EXPLORING THE IMPACT OF COMPUTER-BASED TECHNOLOGIES FOR CORPORATE FORESIGHT

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Abstract

The present paper focuses on the computer-based technologies supporting Corporate Foresight (CF): how organisations use technologies to anticipate future trends and detect weak signals.

The research focuses on a multiple case-study in different industries. Through a comparison of twenty projects in companies clustered in four industries that perform CF, the paper highlights and describes the different technologies that are used, subdividing them in knowledge management technologies, semantic technologies and network technologies.

The different technologies have been related to the phases of the process of CF, to the amount of resources needed to implement them and, taking a contingent approach, to the different needs in terms of turbulence of the project environment (in terms of rapidity and unpredictability) and to the different industry sectors.

Finally, the research relates the different clusters of technologies to CF performance measures and draws hypothesis on their influence on CF performances.

Keywords

Corporate foresight, computer-based technologies, software, multiple case study

INTRODUCTION

Foresight is becoming an increasingly more important business practice, particularly under the intense competition of the technology industry. However, organizations are reluctant to experiment in the absence of reliable information and many organizations are spending valuable resources either on projects assessed with insufficient information or on information that they are unable to internalize. The present paper focuses on the computer-based technologies supporting Corporate Foresight (CF): how organisations use technologies to anticipate future trends and detect weak signals. CF is a set of methods, activities and capabilities in order to investigate and imagine the future scenarios. The aim is to provide suggestions to help organizations in deciding for software tools that help in effective information scanning, analysis and foresight.

Research has shown that CF can be based on methods, processes and capabilities. Scholars of foresight (Rohrbeck, 2011) discussed the different ways in which value for CF can be created. These can be broadening the perspective by considering a wide range of issues and trends outside the industry, identifying the systematic drivers of change, finding more and deeper information (including peripheral information and tacit knowledge held by individuals), informing about external change and long-term consequences, challenge basic assumptions. An important theme is to provide a platform to integrate people in the strategic discussion, to help them in searching for trends and weak signals, to facilitate the connection among distant themes and enable the elaboration of inputs toward future outputs.

Foresight can be viewed as strictly connected to knowledge management: foresight is strongly based on knowledge sharing, it needs to manage different and many forms of documentation and analysis and foresight knowledge needs to be captured, stored and organized according to the context of each company. Moreover, foresight is about imagining and

connecting different information and foresight software systems help in finding ways to connect and develop this foresight knowledge.

Foresight has various components and aspects such as socio-cultural, organizational and technological. In this paper we address the technological aspect, more precisely we studied in 20 different companies the most used softwares to support different foresight activities. Moreover, we surveyed available software systems in the internet. We categorize them in classes, based on their capabilities and functionalities and on the foresight phases they support. Foresight tools can be potentially used to create "gatekeepers of knowledge". This paper would like to investigate them in the context of companies, and identify which actions is capable of performing. In this paper we analyse software systems and technology that support foresight in companies using two classifications: (1) typology of knowledge (2) phases of Corporate Foresight process.

The organization of the paper is as follows. Foresight tools are defined in Section 2, Section 3 explains the methodology, Section 4 looks at the

THEORETICAL BACKGROUND

Corporate foresight software tools

In general, as regards the Knowledge Management, research has shown how it can be based on an IT infrastructure, such as web browsers, word processors, email browsers, file servers, DBMS, multimedia generators, messaging tools, and internet/intranet services. Moreover, KM tools support data and knowledge discovery and collaboration services. Through portals, knowledge can be distributed as needed by different users and applications, such as e-learning. Literature supports us from the knowledge management tools point of view (e.g. Rugges, 1997;

Angus *et al*., 1998; Alavi and Leidner, 1999; Jackson, 1999; Wensley, 2000; Tyndale, 2002). This literature conducted to the following tools classification: document management system, information management system, searching and indexing systems, expert systems, communication and collaboration systems and intellectual asset systems.

The theme of technologies supporting Corporate Foresight (CF) is not deeply investigated in the literature. It can be found evidence from practitioners, for example foresight consulting companies use trend-databases that monitorate continuously many trends and integrate information in modules such as scenarios, weak signals and wild cards.

