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Collective intelligence process to interpret weak signals and early warnings

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ABSTRACT The treatment of weak signals is identified as a method to identify strategic surprises in a firm's environment. Many researchers address the problem of anticipation of movements that have an impact on a firm's environment. Weak signals are considered in some approaches and presented in the literature, but also other methods are explored. This article tries to deepen the discussion of how to treat and interpret weak signals collected in a firm's environment. The concept of a weak signal is explained and the discussion about how to collect and interpret them is presented. Two important aspects are distinguished in the article: the usefulness of information technology in collection and treatment of weak signals and the concept of collective sensemaking in interpreting weak signals. Two cases of weak signal interpretation are presented as illustrations.

KEYWORDS Collective sensemaking, competitive intelligence, weak signals

1. INTRODUCTION

There is an ongoing lack of understanding of the notion of weak signals and few methods exist to explore them. Some researchers developed methodological procedures to explore them (Lesca and Lesca, 2014) and produced methods for collecting and interpreting weak signals in a competitive intelligence process. The traditional competitive intelligence process (Herring, 1988) considers key intelligence topics (KIT) to "provide the focus the prioritization needed to conduct effective intelligence operations and to produce the appropriate intelligence" (Herring, 1999, p.6). KITs are comprehended in the first step of planning and direction of competitive intelligence cycles. This step defines an organization's intelligence needs and orients the search of a firm in the competitive environment. Many organizations consider the environment as analyzable and that it has

the information needed to obtain correct answers to their questions. It is just a matter of searching for this information through "discovery", one of the four scanning methods that may be assumed by an organization in an environmental scanning process (Daft and Weick, 1984). There is no reflection and hypothesis of what may or may not exist in the environment. The information is there. The intelligence needs and KITs identified in the "planning and direction" step, conducted in the competitive intelligence search process.

Some organizations may consider the environment unanalyzable and adopt "enacting" as a strategy to approach the interpretation of the environment. "The organization in some extent may create the external environment. The key is to construct, coerce, or enact a reasonable interpretation that makes previous actions sensible and suggests some steps. The interpretation may

shape the environment more than the environment shapes the interpretation” (Daft and Weick, 1984, p.287).

Weak signals suggest interpretation and sensemaking (Shoemaker and Day, 2009) as the environment is considered unanalyzable. Weak signals through an inductive process stimulate the hypothesis generation and sensemaking of the competitive environment. It is not a matter of finding the right answer, as in a discovery scanning processes, but creating perspectives and possibilities that outline how the future environment and competitive may move (Gilad, 2011). Whatever future is considered, the future does not exist yet and the perspective of today may not happen in the future. For example, possible competitive moves identified today may not happen if the environmental scenario changes as a consequence of economic change, competitive moves or any other unexpected environmental change.

In this article Ansoff’s concept of weak signal and an operational process of treating this weak signal is discussed. It allows us to create hypotheses and perspectives about future moves in a competitive environment that may impact an organization. Weak signals are considered here to be an inductor of collective sensemaking about what may or may not come in a future environment.

2. THEORETICAL BACKGROUND

2.1 Weak signal

Information of an anticipatory nature is a weak signal. The notion of weak signals, a type of metaphor (Ansoff, 1975), has proven interesting on account of its orientation toward attention given to surprises and ruptures that may occur in the business environment. “For the first time, the idea of a need to be ‘early’, or rather as early as possible in anticipating change, was expressed and translated into a complete methodological proposal” (Rossel, 2012, p.230).

However, the weak signal definition lacks precision and does not constitute actionable knowledge (Argyris 1996), despite the fact that Ansoff (1975) clearly attributes an anticipatory character to weak signals. According to the author, these fragments of information have a propensity to trigger, in the entrepreneurs that observe them (provided they pay attention), a sensation that something important may happen in the general environment. “For Ansoff, any change taking place is preceded by

some form of ‘warning’, which the analyst has the role of capturing and making good use of. This is what he called a signal, based on the Information Theory work of Shannon and Weaver in the 1940s” (Rossel, 2012, p.230).

This sensation approaches that of intuition, triggered by data that is perceived and then examined attentively. Such information plays a triggering role, inducing the stimulus of an interrogation followed by an interpretation. Next, an inquiring entrepreneur will wish to know more about the question and obtain further information to refine this sensation. Before the interpretation through a weak signal, the decision maker had probably not asked for anything concerning the subject as his/her attention was not activated.

