is impossible to define the

response percentage of the study. All in all, 121 people responded to the study. To make sure that the respondents were suitable for this study (i.e. had experience in working with futures issues) their background in futures was asked[3]. Those who did not have experience in working in the futures field were dropped out of the analysis (N=1). Also, people who did not answer that question (N=2) were dropped out of the statistic calculations. This makes the total number of respondents 118. However, all of the respondents did not answer every question. This is why the number of respondents is shown with the results.

The questionnaire consisted of four pages. The questions in the first page inquired the background information of the respondents (demographic factors) and the level of the expertise in futures field. Pages number 2 and 3 focused on listing the sources of weak signals. In those pages, the respondents were asked to mark the area of life which they follow the most (referred as priority 1 in this study) and the second most (referred as priority 2). Then they were asked to tick from a list the sources of weak signals they consider good for the chosen area of life. Also, the respondents were asked to mark the best and second best sources. The sources to the questionnaire were collected from various research (e.g. Webb, 1987, Choo, n.d.), and some sources were added by the researcher. For the analysis purposes the sources were divided, as stated above, according to categorization of Choo (1995, p.139). In the last page, the respondents were allowed to write freely about good sources of weak signals. They also had the chance to comment on the questionnaire. To look at the definition of weak signals, the respondents were given in the questionnaire and construction of the questionnaire, see Appendix 1.

The questionnaire was first piloted among Finland Futures Research Center people and slightly changed for the international study based on the feedback and user experiences.

Background Information of the Respondents

The average respondent of the study appeared to be an experienced male futurist. Unfortunately hardly any young futurists responded to the study. Out of 118 people that answered to the question about age, 5.9 % were 30 years or younger. 11.9% belonged to the age group 31-40 years, 28.8% of the respondents belonged to the age group 41-50 years and the same percentage was valid for the age group 51-60 years. Rest of the respondents were over 60 years (24.6%). Nearly 74% of the respondents were male and 26% female (N=114 respondents).

The majority of the respondents (N=118 respondents) lived in Europe (44.9%) and North America (37.3%). A few people from Australia and Oceania (5.9%), South America (5.1%), Asia (4.2%) and Africa (1.7%) also participated in the study.

Experience and interests in the futures field was measured in the questionnaire in several ways. Half of the respondents (50.8%, N=118) classified themselves as futurists, which was more specifically defined in the questionnaire: futurist (for example consultant, professor or researcher in futures studies). The second biggest group were the researchers in areas other than future studies (16.1%) and the third were professors in areas other than future studies (14.4%). Among the respondents there were also

business managers (5.1%), government officials (3.4%), journalists (1.7%) and trend analysts (0.8%). 7.6% of the respondents categorized themselves as "other" occupation.

The experience of the respondents in looking at futures was considered to be a key question to evaluate the expertise of the respondents in the futures field. As mentioned above, the respondent who marked his/her experience to be none, was dropped from the analysis. Also respondents who did not answer to the question of the experience in the futures field were dropped out from the statistical analysis. In general, the respondents had years of experience in futures field. The majority of the respondents (45.8%, N=118) had over 15 years of experience in looking at futures. 16.9% had 11-15 years of experience and the same percent of respondents were valid for 6-10 years of experience. While 15.3% had experience of 2-5 years and 5.1% had experience of less than 2 years.

The respondents were also asked to tell the maximum timescale that they are looking at the future. Majority of the respondents (36.4%, N=118) said that they look maximum 11-20 years ahead, 26.3% looked 21-50 years ahead in the future, 24.6% 6-10 years ahead in time, 6.8% more than 50 years ahead in the future, 5.9% 1-5 years ahead. None of the respondents looked less than one year to the future.

For getting information about weak signals, the respondents were also asked to mark the areas of life from the seven possibilities which she/he is interested in and mark good sources of weak signals for those areas of life. The respondents were able to choose two areas of life of which changes they are interested in and then mark good sources for them from the list of alternatives. The reason why the respondents were not simply asked to mark good sources for weak signals was that the researcher had a hypothesis that different sources of weak signals would be better for some areas of life than others. This appeared to be true, because the sources varied by the area of life, even though in some cases very slightly.

In this study the respondents followed the changes in culture and society the most. Technological changes were the second most followed area of life. Economic and business changes were the third. Environmental changes were ranked as the fourth most among the respondents, changes in learning and education the fifth, and changes in politics the sixth. The respondents followed changes in fashion the least. Only two people marked that they follow this area of life. Because of the lack of respondents in this area, it was excluded from the analysis.

