

# Brokers on cost management make use of knowledge based practices and ontology based tools

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## Abstract

The purpose of this paper is to demonstrate how consultancy firms on cost management often play the crucial role of brokers among organizations (buyers and suppliers). The analysis has been carried on within an Italian consulting company, and has been aimed at understanding: (i) how consultants on reduction costs manage their knowledge in order to produce effective value from their activities; (ii) how consultants play the role of brokers between buyers and suppliers, and enable product or process innovation; (iii) how semantic based technologies can help consultants and organizations to effectively manage costs.

The work has been based on two different activities: (i) an ethnographic study, and a series of interviews aimed at understanding knowledge management processes (according to the Weick's sensemaking approach (1995)) between the consultancy firm and its clients; (ii) the investigation of semantic based tools developed within the consultancy firm. These tools are used to manage knowledge about costs and purchasing processes, and their implementation implies some technological and organizational consequences.

We demonstrate that theoretical approaches on cost management can be improved by a knowledge management approach, such as the sensemaking framework. This one becomes much more relevant when cost management activities are developed in outsourcing processes, when distinct organizational perspectives and cultures encounter, and finally when information asymmetries arise. We also explain, how consultants allow the encountering of various perspectives, forcing purchaser officers to look for more suitable, innovative, and less expensive solutions. Finally, the analysis of semantic based technologies would illustrate how the industry of cost management is evolving and how these ones might enable purchaser officers to effectively manage knowledge about products and services, and electronically buy the more suitable (less expensive) products or services.

**Keywords:** brokers, sensemaking, knowledge management, ontology based systems, cost management processes.

## Introduction

In these last decades and in dynamic markets, firms are increasingly focusing their attention on their core competencies providing products and services with lower costs, higher functionality, quality, and technologies. Companies have, also, moved from hierarchical structures to networked models, based on both intra-organizational networks (among strategic units, divisions, groups, and so on), and inter-organizational networks such as industrial districts and knowledge networks (Hamel & Prahalad, 1990). In this scenario, cost management encompasses a broader scope than in the past. The

increasing trend of partnership participation, outsourcing processes, de-localization of productions, etc. forces organizations to accurately manage the total costs of their products, even if an increasing amount of items do not rely upon their core competencies. Therefore, specialized expertise and competencies on innovative cost management methods and tools are needed, and practitioners and consultancy firms are now offering their specialized knowledge and skills.

This paper is focused on the role of cost management consultancy companies as knowledge brokers between buyers and suppliers. The hypothesis of this paper are the following:

- consultants on spend data management and reduction costs share knowledge with their clients (the buyers) through a sensemaking approach. In this way they achieve a common agreement on innovative purchasing strategies;
- consultancy companies enable “knowledge boundary crossing” between buyers and suppliers, enabling products and services innovation;
- semantic based technologies help consultants to effectively manage and analyze information about purchased products and services.

The ideas showed in this paper, are the results of two years of collaboration between the University of Verona (Italy) and Creactive Consulting S.p.A. (Affi, Italy). In the next paragraphs, the relevant literature for this work is illustrated, the research hypothesis are depicted, the case study is described, and finally some results are sketched out.

## **State of the art**

Client’s cost management process is developed in a relational context that doesn’t fall anymore into the simple dichotomy of markets an hierarchy (Williamson, 1975), but generates real complex systems of negotiation and product/knowledge sharing. These relationships might represent intermediate or hybrid forms of governance that enable firms to access the knowledge of their trading partners in more efficient ways, and act on it. In any case, these hybrid relational contexts are characterized by incomplete contracting since it is either impossible or unreasonable to develop standard agreements that completely specify all of the probable interactions’ outcomes (Cooper, Slagmulder and Drucker, 1999; Cooper and Slagmulder, 2002, 2002b). This causes a more complex system of cost management which should take into account a set of knowledge that is buyer’s or supplier’s property, such as technologies, functionalities, and qualities of products, semi-processed products, and services. This complexity increases the need of specialized expertise on products and cost management methods, tools and organizational processes. It encourages the proliferation of consultants and experts in cost reduction and management. These experts collaborate with a growing number of firms, have strong networks with producers and vendors, know innovative strategies of negotiation processes, are aware of new production technologies. Consultants know, also, the preferences and the needs of both buyers and suppliers.

In this context various theories can help us to explain the research hypothesis of this paper. Thus, the state of the art of three main studies is described:

- Fundamental notions of cost management theories, methods and tools;
- Knowledge management, the constructivist approach, and the sensemaking framework;
- Semantic based and ontology based technologies for cost management.