This notion of a weak signal does not have an operational definition. In practice it can be seen that expressed weak signals are misinterpreted in companies and generate contradictions (Lesca, 2011).

2.1.1 Meaning of the word weak: contradiction and propositions

Our experience through numerous company-based action research projects leads us to verify that the expression of weak signals is misinterpreted by most entrepreneurs due to the adjective *weak*. We often hear: “We don’t want to capture weak signals, but strong ones!” Evidently, the word “weak” leads entrepreneurs in the wrong direction. Indeed, a signal can be weak in its appearance and thus discrete in terms of meaning but potentially very rich in meaning; in this sense it can “announce” something very important for the individual that is able to capture and interpret it.

In our view, Ansoff (1975) meant that a signal can be classified as “weak” if it bears the following characteristics:

a) Fragmented: for example, there is only a fragment of information from which it can be attempted making inferences in a holistic procedure. It is expect that the number of weak signals is very small. It is not a context where the amount of information is high and it is not a matter of treating a huge amount of data.

b) Submerged amidst myriad bolder data: it is weak because it is submerged, mixed with a myriad of useless information that creates noise. It appears thus, with weak visibility,

most people pass over these signals, barely noticing them.

c) Meaning not evident: it is weak because of an apparent weak meaning and ambiguousness. Information such as a weak signal does not bring a visible interest. On the contrary it is equivocal or ambivalent. This information is of little significance by itself, and does not have an evident connection with other information.

d) Unexpected, not familiar, non-repetitive, and it risks not to be noticed: The concept of non-familiarity of this kind of information makes it difficult to distinguish. Cognitive biases may also distort its identification or interpretation and analysis in competitive intelligence processes (Memheld, 2014).

e) The operational utility of a weak signal is not immediately evident and it seems not to be very useful. The very same information may be of importance for one person and of no interest for another. It is not evidently interesting, the consequences of the event identified are not evident.

f) The detection of a weak signal is difficult. Because of this the opportunity to use information technology or big data techniques to search for weak signals on the web, or on a newspaper's site is high (Lesca, Buitrago and Casagrande, 2016, Buitrago, Casagrande and Lesca, 2015). The technology can select news with potential weak signals to be evaluated.

Nevertheless, weak signals are at the core of anticipatory, strategic intelligence because they are of potential use to managers, if the managers are able to perceive and interpret them. This type of information can range from indicators of disruptions (Ansoff, 1975) to larger events, and they clarify the intentions of external actors (competitors, clients, suppliers, and various signs of changes in general).

Individual differences may also influence the interpretation and importance perceived of information (Stanovich and West, 2012).

2.1.2 Definition of a weak signal

As posited by Ansoff (1975), a weak signal is a "datum," often with an insignificant appearance and submerged in myriad other data, the interpretation of which can warn that

an event (perhaps not yet initiated) is about to occur and is likely to have significant consequences in terms of risks or opportunities. It has an anticipatory feature (Lesca 2003). Weak signals have the following characteristics presented by Lesca (2001):

- Fragmented: To which information can it be related?
- Isolated
- Uncertain reliability: Is it possible to relate it to something else?
- Imprecise
- Unpredictable: Where to look, when to pay attention to the information?
- Ambiguous
- Apparently little or no utility: How to avoid ignoring it?
- Anticipatory
- No standardized key words: How to access it?
- Unusual, singular, unfamiliar: When to pay attention to it?
- Possibly intentional on the part of the signaler
- Submerged amidst a large quantity of data: How to notice it?
- Subjective
- Often qualitative

2.1.3 Characteristics of a weak signal (adapted from Lesca 2001)

Weak signals originate from two types of sources. Contacts with the field: personal relationships, visual observations, etc. These are the richest sources of anticipatory information, but significant human aptitudes are needed to exploit them. Databases, the internet, websites, etc. These sources have been causes of data overload (Edmunds and Morris 2000; Lesca et. al. 2009, Sherkock, 2011). Lately, efforts at using new technologies are helping to deal with large data sources on the web to identify weak signals (Buitrago-Uitrago, 2014, Casagrande, 2012), and to limit the information overload (Lau et al., 2012).