Results of the Study and Answers to the Research Questions

Owing to the structure of the questionnaire it is not sensible to list the ranking of the good sources for weak signals as such, since the respondents marked these sources good for certain areas of life. However, based on the order of superiority of the good sources of weak signals in all of the areas of life it is possible to draw some conclusions which sources of weak signal in general are good and which are not. In this phase of the article it is more convenient to examine first the good sources for weak signals for looking changes at different areas of life.

In the study, the respondents were asked to mark the areas of life out of seven alternative areas of life (political changes, economic and business changes, changes in society and culture, changes is technology and science, environmental changes, changes in learning, and education and changes in fashion) of which changes the respondent is the most interested in (referred to as priority 1) and follows the most. The respondent were asked to mark *good* sources for weak signals in those areas out of a list of 36 sources (one of them being "other source", see the list of sources and categorization of sources from Appendix 2). The respondents were also asked to mark, which area of life they follow the second most (referred as priority 2) and pick good weak signals for that from the list. In the results the frequencies both in priority 1 and priority 2 areas are added together. It would have been possible to use a weighting coefficient for the frequencies because of their different priorities, but it is not used here. The reason for this is that there would not have been absolute/correct way to set the coefficients. It would have been totally random. That is why the weighting coefficients are excluded from the analysis.

To see more detailed results, the sources of weak signals are divided according to the area of life to which they were connected by the respondents. Summarized results (the top preferred sources) are shown in Tables 1-6.

Table 1. *Good sources for weak signals for changes in politics (N=12).*

sources for politics	priority 1	priority 2	altogether
politicians	4	5	9
government officials	4	4	8
ordinary people (e.g. observing them)	5	2	7
television/radio	3	4	7
colleagues	5	1	6
scientists/researchers	4	2	6
futurists	4	2	6
local newspapers	3	3	6
consultants in areas other than futures	3	2	5
media people	3	2	5
marginal/underground press	3	2	5
government and other public sector reports	3	2	5
reports of research institutes	4	1	5

Note: Priority 1 refers to number of respondents that have selected to follow the most political changes, priority 2 refers to number of respondents looking for political changes the second most.

Table 2. *Good sources for weak signals for changes in economics (N=36).*

sources for economics	priority 1	priority 2	altogether
futurists	14	12	26
consultants in areas other than futures	12	11	23
scientists/researchers	12	9	21
academic and scientific journals	12	9	21
colleagues	12	8	20
popular science and economic magazines	7	12	19
market research studies	6	11	17
Internet: companies' or organizations' web pages	10	6	16
educational and scientific books	10	5	15
reports of research institutes	6	9	15
Internet: electronic journals	5	10	15

Table 3. *Good sources for weak signals for changes in society and culture (N=76).*

sources for society and culture	priority 1	priority 2	altogether
futurists	29	27	56
ordinary people (e.g. observing them)	30	21	51
scientists/researchers	28	21	49
colleagues	26	21	47
popular science and economic magazines	25	18	43
academic and scientific journals	26	14	40
artists	20	17	37
Internet: blogs	21	15	36
reports of research institutes	24	11	35
television/radio	20	15	35
Internet: discussion groups	17	17	34

Table 4. *Good sources for weak signals for changes in technology and science (N=65)*

sources for technology and science	priority 1	priority 2	altogether
scientists/researchers	33	26	59
futurists	24	17	41
academic and scientific journals	21	20	41
popular science and economic magazines	16	20	36
reports of research institutes	17	16	33
science fiction movies, books etc.	18	14	32
educational and scientific books	18	13	31
colleagues	16	13	29
Internet: homepages of individual people/consultants	19	9	28
Internet: electronic journals	18	9	27

Table 5. *Good sources for weak signals for changes in the environment (N=19)*

sources for environment	priority 1	priority 2	altogether
scientists/researchers	14	2	16
reports of research institutes	11	1	12
Internet: companies' or organizations' web pages	9	2	11
colleagues	8	2	10
academic and scientific journals	10	0	10
government and other public sector reports	9	1	10
futurists	9	0	9
consultants in areas other than futures	8	1	9
educational and scientific books	9	0	9
marginal/underground press	6	2	8

Table 6. *Good sources for weak signals for changes in education and learning (N=18).*

sources for education and learning	priority 1	priority 2	altogether
futurists	11	3	14
colleagues	7	4	11
scientists/researchers	5	6	11
academic and scientific journals	7	4	11
popular science and economic magazines	8	3	11
consultants in areas other than futures	6	3	9
educational and scientific books	6	3	9
science fiction movies, books etc.	6	2	8

It is possible to see from the Tables 1-6 that the sources that were considered good for finding weak signals somewhat varied by the area of life of which changes were looked for. At the same time these tables give the answer to RQ 2: "What sources are considered good in different areas of life?"