### ***Fundamental notions of cost management theories, methods and tools***

The traditional volume-driver cost system does not fulfill adequately new emerging needs such as: performance measurement, operational control or product costing purposes (Kaplan, 1990), examination of relationships between a firm’s strategy and the design of information systems, cost control and cost management (Yoshikawa, Tanaka, Innes e Mitchell, 1993; Horngren, Foster e Datar, 1998), etc. Under the pressure of the emerging competition, accounting has moved to cost management and has become an integral part of the planning and control system of manufacturing operations (Brimson, 1991). In addition, cost management can be seen as a set of techniques and procedures that support decision making (Kaplan, 1990), and as an “attitude and a way of life” that takes into consideration market strategies, value of products, etc. (Cooper, Slagmulder and Drucker, 1999). Thus, researchers and practitioners have accepted the idea that, in order to comply with a more complex set of needs, a wide set of possible solutions has to be unveiled. Therefore, various,

and sometimes not well coordinated, approaches and techniques have been designed and proposed, taking a great deal of inspiration from “Japanes Cost Management approaches”. For in depth analysis, see:

- the Activity Based Costing (ABC) that supports decisions making on products, analyzing the product life cycle according to Activity Based Management and Activity Based Management Accounting (Turney, 1991; Brimson, 1991);
- the Life Cycle Costing and the Target Costing (Berliner e Brimson, 1988; Susman, 1989) that aim to enhance value and reduce costs of products throughout the product life-cycle and highlight opportunities for cost reduction (Susman, 1989);
- the Target Costing, in which a target price and a target profit should be achieved by a combination of products and their components (Sakurai, 1989; Cooper, 2002);
- the Total Cost of Ownership that takes into consideration the overall costs of the supply chain, analyses processes within the firm and also the relationships among supplier and customers in terms of control and management costs (Ellram, 1995; 2002).

At the same time, various tools –such as Value Engineering, Variety Reduction Program, Cost Table, Quality Function Deployment, Design For Manufacturing and Assembly (Monden and Sakurai, 1989; Akao, 1989; Yoshikawa and Innes, Mitchell,1989; Yoshikawa, Innes and Mitchell, 1990; Koudate and Suzue, 1990; Gerthardt, Hutchinson and Mistry, 1991)– have been used to define the most acceptable combination of components which sustain a cost reduction (Cooper and Slagmulder, 2002; 2002b; Monden and Sakurai, 1989). All the combinations of products, semi-processed products and services, should satisfy the functional requirements explicitly or implicitly needed by the firm and its departments, even if the combinations of various components could change products functionalities.

Finally, a lot of studies and works have been devoted to the creation of some organizational norms and best practices of purchasing processes. Such as:

- the active participation of members, who operate in different organizational divisions (marketing, production, administration), to the purchasing processes;
- the creation of multidisciplinary teams that analyze the spending data, etc.;

In some studies it has emerged that the continuous interaction between experts of different functions and disciplines helps to generate innovative solutions; the vertical interactive control between top management and middle management supplements the top management’s monitoring activities and helps to formulate their strategy; the continuous interplay of multiple “local technologies”, and the interactions at the boundaries between different units are critical factors for innovation and for creation of new knowledge (Brown and Duguid, 1991); the encounter of different perspectives sustains innovation (Boland and Tenkasi, 1995), etc. However, to achieve good and innovative results, it is not sufficient to organize multidisciplinary meetings and inter-functionality teams since knowledge, values and trust are not shared.

In this paper, we believe tat the role of consultancy firms, their activities and processes, affect on buyers’ organizational processes, enabling communication with suppliers and innovation.

### ***The constructivist approach and the sensemaking processes***

According to the constructivist approach –(for in depth analysis see (Berger and Luckmann, 1966; Weick, 1979)— members of a group give precise meanings to their activities and roles. These meanings are strongly influenced by (and at the same time manipulate) peoples’ believes, actions and environment. In the constructivist approach, the sensemaking process is defined as an interpretive action in which people assign meanings to ongoing occurrences (Weick, 1995) through three main elements:

- a framework: the system of mental constructions that individuals use interpreting objects or reality. In a collective sense, it is the system of values, routines, stories that are embedded in the organizational culture;
- an issue: an object that only if connected with the framework has a meaning;
- a cognitive shock: a gradual or radical interruption of the continuous flow of issues interpretations. This interruption is caused by a significant deviation between expectations an interpreted issues. Namely, individuals or groups recognize issues and experiences but are not able to interpret them in a sound way as long as framework changes take place.

According to Weick, to make sense means to create order and understanding among experiences by applying mental frameworks. The process of connecting a framework to an issue, which has been introduced into the mind or into an organizational environment, is the very core of making sense. A lot of practices are now establishing in knowledge management, and a lot of consultancy firms are

adopting these techniques in order to enable cognitive shocks and innovative solutions. We believe that sensemaking techniques might improve the effectiveness of knowledge management processes within the consultancy firm and among consultants and their clients.

### ***Knowledge representation theories, and semantic based tools.***

The knowledge representation theories are strictly dependent on formal ontologies and ontology based systems. An ontology is “the systematic, formal, axiomatic development of the logic of all forms and modes of being” (Cocchiarella,1991). Another commonly accepted definition is that an ontology is an explicit specification of a shared conceptualization that holds in a particular context. In other words ontologies define the kind of things that exist in the world and, possibly, in an application domain. They provide explicit conceptualizations which describe semantics of data, providing a shared and common understanding of a domain. The main idea is to develop an understandable, complete and sharable system of categories, labels, relations, which represent, in an objective way, the real world. In cost management, ontologies might conceptualize the notions related to purchaser orders, invoices, inventory, etc.