One should not use anticipation and prediction interchangeably. Prediction is mainly the calculation of the trends in the quantitative database collected over a period. The calculation does not include singletons or outliers, and computers are of great use. It is more related to Daft and Weick's (1984) discovery processes. Prediction may be

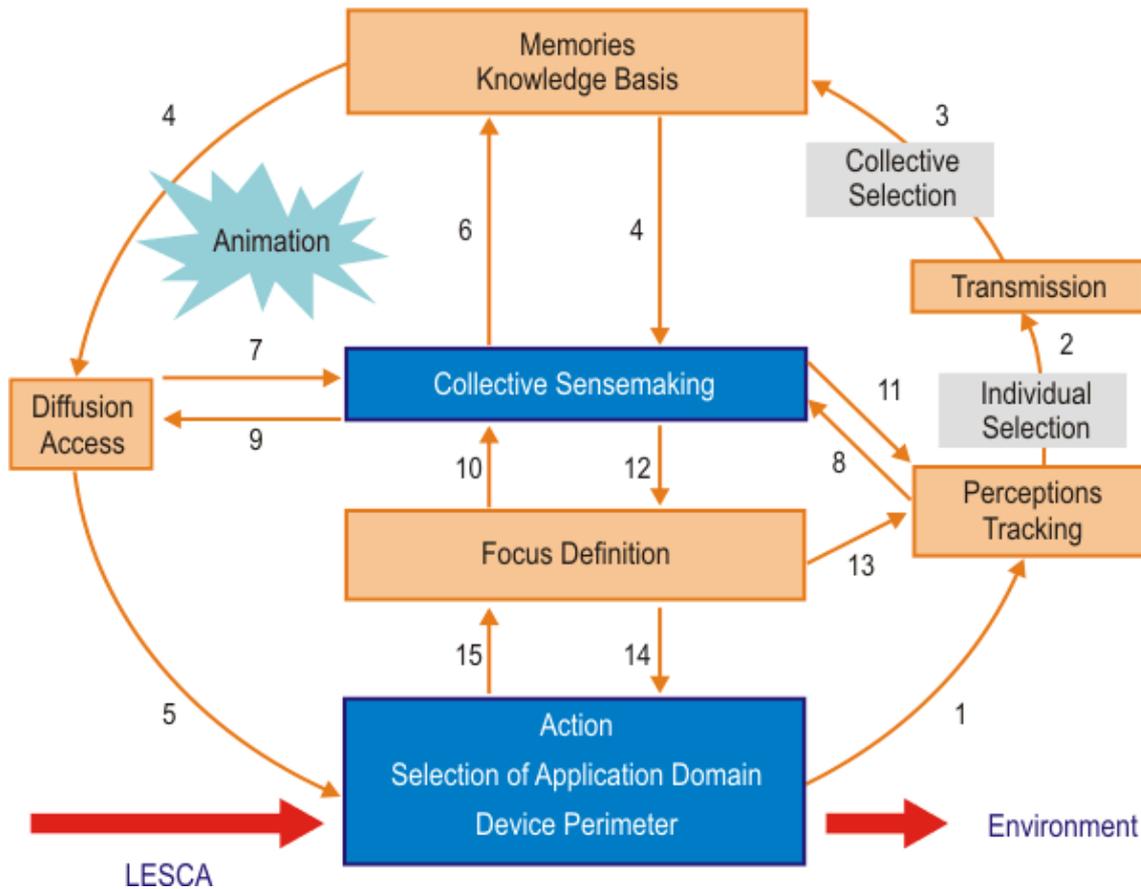


Figure 1 SCIS Conceptual Model.

expressed by a curve integrating a significant part of the data (for example, 80% of the observations), extrapolating to the future what was learned from the past. The 20% of the observations not integrated in the predicting curve are considered to be less important or outliers.

Anticipation concentrates singular information or outliers left aside by prediction-makers. It is interested in the 20% of the data left aside by the predictions. Though considered outliers by the statistics, this is possibly where weak signals can be detected early, as well as possible surprises, discontinuities or disruptions. These weak signals should be stimuli for strategic management (Reinhardt, 1984; Starbuck and Milliken, 1988; Gilad, 2004; Marrs 2005).

Consequence 1: The first question to be presented is: "What is one's objective: to predict or to anticipate?" If it is to detect surprises, ruptures, or breakthroughs, then weak signal treatment is a appropriate method.

Consequence 2: Information like weak signals are the one considered by a process

that Daft and Weick (1984) called enacting, where a process of sensemaking and interpretation is induced by the weak signal.