CF can be supported by a collection of technologies for storing knowledge, contextualizing and retrieving information, connecting and elaborating knowledge. This paper refers to Corporate Foresight tools as:

- established information technology based tools borrowed from other disciplines (e.g. knowledge management) that are used with extended functionality;
- information technology based tools that have been used as foresight tools from their beginning.

In general, the role of the tool is an enabler and the humans still need to conduct knowledge activities. They are designed to burden work and facilitate soacil processes of collaboration, sharing knowledge and building foresight outputs connecting insights and ideas. Many organizations, while they have necessary technological infrastructure to support knowledge management, not exploit the full potential of the technology they already possess.

Foresight tools support the performance of foresight activities and enable the process to improve decision-making. Not all tools are computer-based, as foresight is especially a human-

based discipline, but recently many companies are placing enphasis on these electronic tools for their dynamic capabilities and quick resolution of problems.

Technology becomes therefore a powerful enabler of foresight objectives. The goal of a foresight tool is to facilitate the implementation of the foresight process. Such tools can facilitate the process of structuring information, sharing it and generating new knowledge as regards the future. Such tools can also be used to speed communication and facilitate collaboration. Moreover, they can be able to catalogue insights and automate certain work.

Foresight tools have to take into account that foresight is a fluid process of evaluating the relevance of information, combinating it and generating insights on the future.

METHODOLOGY

The research has been based on four main steps: (1) literature review, (2) pilot case study, (3) systematic literature review and (4) multiple case studies.

A *general literature review* focused on Corporate Foresight lead to the identification of the main areas of research on CF and of the main literature gaps. The CF is a complex issue, still little investigated and little conceptualized (Liebl, 1996). For new investigations (Eisenhardt, 1989), to identify crucial variables (Yin, 2003), to observe a phenomenon in its complexity (Yin, 2003; McCutcheon and Meredith, 1993), to do an holistic and contextualized research and to collect a wide array of data (Hartley, 1994) and to study a phenomenon with a dynamic nature and process and where not-considered events play an important role in building explanations (Pettigrew, 1992), an explorations is needed. We chose a *pilot exploratory case-study* in an ICT company, that stimulated our curiosity on some aspects of CF and to develop and to detail the research questions, in terms of technologies for CF. Moreover, it permitted to

cover research areas and to identify the relevant aspects on CF practices, in particular we understood the importance to identify measures of performance for CF. Therefore, it led to a *second (focused) literature analysis*, focused on CF technologies and on CF performance measurement. Then, the research methodology followed for the theory building the *multiple-case study* research design as suggested by Yin (2003) and McCutcheon and Meredith (1993), in order to identify and descript the key variables, to identify the links among variables and to identify why these relationships exist. The case studies selection focused on four different industries and comprises 20 different cases. Our main contrast factors is the expertise in foresight of the companies, and we differed also by industry in order to increase the possibility to have a broader view of the matter. The four industries are the ICT and telecommunication, the biochemical, the energy and the fashion. In this way, the cross-case analysis permitted to highlight the technological tools characteristics and the activities concerning the foresight. Table 1 shows general data as regards the companies considered.

Table 1 – Companies of the multiple case study

NAME	DIMENSION	INDUSTRY	FORESIGHT EXPERTISE
Company A	Big	TLC	old
Company B	Big	TLC	old
Company C	Big	TLC	recent
Company D	Small	ICT	recent
Company E	Big	ICT	recent
Company F	Big	ENERGY	old
Company G	Big	ENERGY	recent
Company H	Big	ENERGY	recent
Company I	Big	ENERGY	recent
Company L	Medium	ENERGY	recent
Company M	Big	BIOCHEMICAL	old
Company N	Big	BIOCHEMICAL	old
Company O	Big	BIOCHEMICAL	recent
Company P	Big	BIOCHEMICAL	recent
Company Q	Medium	BIOCHEMICAL	very recent
Company R	Big	FASHION	recent
Company S	Medium	FASHION	recent
Company T	Medium	FASHION	very recent
Company U	Small	FASHION	very recent
Company V	Small	FASHION	very recent

As regards the research protocol, despite the focus of the research is the CF technology, in order to build an overview of the CF activities other sections that in our opinion can influence CF supporting technologies have been considered. These are CF strategy, CF organization and CF management.