In this work, we take into consideration only statistical algorithms that are ultimately based on *bag of words* document models (Manning and Schutze, 2000): an approach that focuses on the number of occurrences of the words, regarded as opaque tokens, thus disregarding the information that would be provided by the knowledge of their meaning. In this way we neglect approaches based on natural language semantics and pragmatics, because they generally requires much richer language-specific resources (annotated lexica, language-dependant rule databases), which are not developed or available to a sufficient extent for our primary applicative focus: multi-language enterprise settings. See the work of (Klavans and Resnick, 1996) for a comparison between statistical and symbolic approaches to natural language analysis. More generally, bag of words models are often extended in order to work with short phrases, collocations and other linguistic features that can be selected on the basis of their statistical significance. For a general analysis of the text classification techniques based upon statistical data pattern analysis readers should refer to Yang (1999). The majority of industrial implementations of document classifiers make use of algorithms that exploits a by-example training scheme, such as naïve Bayesian classifiers, Bayesian networks, k-nearest neighbors, maximum entropy, keyword and rule extraction, and support vector machines (Mitchell, 1997; Nigam, Lafferty and McCallum, 1999; Yavuz and Guvenir, 1998; Chai, Ng and Chieu, 2002; Joachims, 1998; Zaane and Antonie, 2002, Apte, Damerau and Weiss, 1994; Allen 1995).

On this trend several commercial systems and suites of tools, in particular used to manage costs, and information and meta-data on items and catalogues, have been developed and are under construction. In order to help the cost analysis process, these tools usually perform an automated or semi-automated categorization of the purchased items, and keep track of their technical specifications. Some of the most widely used solutions are:

- Ariba helps companies to analyze, understand, and manage their corporate spending to achieve increased cost savings and business process efficiency. Ariba applications currently operate on nearly four million desktops around the world and Ariba solutions enable global industry leaders to greatly increase their competitive advantage. Some customers of Ariba are: ABN AMRO, BMW, Chevron, Cisco Systems, Hewlett-Packard, and Unilever (Ariba, 2005);
- Zycus Spend Data Management™ (SDM) software provides automatic classification and enrichment, to enhance data quality within an enterprise Sourcing & Procurement system. SDM product suite consists of a set of software tools which can plug in with existing IT infrastructure like ERP, Data Warehouse, eProcurement applications etc. to provide automated spend/master data classification and enrichment. Zycus Spend Data Management™ has helped leading enterprises around the globe build end-to-end solutions across their existing IT infrastructure for: Detailed Spend Visibility, Purchasing Compliance, Material Master Enrichment, and Catalog Search. Fortune 500 organizations such as General Electric, P&O, ABB and Unilever have already implemented and experienced the power of these solutions (Zycus, 2005).
- Requisite Technology helps to solve the "unsolvable" problem of spend data visibility and management at the item level, not just at the category level. In fact, Requisite solutions allow to manage millions of products at the item level, enables comparison of matches, and handle foreign currencies and 14 languages. They map to required industry-standard schemas and internal business processes, letting users maintain current systems while gaining visibility into parts at the item level (Requisite, 2005).

- PurchasingNet can import catalogs via CD-ROM, the Internet, or any other data source. The Catalogue Junction allows clients to maintain catalogs themselves, thus ensuring supplier independence (PurchasingNet, 2005).

We believe that industrial implementations of document classifiers, which make use of algorithms that exploits a by-example training scheme, are generally unsuitable for cost management activities. The main reason are:

- it is often difficult to find a sufficiently large set of training documents. It depends on several reasons, such as few accessible documents in the system (hardly accessible for technical reasons, or for restrictions imposed by the policies of firms). In several cases of industrial applications, it has also been taken into consideration the use of specific tools to create “rehashed” artificial documents by mixing the content of a set of original documents without altering the regularities that our classifying algorithms tried to exploit;
- when there is a sufficiently large set of documents, these may be “unevenly descriptive” of different parts of the taxonomy;
- it is difficult to determine if a training set covers the whole range of the intended meaning of a taxonomical category, rather than enumerating a series of too specific instances. Naive developers might suppose that the problem of *overfitting* is solved with a large enough set of examples, but it often happens that such examples are chosen from a small number of sources that carry on some significant common biases.
- the *purely syntactical* aspects of description of documents are not specifically relevant for this matter, because these discrepancies can be directly addressed with specific normalization techniques (Manning and Shutze, 2000; Aizawa, 2001);
- it is often presupposed that those semantic difficulties could be solved or effectively addressed with the use of a semantically annotated lexicon, such as *WordNet* (Fellbaum, ed., 1998), or a thesaurus, but these general-purpose tools are too generic to handle the subtleties of a domain-specific taxonomy, and their contribution results indeed misleading in many cases;

## **Research Hypothesis**

The hypothesis of this paper are the following:

- consultants on spend data management and reduction costs share knowledge with their client through a sensemaking approach. In this way they achieve a common agreement on innovative purchasing strategies;
- consultancy companies enable “knowledge boundary crossing” between buyers (the companies’ clients) and suppliers, enabling products and services innovation;
- semantic based technologies help consultants to effectively manage and analyze information and knowledge about purchased products and services.