The treatment of weak signals stems from interpretation through collective sensemaking, and not an algorithm with information technology (Daft and Weick 1984).

2.2 Detection/ acquisition of weak signals

Strategic Scanning Information Systems (SCIS) is the way by which a firm seeks to detect signals as early as possible, before the occurrence of changes in the environment, so as to secure sustained competitiveness. It is a collective, transversal, proactive, and continual process through which a group of individuals collaborate to pursue, capture, and use information of an anticipatory nature concerning the external environment and changes that can be produced there (strategic surprise), including disruptions (Lesca, 2003, p10). A conceptual SCIS model is shown in Figure 1.

Over successive experiments in different organizations, it was possible to distinguish two types of strategic monitoring processes. There are those including a phase of collective sensemaking that is particularly important in recognizing and exploring weak signals. It can be referred to as an anticipatory collective intelligence processes in the sense of Daft and Weick's enacting process. The second is those that do not include the collective sensemaking phase. This type of process is currently the most-used by companies. Daft and Weick called it a discovery process.

According to Daft and Weick (1984, p291), there are four different ways to interpret the environment, leading to four different modes of organizing processes for scanning the environment (four quadrants). Daft and Weick (1984) suggested a model to categorize organizations according to the way top management interprets the collected information to make a decision and to define actions. They suggested the existence of a relation between strategic orientation and the way firms monitor the environment, based on Aguilar's (1967) and Miles and Snow's (1978) models respectively. Daft and Weick (1984) used two dimensions to explain how organizations approach environmental knowledge. The first one is how much top management considers the environment stable and the second one is how actively the organization searches information allocating resources. From these dimensions, four ways of interpreting the environment are derived: undirected viewing for reactive organizations that obtain information randomly; conditioned viewing for defensive organizations that frequently use information that once in the past was helpful; discovery for analytical organizations that intend to formally search and structure environmental knowledge; enacting for prospective organizations that intend to transform the environment through innovation and are characterized by informal searches of information.

Daft and Weick (1984) suggest two different dimensions concerning the scanning strategy and firms environment perception. The first is intrusiveness. The firm exhibits proactive behavior, searching for business opportunities, and strives to prevent all types of threats. To this end various sources of information are accessed (formal and informal, documented and field-based). It seeks several types of information (field-based, formal, and digital information). People in charge of collecting

information belong to different parts of the organization. Exploiting the information, mainly weak signals, is done through interpretative processes, considering the characteristics of weak signals presented above. The results of the interpretations aim to assist in strategic decision-making.

The second is the unanalyzable dimension. The enterprise is in an unanalyzable environment. The sources of information are diverse, but the richest are also the least formal: human contact is essential. Information collection is not done by a bureaucratic "cell," but is entrusted to collaborators with main activities other than scanning. Perception processes are essential. Exploring information is not automated: it is mainly based on human and heuristic cognitive processes. People interpret information individually and then collectively. Collective learning is important. Understanding weak signals advances by trial and error, or "learning by doing".

2.3 A collective sensemaking of weak signals

Weak signals are of little interest per se. They start to become useful if it is known how to exploit them to create a useful meaning for strategic management (Haeckel 2004). The treatment of weak signals lies in the resulting interpretation (Daft and Weick 1984). Information technology is becoming more and more effective in detecting weak signals automatically (Lesca, Buitrago and Casagrande, 2016, Buitrago, Casagrande and Lesca, 2015). However, interpretation can only be made by individuals, alone or in groups (Almeida, 2009), as interpretation is also a matter of a decision maker's perspective (Gilad, 2011).

It was shown that the characteristics of weak signals create a number of difficulties when considering its features. Lesca (1995) suggest that the exploitation of weak signals could be accomplished with heuristics. The conceptual model for the application of the heuristics was illustrated in Figure 1 and agrees with the works of Daft and Weick (1984) and Nonaka (1991, 1994). Lesca and Lesca (2014) suggest that heuristics must be used within a collective working group of people chosen according to their involvement in the subject and their knowledge. The work of collective interpretation is called "collective intelligence" (Lesca and Caron 1996; Blanco

and Lesca 1998; Blanco et al. 2003; Lesca, 2003).