Mostly, the top sources for weak signals were the same, but their order varied a little. However, there was an area of life, politics, for which results differed from the others a lot. For example, the responses show that the respondents ranked *politicians* highest as a source of weak signals in political changes. In other areas of life, politicians were on the tag end of the list of good sources. Also government officials were raked high in the area of politics, while they were not considered to be the top for finding weak signals in other areas. The raking of the top sources for good weak signals was very uniform.

There were some sources that were at the top of the ranking in many areas of life. Scientists/ researchers in universities or institutes, futurists (except in environmental changes) and academic and scientific journals (except in changes in society and culture) were usually ranked very high as a good source for weak signals.

It is not possible to draw conclusions from the total frequencies of good sources, because the number of the respondents varied by the areas of life in question. However, it is possible to rank the sources by combining the rankings of the sources in all areas of life. This way it is possible to answer the RQ 1: "What are the sources that futurists or futures oriented people consider good for finding weak signals?"

Table 7 shows the order of superiority of the sources for weak signals calculated in this way.

Table 7. *Order of superiority of the sources of weak signals in all areas of life.*

number of order	A good source of weak signals
1	scientists/researchers
2	futurists
3	colleagues
4	academic and scientific journals
5	reports of research institutes
6	consultants in areas other than futures
7	popular science and economic magazines
8	television/radio
9	educational and scientific books
10	Internet: companies' or organizations' web pages
11	ordinary people (e.g. observing them)
12	media people
13	Internet: electronic journals
13	Internet: homepages of individual people/consultants
15	email newsletters
16	science fiction movies, books etc.
17	government and other public sector reports
17	Internet: discussion groups
19	Internet: blogs
20	marginal/underground press
21	Periodicals
22	local newspapers
23	Internet: electronic databases
24	government officials
25	email lists
26	movies
27	artists
28	market research studies
29	politicians
30	annual reports of companies
31	family/friends
32	patents
33	doctoral dissertations
34	proposals for laws
35	other source?
36	art exhibitions

From Table 7, it is possible to see that the top ten sources of weak signals included many human sources such as scientists, futurists, colleagues and consultants. Three most appreciated sources belonged to the category human sources. This supports the earlier findings of other researchers' that personal networks are important for finding information. Textual sources like academic and scientific journals, research institute reports, popular science and economic magazines, television/radio, and educational

and scientific books were also appreciated. From online sources company and organization websites were the only ones to appear in the top ten. However, two more appeared in the top fifteen sources. Blogs, the importance of which Day and Schoemaker (2006, pp. 58-59) emphasized, were ranked no more than 19/36 (the figures refer to the ranking in list of 36 sources in this study). Obviously, futurists have not found these sources of weak signals yet.

When comparing there results to the "information life cycle" by Choo (n.d.) in Figure 1, it is interesting to see that respondents did not have a tendency to use the sources listed in the "idea creation" phase, from which weak signals can be found. Sources in *the idea creation phase* included, for example, artistic works (rankings in the study 27/36, 36/36), science fiction (16/36), fringe and alternative press (20/36), academic and scientific journals (4/36), patent applications (32/36) and doctoral dissertations (33/36). As can be seen of these sources, except for academic and scientific journals, the respondents did not much assess them as good sources for weak signals. On the other hand, sources mentioned in the "elite awareness phase" (in which sources of weak signals can also be found) were ranked higher as good sources of weak signals (reports of research institutes 5/36, popular science and economic magazines 7/36). However, it is important to notice that Choo's information lifecycle includes only textual sources.

Use of human, textual and online sources for finding weak signals different area of life

Choo's (1995, p. 139) division of sources into human, textual and online sources is used here to compare where good sources for weak signals are found for different areas of life. The division of all the sources (except for "other source") is listed in Appendix 2. The results of good categories of sources of weak signals in different areas of life are calculated and the average frequencies of source categories in different areas of life are compared. By this way the RQ 3: "What categories of sources are preferred in finding weak signals?" is answered. Results are presented in the Figure 2.