### ***The sensemaking approach in the spend data management processes***

According to the constructivist approach, during meetings and focus groups participants (buyers and consultants) are stimulated to

- perceive the real situation within the firm (combination of products, strategies, contracts and service level agreements (SLA), etc.),
- confirm their framework or make new meanings (understand and change the framework),
- help members in changing their perceptions,
- unveil problems in product combinations and SLA, etc.

In this context, and in particular in outsourcing processes of cost management, different frameworks (the one of consultants and the other of purchasing officers) meet. This generates cognitive shocks which are explored and adapted to new interpretations, thus frameworks change and innovation occurs (Kezar and Eckel, 2002).

In the paper of Collini, Cuel, and Fabrello (2005) three cases studies have been depicted and guidelines for effective processes of cost management have been unveiled. These are:

- the creation of a collaborative partnership. Buyers and suppliers become accomplices that share knowledge and strategies in a cooperative way;
- the establishment of a collaborative environment in which cost management consultants and buyers feel free and trustful to share knowledge about the organizational needs;

- the agreement on a common initial situation in which some profitable solutions can be developed;
- the emerging of a cognitive shock. The new profitable solutions might emerge from a cognitive shock (officers didn't perceive before), which stress members of the interfunctional and interdivisional group to search for new solutions;
- the adoption of innovative solutions. It is not obvious that the adopted solution is the more innovative and less expensive. Even if innovative and suitable solutions are proposed, other less convenient might be implemented within the firm, only because these last ones are much more coherent and consistent with the decision makers' frameworks.

Only by taking a cognitive approach at the interpretation of the decision making process, the innovation of cost management processes can be understood and explained, by perceiving the importance of the different steps of the organizational process and the crucial role of both information and "players" within a "sensemaking framework".

Finally, accepting the "human beings cognitive limitations" as matter of facts and not as a "pathology", or, in other words, accepting the theoretical framework of bounded rationality, might not only help to understand the success (or the failure) of many cost management approaches, but also might help in designing new approaches with a better understanding of the consequences they have on actual decision making processes.

### ***Consultancy companies on cost management as knowledge brokers***

In networked organizations, consultancy firms on cost management must take into account the distributed nature of knowledge, and should allow coordination among buyers and suppliers. This is reflected in the duality between the need for highly articulated local perspectives that make-up the communication and knowledge creation tissue of each community, and the need for sharing cultures and instruments that enable communication across different units (Mark et al., 2002).

This vision allow us to take into consideration the communities of practice (COP) approach: a well-known branch of researches, based on field observations, that disclose the importance of social dynamics and practice-based relations in knowledge production processes (Lave and Wenger 1991; Brown and Duguid 1991; Wenger 1998).

From both constructivist and pragmatist perspectives, COP theories underline the role of subjects as knowledge constructors and the role of action in shaping social reality (Gherardi and Nicolini 1999; Engestrom 2000) focusing on contextual interactions. In some studies the self referential nature of competences formation and the conservative attitude of COP are disclosed as obstacles to innovation. Therefore the role of brokers and boundaries among COP and their related negotiation practices have been deeply described from different points of view (Beacky, 2003; Swan et al., 2002). For in depth discussion sees concepts of brokers, boundary roles and objects (Wenger, 1998) and perspective taking (Boland and Tenkasi, 1995).

In particular, the features of brokers are the following:

- the capacity to be transparent, enabling various actors to understand each other. Even if each actor has her/his point of view, perspective, and a personal conceptualization schema, should be enabled, by brokers, to take different perspectives. Namely, each actor should try to recognize the perspective of others, becoming familiar with terms and concepts used by them, understanding their point of view, and improving her/his personal conceptualizations;
- the capacity to establish stable commitments. Actors have the possibility to mediate different schemas and to establish commitment, enabling meaning negotiations among community's perspectives (Carlile, 2004).

In this work we demonstrate how consultancy firms carry on the role of brokers, enabling boundary crossing among suppliers and buyers.

### ***Semantic based technologies to effectively manage information about products and services.***

Semantic-based tools can be used to pre-process raw historical purchase order data. Such data is usually available only in a semi-structured format, in particular the actual description of the purchased items is provided only as natural text, without any further codification scheme. This pre-processing activity augments the raw data in two ways:

1. items are automatically classified within a fine-grained taxonomy (i.e. a hierarchical classification scheme composed of increasingly specific categories), whose structure is cooperatively defined by the client (the buyer) and the consultant, in order to best match the client's domain, in terms of functional equivalence and substitutability;
2. a structured relational representation is automatically built for each purchased item, by extracting the list of category-specific technical parameters from the semi-structured textual description. This structured representation enables automated, algorithmic similarity comparisons between items.

Since the acquisition and pre-analysis of data is by far the most time-consuming activity for cost analysts, the primary functional goal of the use of semantic-based technologies is to provide methodologies and tools to automate these processes, while preserving accuracy.