Collective sensemaking is the operation of collective interpretation thanks to which meaning and knowledge are created from weak signals (input) that have the role of inducing stimuli, and through interactions among participants (Mamykin, Nakikj and Elhadad, 2015, Lesca, 1995). The result of collective sensemaking (output) is the formulation of plausible future views capable of orienting entrepreneurs (Lesca and Caron 1996). The collective sensemaking accomplished according to Lesca's (1995) heuristics is in line with Schoemaker and Day (2009). Collective sensemaking cannot be understood as "organizational sensemaking," because experience shows us that it is not possible to mobilize all people within a firm to interpret information.

The process of collective intelligence arises from a group of individuals when the signals coming from the competitive environment are collected, selected, interpreted, and compared through collective work so as to make sense. It is a process in which group members interact in different ways, subject to behavior rules of collective work (Lesca, 2003). A weak signal must be examined from different points of view, by different people holding different positions within a firm (Starbuck and Milliken 1988).

The discussion of collective sensemaking appears in the academic literature in different domains like teaching (Coburn, 2001), on-line services (Mamykin, Nakikj and Elhadad, 2015) and competitive intelligence (Soilen, 2017, Lesca, 1995).

The discussion of weak signals in a collective way is in line with the idea that in a competitive intelligence process, it is not effective to deliver reports and answers to managers as they tend to ignore them or to consider them threatening to their position (Soilen, 2017). In a collective process around a group of individuals, they debate and discuss the environment. The role of the competitive intelligence staff is to conduct and help the discussion process. Decision makers then may have insights about the market, have their own perspectives about what is going on and take decisions based on their own perspectives (Gilad, 2011, Rohrbeck and Bade, 2012).

3. TWO CASES OF WEAK SIGNAL INTERPRETATION AND SENSEMAKING

Two examples are explored here to access the concept of weak signals as follows. These two examples were treated by the team involved in this research in order to analyze weak signals for to companies.

The first is the ABB Case (Lesca, H., Buitrago-Uitrago A. F., Casagrande, A., 2015).

Let's consider a company with a strategic intelligence process that is interested in ABB as a target of the process. The information to be treated in the following paragraphs was presented as follows:

"ABB wins the Energy Prize at the Arabian United Emirates."

Why can this data be considered a weak signal? It is fragmented (less than a line). It was taken from a newspaper that contains over thirty pages per day. It is submerged in a huge volume of data.

How can this be seen a warning sign in this weak signal?

- Pertinence. Considering ABB as an example of a target, this is a fragmented piece of information.
- Surprise. This data was not expected, caught someone's attention, and triggered a process of collective reflection. As of that moment, this data gained the status of information for us.
- Importance. Considering ABB as a target and the motivations justifying a process of strategic intelligence, it can be raised the hypothesis that ABB relations could suggest business opportunities for the company interested in it. A manager considering this information observed: "The information thus began to be potentially useful to us. We could enter the Arabian market through ABB."
- Anticipation. Is this information anticipative? It is clear that ABB prize is already a past event. On the other hand, it could be estimated that there still may be initiatives not known of ABB in Saudi Arabia showing opportunities.

The set of collective reflections by a group in the company dealing with the information, led it to see in the weak signal as a warning sign. Thus, it was possible to exploit a weak signal and trigger the concrete action of contacting ABB. This procedure gives rise to a positive

output beyond the company's initial expectations. This example shows that, in certain cases, detecting weak signals and transforming them into early warning signals fully exploited by the firm's leadership generates benefits that may be far superior to costs.

The second example is the AZULY case. The information was presented as follows:

“P. AZULY goes to the X group”.

Why consider this data to be a weak signal? It is very fragmented, qualitative data. At first it was captured through oral communication, talking with a work associate. Later it was found printed in a recent issue of a professional magazine. The information occupied only two lines—a piece of news submerged in a 150-page magazine, bound to go unnoticed. The utility of this information leading to action was not evident. Furthermore, this data is ambiguous and open to multiple interpretations. It was a surprise. It caught the researcher's attention almost by chance. The piece of information started to have a meaning for the team.

The information is probably anticipative: the strategic operation of the X group is only in the initial stage of its preparation. A field expert that was contacted informs us that this sort of operation and a communication campaign related to the strategic topic possibly identified requires around 12 months of preparation.