In politics, society and culture, and learning and education human sources were appreciated notably more than in other areas of life. Textual sources were appreciated almost equally in all the areas of life. Online sources were least appreciated in the field of politics and education and learning. As a summary, there were no big differences in the categories (human, textual and online) the sources of which were considered good for finding weak signals from different areas of life. The sources for political changes, again, seemed to differ slightly. However, it is important to see the limitations of this analysis: the overlapping of the sources (like in human sources: futurists and colleagues are sometimes the same) change the results from what is seen from the Figure 2. That is why the results should be only taken as suggestive.

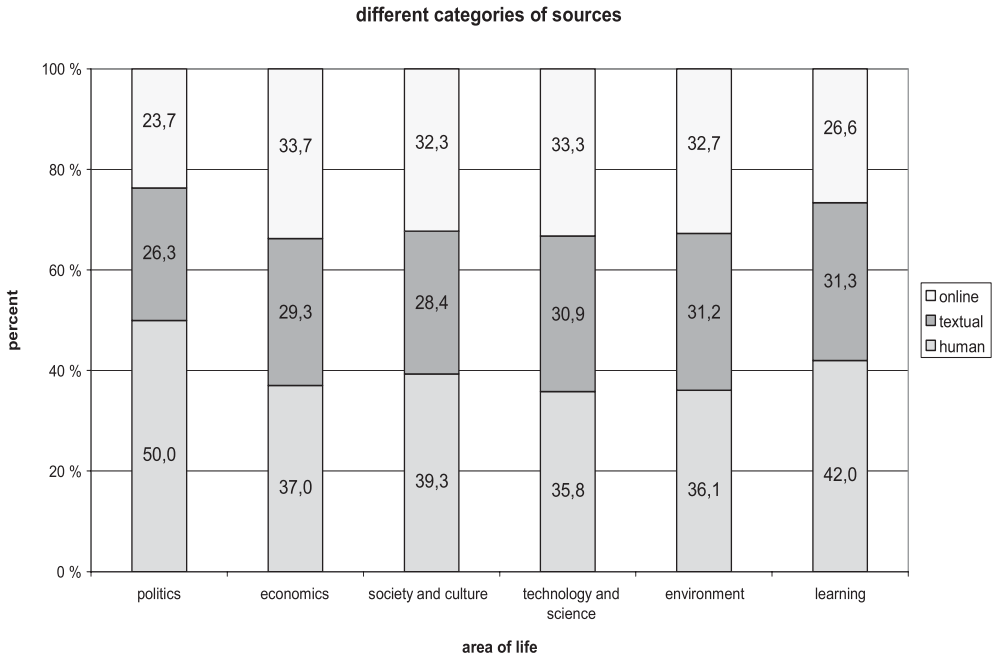

Figure 2. Good sources of weak signals by categories in different areas of life.

Characteristics of good sources for weak signals

Even though the questionnaire was mainly quantitative, the respondent had also the opportunity to write comments about weak signals freely. The respondents wrote as many as eighty valuable comments.

Certain things in the respondents' answers stuck out. Some respondents emphasized the need for interaction, openness and discussion in finding weak signals. Also working with different kinds of people was considered to be an asset in search for weak signals. There were comments, which made it clear that weak signals are not sought from a single source, but many. One has to look for various sources with wide coverage and preferably in different areas of life. Combining information from many sources is important. One good way to find weak signals is to scan the scanners as one respondent commented (futurist can be considered as scanners). More generally, keeping eyes open, having sensitivity to changes, creativity, receptiveness, intuition and a curious mind is needed to find weak signals of change.

Some of the respondents emphasized that it is not the sources of weak signals that are important, but rather the processing of them. Cross-mapping signals was mentioned as one tool for understanding changes. On a personal level sense-making processes for weak signals is much to do with scanning the changes, using intuition and feelings and interacting with other people.

There were also some sources that were not mentioned in the questionnaire but some of the respondent wrote in their answers: extremes, life itself, school children, conferences and traveling are among some of the mentioned sources.

Limitation and Critique of the Study

As in all studies, there were some challenges and limitations in this study, too. In making a questionnaire, there is always the dilemma of balancing with the length of the questionnaire in order to make sure that respondents have the energy to answer as many questions as possible and to get as much results as possible from the questionnaire. In this research there appeared amazing opportunities to gather information from futurists and future oriented people globally – thanks to many friendly people who helped to spread the invitation to participate in the research. This encouraged the researcher to make the questionnaire slightly longer than the original idea was, which enabled receiving more material from this unique group of respondents. It should be pointed out, however, that not a single question in the questionnaire was compulsory to answer. The length affected the feedback, and some of the respondents considered the questionnaire too long and "mechanistic". However, there were opposite views, too: someone commented that the questionnaire was short and to the point.