The main purpose, of the data gathering and cleaning phases, is the identification of functionally equivalent artifacts (material products, and services) along the segment of the purchasing history. The identification (and aggregation) step is not trivial, since the primary source of information about each purchased product or service consists in a natural language textual description of the item itself, a description written by an human being for another human being, thus usually incomplete and context-dependent, potentially ambiguous, generally non providing any formally shared identification token (such as a catalog-based product ID), and based on an open-ended vocabulary.

A possible solution is to develop an ontological model of the target domain, supporting the notion of functional equivalence (which, in turn, is strictly domain- and context-dependant), and then, populating a knowledge base of the purchase history, based on the schema provided by the model, extracting data from the orders. As depicted above, the most common industrial implementations of document classifiers make use of algorithms that exploits a *by-example training* scheme. However, we believe that all these approaches are generally not suitable for our applications, since they are not able to support a relatively complex model of the target domain. In fact, by-example classifiers are usually good enough to generate a hierarchical classification (that is, to support a IS\_A relation between classes), but not acceptable to model and recognize more complex relationships (such as PART\_OF), and extract and normalize category-specific attributes (such as those referred in the technical datasheet of the artifacts).

Furthermore, a relevant disadvantage of these methods is that they try to extract knowledge about the target domain mainly from (descriptions of) instances of entities of the domain itself, rather than from an introspection of the domain expert's conceptualization.

The semantic based technologies, to effectively manage information about products and services, should be configured by "decorating" the ontological schema (consisting in entities, attributes and relations, organized mainly by hierarchical sub-sumptions) with collections of weighted rules that recognize user-defined terminological and linguistic features, which are expected to be relevant in the source text. The rules are exploited by three components of the text-processing tool, a classifier, an attribute extractor and a normalizer. They perform a shallow parsing of the item description, in order to provide a set of tentative representations of the described artifact in terms of the ontological schema. Now the rules are mainly written by hand. A methodology has been developed in order to allow consultants to easily develop and write rules, performing a set of statistical textual analyses on the description corpus.

Finally consider that the domain model and classifier, as a knowledge repository, can become reusable "as is" in the same context and with similar input data, and can be used as a basis for deriving similar models for "contiguous" contexts (within other organizations).

This augmented corpus of item descriptions, enables different actors in the cost-reduction process to reach different goals:

1. the automated fine-grained classification of the items enables the consultant analysts to quickly build a more precise expense model from the raw purchase order data;
2. the clean, structured representation of items, both purchased in the past and available on vendors' catalogues, enables the client to perform a more precise comparison between similar and/or functionally equivalent items, and thus to implement a more cost effective purchase strategy for the future;
3. the new purchase strategy can be implemented as a formal purchase model, whose compliancy and effectiveness may be continuously monitored by the client, by analyzing in

real time the newly issued purchased orders, and automatically matching them against the initially defined taxonomical classification;

4. the improvements brought by the new purchase strategy can be quantified and certified by analyzing a new historical segment of purchase orders issued following the new model;
5. the consultant can gain insight on the expense model of the client, by examining the cooperatively defined taxonomical model and structured relational representation of the purchased items. Furthermore, this formal model is an important knowledge asset for the consultancy company.

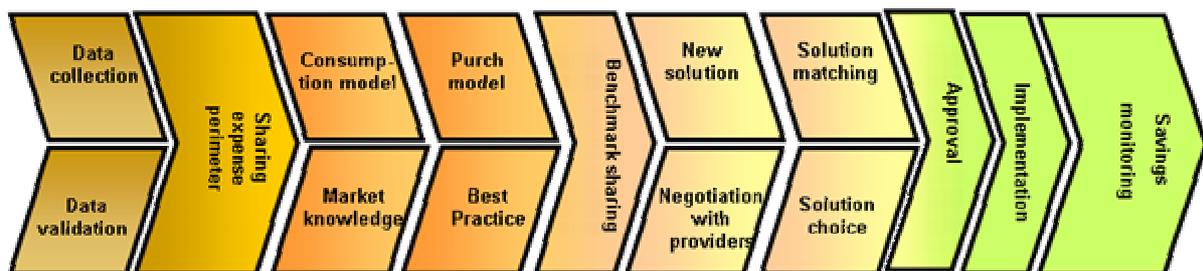
## The case study

In this work, a paradigmatic case study is described. Creative Consulting S.p.A. is an Italian consulting company in cost management for medium and large firms (Creative, 2005). Established in year 2000, now Creative Consulting S.p.A. is specialised in offering cost management services such as: expense reduction projects for a specific cost area (e.g. logistics, tools), projects for one specific expense category (e.g. express delivery) or special jobs for critical areas. In year 2004 Creative Consulting S.p.A. has set up an effectiveness partnership with ACP (an IT company) to develop semantic based technologies and tools aimed at supporting cost management processes, managing catalogues, and comparing products and services.

The consultancy firm, composed by 6 partners and 40 experts in cost management, has carried out many projects of costs reduction for over 100 different clients, both public organizations and private companies which belong to Italian and international firms. Some of them are: Telecom, Pirelli, Veronesi Group, Automotive Lighting, Banca Intesa, Siemens, Nestle, etc. At the beginning, the firm managed a huge number of projects for small and medium enterprises (almost 50 projects in a year), now it focuses on large organizations and the number of contemporary managed projects was progressively reduced to 10. These projects are long term activities, have a higher level of complexity that requires stronger attention to human and technical resources allocations.