In conclusion, in this example one moves from a weak signal to an early warning signal (Gilad, 2003). Clearly, the latter is based on hypotheses (Lesca, 2014) that are formulated and are able to be verified. Such interpretation of the weak signal is not the only one possible. It allows the decision maker to be placed in an “alert mode”. From then on, it is up to him/her to accomplish what is necessary to further explore the situation and reduce the uncertainty if it is judged useful.

But what type of usefulness does this weak signal represent to the X group? The strategic operation was revealed to be of great importance, both for the X and Y groups. Group Y had available to itself of a sufficiently long term of anticipation to create plans to consider an offensive vis-à-vis X.

4. A STRATEGIC INTELLIGENCE METHOD

In order to organize the detection, capture, and exploration of weak signals, Lesca (2003)

suggests the LEscanning (Learning Environmental Scanning) method. Figure 1 indicates the different blocks that make up the entire process of anticipatory strategic intelligence.

4.1 Domain delimitation

Approaching the SCIS (Strategic Scanning Information System) device: a company can have various SCIS devices. In a large company, for instance, there are devices at the company level, together with the CEO, or at the group level when the company comprises a number of autonomous units or “business units.”

Perimeter delimitation of the SCIS device: perimeter refers to the list of people included in the device, each of whom will have to contribute and will experience some benefit.

4.2 SCIS target

Targeting is the operation of delimiting the portion of the environment-of-interest to the members of the perimeter of the future SCIS device. Focusing means expressing in an explicit and formal manner who/what can serve as a common interest for the different participants of the SCIS process.

4.3 Collecting/surrounding the information by designated people

This phase requires human and formative qualities. It is an elementary form of the perception filter (Starbuck and Milliken 1988).

4.4 Information selection

This consists of retaining, from the collected information, only that which is of interest to potential users within the SCIS perimeter. This is a crucial operation: lack of selection leads to data overload and suffocates the SCIS process, whereas too restrictive a selection impoverishes and empties the SCIS process.

Selection (or filtering) is the separation of raw data from potentially weak signals. It is conducted by taking the target into account.

4.5 Collective sensemaking

This is the process of exploring weak signals to create sense. The interpretation of weak signals cannot be valid if conducted by just a single person. It requires plurality and competing viewpoints from people with different knowledge, experience and points of

view. But it requires a certain familiarity with environment from the 1950's and 1960's