Even though the questionnaire was tested in the Finland Futures Research Centre, and on the basis of that some adjustments were made, there were some elements in the questionnaire that appeared to be too complex, demanding and/or frustrating from the point of view of the respondents. For example, some of the questions, such as asking the best and the second best source for weak signals, were quite repetitive. It was also problematic that the sources overlapped. For example, colleagues, one of the sources that was highly valued, can in many case be futurists, which were another source in the list. This overlapping of the sources can affect the results of the analysis. Overlapping however, was unavoidable, but I think in these cases the respondents indicated both as good sources of weak signals.

An issue that was raised by some of the respondents was that looking at the sources of weak signals is not essential, it is more the process that counts. The importance of the process of dealing with weak signals is highly valued by me, but the aim of this study was more to focus on the sources. Why the quantitative study of sources of weak signals then? There are four reasons for that. Firstly, a previous study of mine had raised an interest in finding out sources that futurist consider good for finding weak signals. Secondly, the wide international group of respondents, for whom the study was aimed at, made it tempting to accomplish a quantitative study, because, from a quantitative perspective, the large number of respondents would give statistically more valuable results. Thirdly, the convenient Internet software used in this study preferred quantitative study. However, the software also allowed qualitative open questions, which were also included in the study. Fourthly, the information on the kind of sources the futures experts consider good sources for weak signals could be utilized in organizations when they are planning environmental scanning procedures.

Conclusions and Discussion

This study aimed to answer to some question concerning about sources of weak signals. The first two research question concerned the sources that futurists and futures-oriented people consider good for finding weak signals and what sources are

considered as good for different areas of life. It appeared that there are some differences in sources that are considered good for different areas of life. Some sources were considered in the top ten sources for certain areas of life, whereas for other areas the same sources could be among the last ones. For example politicians were appreciated as top sources on the subject of political changes, in the same way as patents were top sources as regards technological changes. In other areas of life these sources were not appreciated as much. However, there were some sources that were considered good for many areas of life. Among these were scientists, futurists and colleagues, academic and scientific journals, and reports of research institutes. The most surprising finding of this study was that various sources of the Internet were not highly appreciated among the respondents. In the times of fast global communication the fact that Internet sources were not appreciated by futurists was a mystery. Is it so that futurists still rely too much on the written reports instead on being confident on finding valuable data in the Internet?

Research question three focused on finding answer to whether some categories of sources are more appreciated in finding weak signals than others. It appeared that all the source categories (human, textual and online) were appreciated almost equally by the respondents. Human sources were, however, most appreciated in all of the categories.

The results have some implications for organizations, which are planning or modifying their environmental scanning procedures. For getting a good overview of where the world is going, there are certainly some sources that should be added to the scanning list according to the results of this study. Futurists are the ones whose purpose is to look for changes in the world. As one of the respondents commented, scanning the scanners is a good way to find weak signals. People that are making the future, such as scientists, artists, lead users and fringe, are good sources to keep track of, as well as sources that document their actions like popular science journals and the marginal press. I personally recommend scanning the Internet, especially blogs, even though these were not highly appreciated in this study. Blogs provide a way to see what people are really doing and thinking. The future, as we know, is very much dependent on the actions of "ordinary people". All in all, interaction, openness, sensitivity to changes, creativity and discussion are also needed when seeking for weak signals of change.

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Notes

1. Acknowledgements: My warmest thanks for helping me to accomplish my study go to all the people that used their valuable time in filling the research questionnaire and sharing their valuable expertise in futures field. I would also like to thank Professor Markku Wilenius for his support in accomplishing this study and Professor Tomi Seppälä for his valuable advice for the quantitative analysis of this study. For funding my postgraduate studies and making it possible for me to write this article, I would like to express my gratitude to Finland Futures Research Centre and TULIO post-graduate program.
2. The source of the figure is http://choo.fis.utoronto.ca/ncb/es/ESinfoLC.html
3. In the question 5. in the questionnaire experience in futures field was asked ("Your experience in "looking at the futures"). Possibilities for answer varied from none to over 15 years. Respondents that answered none were dropped out from the study.

References

Aguilar, Francis J. (1967). *Scanning the business environment.* New York: Macmillian/ Arkville.

Ansoff, Igor. (1975). Managing strategic surprise by response to weak signals. *California Management Review*, XVIII Winter (2), 21-33.