Flexibility and concrete approach, together with a steady activity to develop new solutions have allowed Creative Consulting S.p.A. to operate in any area and on any category of cost: from the easier general expenses to the more complex dynamics of core business costs. The keystone to develop successful projects is the correct knowledge of customer's costs structure such as the series of products and services that are consumed and purchased within the firm and their functional and technical characteristics.

The cost management processes developed by Creative Consulting S.p.A. are represented in the Creative Consulting's Value Chain depicted in Figure 2.



**Figure 2.** The Creative Consulting's Value Chain

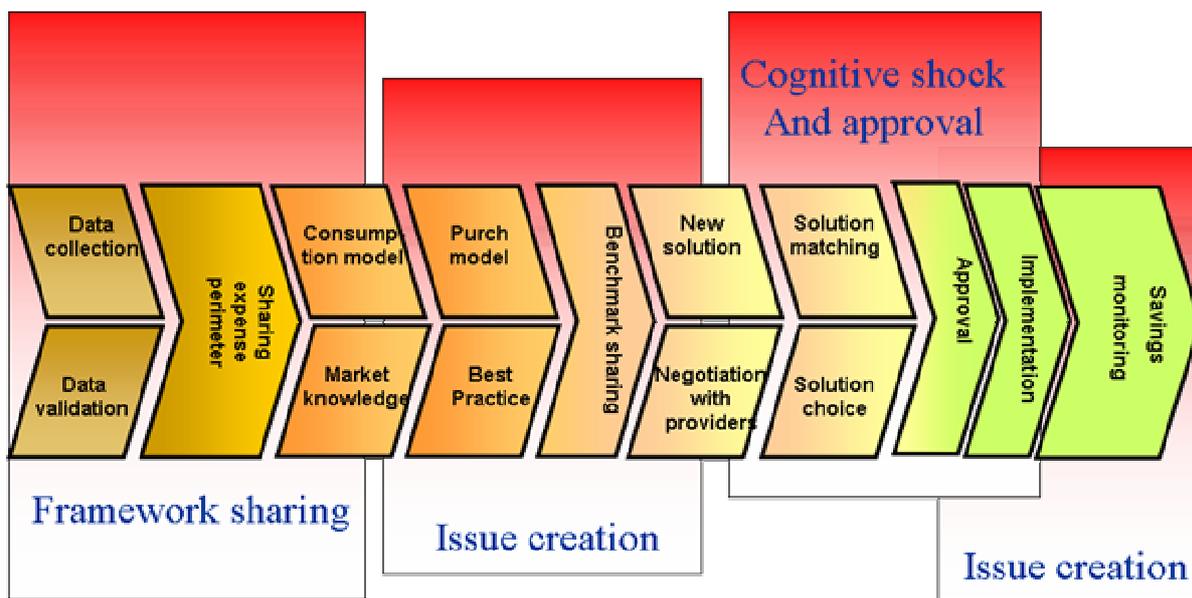
To achieve an effective expenses reduction the company collects data within the buyer company, analyses competitors, market opportunities, and purchasing practices. Finally define the benchmarking purchasing processes, and proposes innovative solutions to the buyers, maintaining or improving the level of service. Due to the expertise of qualified consultants and partners, a series of new solutions are often unveiled and shared with the client. Thus, one solution is chosen, approved by purchasing officers, practitioners, etc, and finally implemented in the firm. In the 95% of its projects, the firm has guaranteed a 15% of savings on average, in particular it has obtained the following percentages of savings on products and services: 26% on clothing, 15% on insurance policies, 22%

on paper and forms, 27% on hardware and software, 32% on copiers machines, 30% on mailing services, 29% on telecommunication services, 25% on waste management services, 16% on cleaning and logistic services, etc.

After that, Creative Consulting S.p.A. implements the new solutions within clients' firms, consolidates the services and supervises the achieved results in order to make the company completely able of self-governing its expenses. The success of Creative Consulting S.p.A. is sustained by its system of reward (based on success fees on achieved savings), the active participation in multidivisional teams, and the ability of consultants to understand the corporate cost structure of clients (spending data models, demand analysis, strategy compliance, etc.), the capacity to find feasible deviations in the cost structure of products and services, and the ability to propose and then test innovative solutions (Creative, 2005).

**The sensemaking approach in Creative Consulting S.p.A.**

In (Collini, Cuel, Fabrello, 2005; Cuel, 2006) two case studies have been analyzed: the food and the vehicle cases. In both analysis the Creative Consulting's Value Chain has been analyzed through the sensemaking approach and it has emerged the following schema.



**Figure 3.** The sensemaking approach in the value chain of Creative Consulting S.p.A.

As described in the hypothesis, consultants establish a collaborative environment in which they and the buyers feel free and trustful to share a common framework on purchased products and services, organizational needs, and markets. They identify some critical products, and create a common issue: an agreement on a common initial situation in which some profitable solutions can be developed. Consultants propose new solutions that will impact on organizational processes, if these are understood, and compatible with the buyers framework, they will be approved by the chief officers, and finally adopted within the firm.