DISCUSSION

The paper highlights and describes the different technologies that are used, subdividing them in knowledge management technologies, semantic technologies and network technologies. Table 2 shows the classification of softwares.

These tools contain different typologies of knowledge on the future. As inputs, the future factors (trends, issues and technologies driving future developments), the signals (news), information from the periphery, documents (studies, reports, books, videos, pictures, ...), database of people (persons as experts and future researchers); or as outputs experts opinions (expert assessments of future developments), study of effects of strategic choices, opportunities (business opportunities), surprises (improbable but high impact future developments), scenarios (pictures of the future).

Companies adopt ICT tools for managing foresight. The case analysis showed that the CF is often supported by ICT technologies, as Intranet, IT tools for trenddatabses, online tools (web-based roadmaps), blogs, wikis and collaborative platforms. But the cases show that the technologies system has to be adapted to the specificity of the company.

The foresight software tools have the aim to enable the management of foresight as regards specifically two *phases*: (1) searching and gaining information and (2) elaborating results and communicating them.

Another point of view is the *functionality* of foresight software tools. These have been identified mainly in three clusters: (1) knowledge management technologies, (2) semantic technologies and (3) network technologies. Relevant information can be inserted in the system and can be elaborated by a foresighter or by ontological and semantic systems (a “smart system” that permit to manage, to collect and to connect a wide amount od data). The system can be based on web 2.0, it permits to build social networks and to communicate thorugh people.

From the interviews, we defined other important dimensions to consider for the software tools: iteration (collaborative or not collaborative), governance (hierarchical or flat), value integration (high or low), participation (closed or open), time of collaboration (synchronous or asynchronous), collaboration transaction (spot or repetitive), use in the CF phases.

Finally, the classification has been referred to four phases of Corporate Foresight: information gaining, interpretation, scenario formulation, comunication.

Table 2 – Classification of foresight softwares

#	SOFTWARE OR TECHNOLOGY	TECHNOLOGIES TYPOLOGIES			PHASE			DEGREE OF FORMALITY	RECURRENCE IN COMPANIES
		KNOWLEDGE MANAGEMENT TECHNOLOGIES	SEMANTIC TECHNOLOGIES	NETWORK TECHNOLOGIES	gaining information	Scenarios and trends	elaborating results and communicating		
1	Agents	•	•	•			•	•	
2	Bibliometric analysis	•			•	•		•	
3	Blog		•	•					
4	Business intelligence tool		•	•					•
5	Change watch		•	•					•
6	Content management		•	•					•
7	Corporate directory	•			•	•			•
8	Data mining		•	•					
9	Data warehousing	•	•		•		•	•	
10	Deep innovation	•			•	•		•	
11	Delphi Software	•		•					•
12	Document management system	•	•	•	•		•	•	•
13	Electronically mediated scenario process		•		•				
14	Future management audit		•	•				•	
15	Future management reporting	•			•				
16	Future management system	•			•		•	•	•
17	Future map	•			•				
18	Future market radar	•	•	•			•	•	
19	Future screening	•			•	•		•	

20	Future-net		•	•					
21	Groupware		•	•					•
22	Instant Messaging		•	•					•
23	Internal foresight libraries		•	•					•
24	Internet search Screening of web sites	•			•	•			•
25	Intranet	•	•	•			•	•	
26	Knowledge creation application	•			•	•		•	
27	Lesson Learned		•	•					
28	Lipsor software		•	•					•
29	Mailing list		•	•					•
30	Market research		•	•					•
31	Mindmapping	•			•	•			•
32	News reader (RSS-feed)		•	•					
33	Scenario analysis	•	•		•		•	•	
34	SCEN-LAB	•			•	•		•	
35	SRI	•		•					•
36	Tagging platforms	•	•	•	•		•	•	•
37	Tech mining		•		•				
38	Text analysis software		•	•				•	
39	Trend database	•			•				
40	Trend radar	•			•		•	•	•
41	Web platforms for innovation	•			•				
42	Web portals		•	•				•	
43	Web-based roadmap		•	•				•	
44	Wikis	•	•				•		