Ansoff, Igor. (1980). Strategic issues management. *Strategic Management Journal, 1*, 131-148.

Ansoff, Igor. (1982). Strategic response in turbulent environments. Working Paper No. 82-35, European Institute for Advanced Studies in Management, August.

Ansoff, Igor. (1984). *Implanting strategic management*. Englewoods Cliffs, NJ: Prentice/Hall International.

Ansoff, Igor. (1985). Conseptual underpinnings of systematic strategic management. *European Journal of Operational Research, 19*, 2-19.

Blanco, Sylvie, & Humbert Lesca. (1997). Environmental scanning: designing a collective learning process to track down weak signals, presentation in Actes de la 3e Conferénce de l'AIS Amérique (Association for Information Systems), Indianapolis, USA.

Brummer, Ville. (2005). *Innovaatioaihioiden verkkopohjainen ideointi ja monikriteerinen seulonta (Internet-based generation and multi-criteria screening of innovation ideas).* Thesis for MSc (engineering), Department of Physics and Mathematics, Helsinki University of Technology. Retrieved, April 26, 2008, from http://www.sal.hut.fi/Publications/pdf-files/TBRU05.pdf

Choo, Chun W. (1995). *Information management for the intelligent organization: The art of scanning the environment.* Medford: Information Today.

Choo, Chun Wei. (1999). The Art of Scanning the Environment, ASIS Bulletin Article Preprint, *ASIS Bulletin 25*(3), 13-19, special issue on information seeking. Retrieved November 2, 2006, from http://choo.fis.utoronto.ca/FIS/respub/ASISbulletin/

Choo, Chun W. (2006). *The knowing organization: How organizations use information to construct meaning, create knowledge, and make decisions*. New York: Oxford University Press.

Choo, Chun W. (n.d.). Information life cycle of emerging issues. Retrieved May 7, 2007, from http://choo.fis.utoronto.ca/ncb/es/ESinfoLC.html

Coffman, Brian. (1997). Weak Signal Research, Part I: Introduction. Retrieved April 26, 2008 from http://www.mgtaylor.com/mgtaylor/jotm/winter97/wsrintro.htm

Coffman, Brian. (1997). Weak signal research, Part II: Information Theory. Retrieved April 26, 2008, from http://www.mgtaylor.com/mgtaylor/jotm/winter97/infotheory. htm

Coffman, Brian. (1997). Weak signal research, Part III: Sampling, uncertainty and phase shifts in weak signal evolution. Retrieved April 26, 2008, from http://www.mgtaylor.com/mgtaylor/jotm/winter97/wsrsampl.htm

Coffman, Brian. (1997). Weak signal research, Part IV: Evolution and growth of the weak signal to maturity. Retrieved April 26, 2008, from http://www.mgtaylor.com/mgtaylor/jotm/winter97/wsrmatur.htm

Coffman, Brian. (1997). Weak signal research, Part V: A process model for weak signal research. Retrieved April 26, 2008, from http://www.mgtaylor.com/mgtaylor/jotm/winter97/wsrprocm. htm

Cook, Lauren. (1986). The state acanning network: An issue identification system for state policy managers. *Futures Research Quarterly*, Spring, 65-77.

Dator, Jim. (2005). Universities without 'quality' and quality without 'universities'. *On the Horizon*, *13* (4), 199-215.

Day, George, & Paul Schoemaker. (2005). Scanning the periphery. *Harvard Business Review*, *83*(11), 135-148.

Day, George, & Paul Schoemaker. (2006). *Peripherical vision- detecting the weak signals that will make or brake your company*. Boston: Harvard Business School Press.

Dill, William. R. (1962) The impact of environment on organizational development. In *Concepts and Issues in Administrative Behavior*, eds. Mailick S. & Van Ness E.H. 94-109. Englewood Cliffs, NJ: Prentice-Hall in Choo, Chun W. (2006). *The knowing organization.* (2nd ed.) New York: Oxford University Press, p. 112.

Ferguson, Sherry D. (1993). Strategic planning for issue management: The communicator as environmental analysts. *Canadian Journal of Communications*, *18*(1), from http://info.wlu.ca/~wwwpress/jrls/cjc/BackIssues/18.1/ferguson.html

Harris, Dyer, & Steven Zeisler. (2002). Weak signals: Detecting the next big thing. *The Futurist, 36* (6), 21-29.