**Consultancy companies on cost management as knowledge brokers**

Although the main purpose of the consultancy activity is to produce a new purchase strategy for the client, the overall boundary crossing interactions and the sensemaking technique have a number of relevant consequences:

1. the buyer becomes more aware of its purchasing model, analyzes its costs from a new perspective and makes sense of all its purchasing processes. This increases the buyer's knowledge about products and services, and makes the balance of the informative asymmetry more favorable to the client itself. As a natural consequence, its negotiation power increases;
2. consultants gain a domain-specific knowledge on the client's core activities, and purchase model. This enables them to focus on a more narrow domain, and identify the last innovative technologies that might implement products and services;

3. consultants bring to their clients the overall innovation of products and services, propose more effective purchasing processes. Along with the client, they build a context-specific purchasing strategy, tightly focused on the current purchase model, the competitive environment and the opportunities of technological innovations;
4. consultants manage their network of actors, remaining vendor-neutral in order to guarantee trustful relationships with the buyers, and to be perceived as unbiased by the prospective clients;
5. the consultants negotiate with various suppliers, and evaluate the supplier that offer the most suitable products and services. Often a product/service reengineering process is required, and suppliers are involved in this activity. Sometimes, consultants manage to create an interdisciplinary and interfunctional team, composed by purchasing officers, shipping agents, producers, and vendors. Through continuous trustful interactions, the team would identify innovative solutions, that are developed, then introduced, and finally adopted by the buyers;
6. the most relevant results, in term of gained cost effectiveness, are usually generated when the three main actors can be brought to a common negotiation table: within this setting, the client is lead to expose some technical details about its domain-specific use of the purchased products; the supplier is lead to innovate its product in terms of technical specifications and/or production and deployment workflow, and the consultant is active at facilitating the merging process, while retaining part of the intellectual property rights of the newly generated solutions;
7. globally, this boundary crossing activity enriches each actor with specific knowledge about its counterparts, and thus favors customer loyalty.

#### ***Semantic based technologies in the case study.***

The two main components of the semantic based system of Creative Consulting S.p.A. are HyperCatalogue and SmartSearch (technical feature are well described in (Bellomi, Cuel, Biscaro, 2005)).

Creative HyperCatalog manages the purchasing model, such as a data base that coherently integrates both information on catalogues, and purchasing policies (the definition of special prices or service level agreements). As described in Figure 4, purchaser officers (or simply users) can navigate the catalogue, looking at products that they wish. Selecting a category, users get automatically other sub-categories, identifying the specific products that they need. The final proposed products will be the more suitable for users, in other words, the less expensive ones that satisfy the technical features required by the purchasing officer.

[Office Supplier] 

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COLLE, COLTELLERIA, CUCITRICI, FERMAGLI E FERMACAMPIONI, NASTRI ADESIVI, PERFORATORI, STRUMENTO DI MISURA, TIMBRI
- BLOC NOTES, QUADERNI E RUBRICHE**  
AGENDE/PRODOTTI CON DATA, BLOCCHI, FOGLIETTI RIPOSIZIONABILI, RUBRICHE
- CARTA**  
CARTA BIANCA, CARTA COLORATA, CARTE PER MACCHINE PROFESSIONALI
- INFORMATICA**  
SCRIVANIA E AMBIENTE DI LAVORO, SUPPORTI MAGNETICI
- MATERIALI DI CONSUMO**  
CARTUCCE PER STAMPANTI INKJET, NASTRI PER STAMPANTI, TONER E NASTRI PER FAX, TONER PER STAMPANTI LASER
- RIUNIONI E CONFERENZE**  
BLOCCHI E LAVAGNE A FOGLI MOBILI, LAVAGNE E ACCESSORI, PROIEZIONE
- SCRIVANIA E ORGANIZZAZIONE AMBIENTE DI LAVORO**  
ACCESSORI PER SCRITTURA E SCRIVANIA, ORGANIZZAZIONE E RECEPTION, SICUREZZA
- ARCHIVIAZIONE**  
ACCESSORI DI ARCHIVIAZIONE, ARCHIVIO BIGLIETTI DA VISITA, CARTELLE SOSPENSE, INTERCALARI, RACCOGLITORI A LEVA, RACCOGLITORI AD ANELLI, SCATOLE E CONTENITORI PER ARCHIVIO, SCHEDARI E CARTELLETTE
- BUSTE, ACCESSORI PER LA SPEDIZIONE, BILANCE E PESALETTERE**  
BUSTE PER CORRISPONDENZA, NASTRI DA IMBALLO, SPEDIZIONE
- ETICHETTATURA**  
ETICHETTATRICI ELETTRONICHE E MECCANICHE, ETICHETTE PER UFFICIO, IDENTIFICAZIONE
- MACCHINE PER UFFICIO**  
ALTRE MACCHINE UFFICIO, AREATORI, CALCOLATRICI, PRODOTTI ELETTRICI, STAMPANTI, TELEFONIA E STRUMENTI DI COMUNICAZIONE
- PRESENTAZIONE**  
BUSTE E CARTELLETTE, MACCHINE PER PRESENTAZIONE, PRESENTAZIONE MANUALE
- SCRITTURA E CORREZIONE**  
ACCESSORI PER LA SCRITTURA, EVIDENZIATORI, MARCATORI, MATITE, PENNARELLI, PENNE, PRODOTTI PER LA CORREZIONE

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Figure 4. Creative Hyper Catalogue categories

The choice derives from the comparison of products (described in various catalogues) according to functional and technical features, and as described in Figure 5, the purchaser officer can directly forward the order to the supplier who offers the more convenient products.