Table 3 – Characteristics of foresight software tools

	Partecipation		Governance		Value integration		Interaction		Condivision		Time		Transaction	
ICT TOOLS	open	closed	hierarchical	flat	low	high	collaborative	not collaborative	trasparent	not trasparent	synchronous	asynchronous	spot	ripetitive
Agents	•	•	•			•	•			•		•	•	
Bibliometric analysis	•			•	•		•		•			•		•
Blog		•	•											
Business intelligence tool		•	•					•						
Change watch		•	•					•			•			
Content management		•	•					•						•
Corporate directory	•			•	•			•					•	
Data mining		•	•											
Data warehousing	•	•		•		•	•							
Deep innovation	•	•	•	•			•	•			•		•	•
Delphi Software	•	•			•	•		•		•			•	
Document management system	•		•	•										
Electronically mediated scenario process			•	•					•					
Future management audit	•		•	•					•			•		
Future management reporting	•		•	•					•					
Future management system		•			•	•			•					•
Future map			•	•										
Future market radar		•	•		•		•	•						
Future screening		•			•	•		•		•			•	
Future-net	•	•		•					•					
Groupware		•	•	•	•		•	•	•					
Instant Messaging	•		•		•									
Internal foresight libraries	•		•	•				•		•			•	
Internet search Screening of web sites	•	•			•									
Intranet	•	•			•		•	•	•		•	•		

Knowledge creation application		•			•							•		
Lesson Learned			•	•	•			•	•			•		•
Lipsor software	•		•			•	•		•		•			•
Mailing list	•			•	•									
Market research	•			•	•					•				
Mindmapping				•	•					•			•	
News reader (RSS-feed)	•	•	•			•	•			•		•	•	
Scenario analysis	•			•	•		•		•			•		•
SCEN-LAB		•	•											
SRI		•	•					•						
Tagging platforms		•	•					•			•			
Tech mining		•	•					•						•
Text analysis software	•			•	•			•					•	
Trend database		•	•											
Trend radar	•	•		•		•	•							
Web platforms for innovation	•			•	•		•		•			•		•
Web portals	•		•					•						
Web-based roadmap	•	•	•	•		•	•	•						
Wikis		•		•										

CONCLUSIONS

The case study analysis permitted to understand how the companies use the software tools in order to cutten the foresight circuit building online networks for collaboration. Theoretically, it is possible to hypothesise that the use of the IT tools can positively influence the efficacy and efficiency of CF. They can help in focus the information search, enable the interpretation, and permit the integration of more people in the interpretation process.

But this is contrast with the empirical evidence. In fact, the cross case analysis did not evidence a clear relation between support technologies for CF and CF performance, and many intervieewees highlighted that they did not see a clear benefit from their implementation. A possible explanation lies in the importance for CF of people and their competences. In fact, one of the main differences among the companies is in the soft aspects of CF: some companies give a strong importance to the individual iniziative while other companies build a more structured system for CF. Another problem derives form the specificity of many themes of foresight, that require specific and expert-based knowledge both for searching words in the software tools both for using them.

The present paper permitted to have a map of the software tools for CF. The different technologies have been related to the phases of the process of CF, to the amount of resources needed to implement them and, taking a contingent approach, to the different needs in terms of turbulence of the project environment (in terms of rapidity and unpredictability) and to the different industry sectors.

Foresight tools can only be understood in the context in which they are used and the methodologies that support them. Richness of foresight is not only in the tools, but in individuals and organizations. Comparing technology with the other three important factors such as strategy, organization and management, the study highlights how the foresight is strongly connected to the abilities and competences of the people. This because foresight is a

very complex task, based on abilities of reasoning and finding ridde interconnections, and based on relationships. Therefore it can be supported by ICT tools in a more efficace way in the phases of information investigation and diffusion, while the elaboration remain a task linked to the "human touch".

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