Harris, Pamela M. (1994). *Testing Molitor's model for tracking the information highway: An issues management study.* A dissertation presented for the Doctor of Philosophy Degree. Knoxville: University of Tennessee.

Heikell, Marianne. (1986). *Scanning the business environment for detecting weak signals,* Teknillinen korkeakoulu, Täydennyskoulutuskeskus, Informaatiopalvelun kurssi, p. 12.

Hiltunen, Elina. (2000a). Heikot signaalit ja tulevaisuuden ennakoiminen (Weak signals and anticipating the future). *Projektitoiminta, 1*, 10-13.

Hiltunen, Elina. (2000b). Heikot signaalit : Teoriakatsaus (Weak signals: Theoretical review). *Futura, 2*, 72- 77.

Hiltunen, Elina. (2001). Heikkojen signaalien köyttö yrityksissä (Application of weak signals in companies). *Futura*, 1, 45-50.

Hiltunen, Elina. (2005a). Kurkistus tulevaisuuteen: Toimintaympäristön ennakointi heikkojen signaalien avulla (A glance at the future: Anticipating the future of organizational environments with the help of weak signals). *Uudenmaan Alueen Insinöörit, 1*, 8-11.

Hiltunen, Elina. (2005b). Creative madness makes a signal usable. *Profile*, March, 17.

Hiltunen, Elina. (2006). Was it a wild card or just our blindness to gradual change? *Journal of Future Studies, 11* (2), 61-74.

Hiltunen, Elina. (2007a). *The futures window: A medium for presenting visual weak signals to trigger employees' futures thinking in organizations*, HSE Publications, working paper- w-423.

Hiltunen, Elina. (2008). The future sign and three dimensions of it. *Futures, 40* (3), 247-260

Ilmola, Leena, & Osmo Kuusi (2006). Filters of weak signals hinder foresight: Monitoring weak signals efficiently in corporate decision-making. *Futures, 38* (8), 908-924.

Kuosa, Tuomo. (2005). Heikko signaali vai merkityksetön kohina: Pattern management: Ontologisesti uusi lähestymistapa heikkojen signaalien tarkasteluun ja tulkintaan (A weak signal or meaningless noise: Pattern management: An ontologically new approach to examine and interpret weak signals), *Futura, 4*, 115-120.

Kuusi, Osmo, Elina Hiltunen, & Hannu Linturi. (2000). Heikot tulevaisuussignaalit: Delfoi tutkimus (Weak signals- a Delphi study). *Futura, 2*, 78-92.

Mannermaa, Mika. (1999). *Tulevaisuuden hallinta: skenaariot strategiatyöskentelyssä* (Managing the future – Scenarios in strategy work), Porvoo: WSOY.

Mannermaa, Mika. (1999). Toolbox ja heikot signaalit (Toolbox and weak signals), *Futura, 2*, 32-37.

Mannermaa, Mika. (2000). *Tulevaisuuden haltuunotto-PK-yrityksen ennakoinnin käsikirja* (Seizing the future: A handbook of anticipating future for SME's), ESR-julkaisut sarja, Helsinki: Oy Edita Ab.

Moijanen, Maisa. (2003). Heikot signaalit tulevaisuuden tutkimuksessa (Weak signals in futures studies). *Futura, 4*, 38-60.

Molitor, Graham T.T. (2003). Molitor forecasting model: Key dimensions for plotting the 'patterns of change'. *Journal of Future Studies, 8* (1), 61-72.

Neufeld, William P. (1985). Environmental scanning: Its use in forecasting emerging trends and issues in organizations. *Futures Research Quarterly, 1* (3) 39-52.

Nikander, Ilmari. (2002). *Early warnings: A phenomenon in project management*, Dissertation for the degree of Doctor of Science in Technology, Helsinki University of Technology.

O'Reilly, Charles A. (1982). Variations in decision makers' use of Information Sources: The impact of quality and accessibility of information. *Academy of Management Journal 25* (4), 756-771.

Saunders, Carol, & Jack W. Jones. (1990). Temporal sequences in information acquisition for decision making: A focus on source and medium. *The Academy Management Review, 15* (1), 29-46.

El Sawy, Omar A. (1985). Personal information systems for strategic scanning in turbulent environments: Can the CEO go on-line? *MIS Quarterly, 9* (1), 53-60.

Uskali, Turo. (2005). Paying attention to weak signals: The key concept for innovation journalism. *Innovation Journalism, 2* (4), 33-49.

Warren, Keegan J. (1974). Multination scanning: A study of the information sources utilized by Headquartees Executives in Multinational Companies. *Administrative Science Quarterly, 19* (3), 441-421.