[Office Supplier] 

Radice > BLOC NOTES, QUADERNI E RUBRICHE > FOGLIETTI RIPOSIZIONABILI > FOGLIETTI RIPOSIZIONABILI DI ALTRO COLORE > **FOGLIETTI DI ALTRI COLORI**

**Totale item: 2**

	Descrizione	Codice	Prezzo	Fornitore	Link
	12 CF 3M Post It note giallo, 38X51	949037.0	3,75	Office Depot - Core List	<a href="#">Info</a>
	12 CF 3M Post It note giallo, 76X76	197144.0	7,95	Office Depot - Core List	<a href="#">Info</a>

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Figure 5. Creative HyperCatalogue and the purchasing order request

Creative SmartSearch allows purchaser officers to search for a specific product using natural language. As it is depicted in Figure 6, the SmartSearch interface is similar to a common search engine, but the search mechanism (based on semantic instruments) and the quality of product identification are completely different.

Presente nel catalogo

- 📁 CARTA
- 📁 CARTA BIANCA
- 📁 CARTA SPECIALE PER STAMPE A COLORI
- 📁 [CARTA SPECIALE PER STAMPANTI INK-JET] 📌

**colore:** Bianco  
**FormatoCarta:** A3

**Dettagli Ricerca:**

Testo: CARTA SPECIALE PER STAMPANTI INK-JET Bianco A3  
 Categoria [Presente nel catalogo]: **CARTA SPECIALE PER STAMPANTI INK-JET**  
 Attributi: FormatoCarta: **A3**  
 colore: **Bianco**

Tempo di ricerca: **0,25** secondi.

**Totale item: 1**

	Descrizione	Codice	Prezzo	Fornitore	Link
ID	RISMA 500 FOGLI CARTA RICICLATA BRIGHT WHITE FORMATO A3 - 80 GR - COLORE BIANCO	2335545.0	1,00	Lyreco - IT	<a href="#">Info</a>

[Richiesta d'acquisto](#)

**Figure 6.** Creative SmartSearch

Creative SmartSearch identifies the one and only product that satisfies the user’s needs and that has the less expensive cost. For instance if the purchasing officers uses the search engine and writes a query like "yellow paper a4", the phrase, written in natural language, will be analyzed in all its parts. Each part constitutes a technical attribute that is recognized and contextualized in the ontological system such as “Type” is associated to "paper", “Color” to “yellow”, and “Format” to “a4”.

The main idea behind these applications is to use text-mining techniques to build a structured representation of purchasing model, starting from items, their natural language and textual descriptions found in suppliers’ catalogues. The structured representation is defined by an ontological model of the items’ domain, which describes the taxonomical organization of the catalogue, and specifies and constrains the technical attributes of the items themselves. Besides, the natural language queries performed by the user are translated into the same structured representation. The main reasoning service enabled by the ontological model is the ability to decide whether two items are “functionally equivalent” with respect to the use intended by the purchaser; in most cases, this can be modelled by taking into consideration only some relevant attributes, while disregarding the others (as an example, the kind of tip and the length of the blade are relevant attributes for a screwdriver, whereas the colour of the handle is not).

### Conclusion and future work

In this work we have shown that Creative Consulting S.p.A. implements innovative solutions within buyers’ firms, continuously sharing knowledge with their clients. This process is enabled by:

- the attitude of consultants to share a framework, involving purchasers officers in the analysis of data, deeply analyzing, and actively participating in multidivisional teams;
- the system of rewards: Creative Consulting S.p.A. is paid on success fees on achieved savings. This system plays a crucial role in the perception of client’s officers. They perceive the consultants as they were working for free, until they don’t gain some savings. Thus officers should help consultants to collect data, explain purchasing orders, and deeply analyze the corporate cost structure of clients;

- the neutral networks of vendors that Creative Consulting has and manage. Each consultant has a personal network of suppliers that are ready to share knowledge, and improve their service in order to satisfy the buyers;
- the fact that consultants have a strong knowledge on the domain of analysis and are able to understand technicalities and features of products and services. This allow them to reduce the information asymmetry, better understand the technical problems, negotiate, achieve an agreement between buyers and suppliers;
- semantic base tools that allow consultants and purchasing officers to better understand the corporate cost structure, in order to better understand the needs of the organization and proceed to negotiate with suppliers.

In any case some other work should be done in order to concretize the model of knowledge broker. The business model of success fee should be proofed in order to understand if it is sustainable in the time. The set of partners and clients should be analyzed because it should be relevant to understand and effectively manage the clients target and the networks of suppliers. Finally some studies will be focused on the analysis of real effectiveness of semantic based tools within the organization.

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