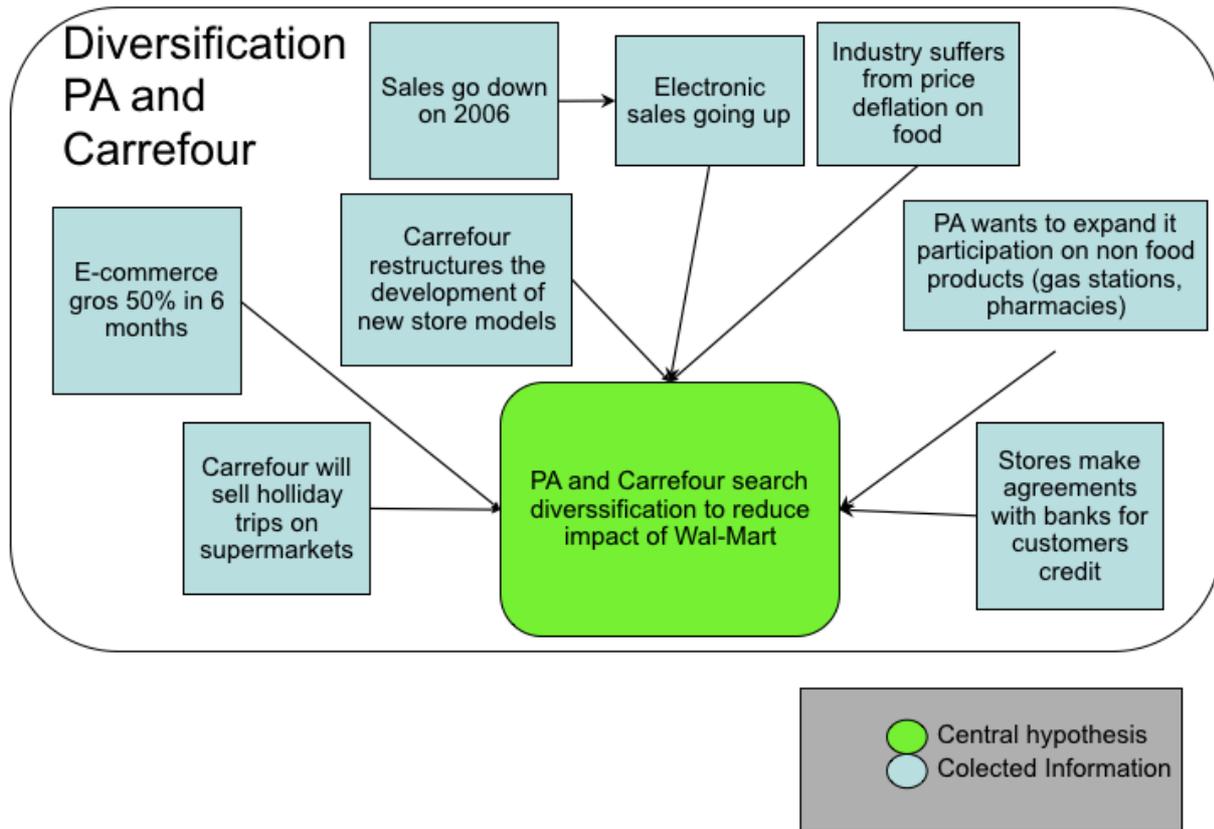


Figure 2 Example of puzzle: the Carrefour case.

the subject. Interactions among people are very important.

It can be suggested that heuristics creating links between the pieces of information (weak signals) used during the collective work session can map fragments of isolated information into a more significant and reasoned visual (or other) representation. Figure 2 shows an example of a puzzle, referring to the Carrefour example in Brazil.

The collective interpretation of weak signals may imply resorting to a single or several external specialists. Lesca and Kriaa (2007) conceived and tested a method of remote monitoring to help the leader of the collective sensemaking sessions using the Puzzle method.

5. CONCLUSION

Ansoff (1975) distinguished the importance of treating weak signals to identify strategic surprises. The point was to identify disruptions and strategic surprises, not tendencies projected from past data. His article comes after some decades of a stable environment and continuous growth where long-range planning was still possible. However, the stable

changed and the environment became turbulent and the experience and projections from the past were not enough to anticipate the future. Formal search is questionable in its ability to predict the future, since it is strongly associated with analyses and statistical predictions that may divert the attention from strategic surprises or disruptions (Ansoff, 1975). Data from the past may be interesting to identify future outcomes only in a stable environment. In this case quantitative data analysis may be of use. Ansoff suggested the importance of paying attention to weak signals that might preannounce changes in the future environment. Kahaner (1997), sharing the same reasoning, comments that one of the most difficult tasks of monitoring the competitive environment is to predict what will happen in the future and that quantitative information, in general, describes the past and therefore suggests that even unstructured information such as rumors and comments should also be part of the scope of monitoring. Rumors may be weak signals of future events.

Decades after Ansoff's proposition, the discussion about weak signals and early warning was extended. Different authors

reinforced Ansoff's preoccupation with this kind of information. They proposed useful approaches to increase firms' attention to not so clear events that might suggest important moves in the environment. Rossel (2012) identified different "neo-Ansoffian contributions" (p.232), considering them diverse and rich. The author considered classificatory maps the richest one, for example, where Morrison and Wilson (1996) made cross references to probabilities of occurrence with impact concerning weak signals. This kind of approach is particularly interesting as it suggests ways of interpreting weak signals. Day and Schoemaker (2005) proposed to scan the periphery in order to identify events not in the main stream of the decision maker's attention.

Treating weak signals requires methods that enable one to identify and interpret them. Because the characteristics of weak signals make them difficult to be identified and interpreted, there is still a considerable opportunity concerning new ways of working on them.

The present study intends to bring some methodological propositions and suggestions. One important aspect of treating weak signals to be further explored is the use of information technology. It may help in identifying and treating weak signal interpretation. It also requires intuition, imagination, and sensitivity in their interpretation, a task that cannot be fully accomplished by information technology, though it is increasingly helpful in the first steps of collection and interpretation of weak signals. It is also importance to distinguish the collective reflection on the eventual meaning of the weak signals, as different persons bring different knowledge and perspective to a discussion.

As suggested in the present paper, the most important support that can be brought by the strategic intelligence processes lies in anticipating surprises and ruptures.

Our experience shows us that weak signal treatment enables long term visibility and enhanced anticipation of threats and strategic opportunities in the environment. The treatment of weak signals requires us to consider their characteristics.

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