Webb, John R. (1987). *An evaluation of igor ansoff's theory of weak signal management by means of an investigation and forecast of future developments in the ophthalmic laser environment*, Doctoral Thesis. University of Strathclyde, Department of Marketing, Glasgow.

Wygant, Alice C. & O.W. Markley. (1998). *Information and the Future: A handbook of Sources and Strategies.* Westport: Greenwood Press.

Appendix A
Forewords of the questionnaire (including definition of weak signals) and structure of the questionnaire

Forewords in the study:

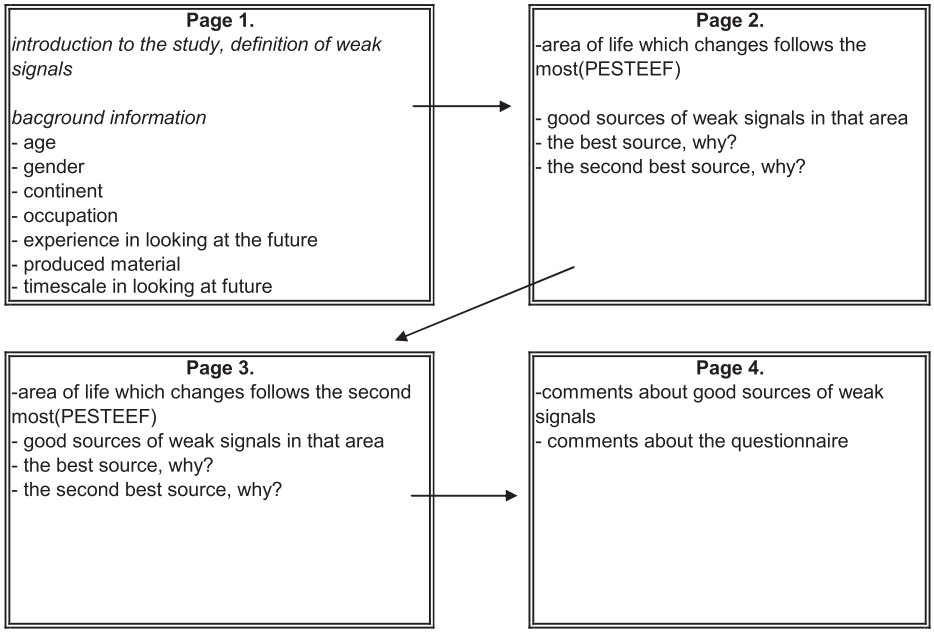
Study about sources of information on future

This is a global study about *information sources of weak signals* for futures professionals and people interested in the future in general. The aim of this study is to?find out where futures professionals and future-oriented people collect information that can foretell changes in the future (i.e. weak signals). The study is conducted by Ms. Elina Hiltunen from Finland Futures Research Centre as a part of her Ph.D. thesis. The results of the study will be available for all participants on request by email: elina.hiltunen@tse.fi. Your participation in the study is highly appreciated!

Definition of weak signals:

In this study, weak signals mean today's information that can foretell the changes in the future. This information might sound funny or strange and it can cause confusion, because it offers a totally new way of thinking/idea/innovation. As time passes, it might come out that weak signals were the first signs or symptoms of a big change, even megatrends. However, weak signals are not always clues about big changes. They might simply be information about strange things that have happened. A practical example of weak signals is an article about some new technical innovation in a magazine

The logic of the questionnaire in this study



The structure of the questionnaire in this study (including the questions)

Appendix B
Categorization of the sources

The sources were divided into three categories: human, textual and online sources. More precisely the following sources belonged to these three categories:

human sources:

- colleagues,
- scientist/researchers in universities or institutes
- futurists
- consultants in other area than futures
- politicians
- government officials
- media people
- artists
- family/friends
- "ordinary people" (e.g. observing them)

Textual sources:

- educational and scientific books
- academic and scientific journals
- popular science and economic magazines and papers
- periodicals, which?
- marginal/underground press
- local newspapers
- doctoral dissertations
- patents
- government and other public sector reports
- annual reports of companies
- reports of research institutes
- proposals for laws
- market research studies
- television/ radio
- movies
- art exhibitions
- science fiction movies, books etc.

Online sources

- Internet: companies' or organizations' web pages
- Internet: homepages of individual people/consultants
- Internet: electric databases
- Internet: electric journals
- Internet: blogs
- Internet: discussion groups
- email newsletters