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- Doctoral Dissertation -

"PROPOSAL OF A KNOWLEDGE AUDIT METRIC BASED UPON A COMPARED ANALYSIS IN PRIVATE AND PUBLIC ORGANIZATIONS"

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To those people who taught me everything I know,
cause this has been possible thanks to them.

To Gigetto and Annamaria
with love

Abstract

The Study approaches the organizational analysis known as knowledge-audit, and in particular proposes to extend the structure of the related models over the mere analysis of the organizational knowledge including the knowledge-management capabilities.

An assessment-process on the knowledge-management systems is thus structured basing upon a specific grid whose components address the organization's intellectual capital, from one side, and the main perspectives of the balanced-scorecard [Kaplan, Norton, 1996; 2001] from others. In particular, applying such grid produces an estimate of the correlation occurring between the *efficiency* of the knowledge-management systems and the *business performances* of the organization; and basing on such correlation here is defined a metric addressing the possible existing relationships among: (a) the support level provided by the knowledge-management system to the organization's intellectual capital; (b) the achievable improvements of the system (by taking quantitatively-defined changes in terms of technologies, personal competence, and personal motivation); and (c) the increases in the business performances. Such a metric then allows to estimate the effectiveness of the knowledge-management systems as well as to individuate those interventions, that must be taken to boost the capabilities of the same system, in terms of technology, personal motivation and personal competencies.

Such metric is tested in the Study's empirical part on two main samples constituted by different subjects: the first is consisting of two subgroups of private technology consulting firms - one operating worldwide and the other operating locally in the Southern Italy; the second instead is consisting of different public organizations that have been selected among Italian public administration bodies, Italian Public Agencies (i.e. INPS, Agenzia Dogane, etc.), public research centers,

and international organizations. The presumably existing deep difference between the samples in the their own operational knowledge-management systems' development is here used as reference term to test the intrinsic consistency of such metric as very different values characterize the produced estimates: over proving the meaningfulness of the metric the positive exit of the test thus allows to define a quantitative estimate of the real divide existing between the subjects and to propose a related suitable strategy for improving the knowledge-management systems of the same subjects.

Premise

The progress reached along the last decades in the information and communication technology produced a wide, epochal to many, transformation of the production systems as well as it deeply changed the habits of our society. To acquire and process large amounts of data at a very low cost and without any space limit made arise new forms of distributed structure of work; the net-working structure of enterprises and organizations is possible today thanks to such kinds of technologies as these make it possible to accomplish in different and indefinitely far places each single sub-phase of the whole production process. Although born as discipline of automatic calculus the information science seems to have deeply changed our way of life. And that change seems to be not finished in modifying our habits as well as all production processes. The conquests gained in this field from science and technology lead today even more than in the past the information and organization disciplines to confront with an issue which has been always coexisting with man: knowledge. This can be considered as the true origin of every human effort aiming at making it possible a very ancient process which is to create and transmit knowledge. That is called today as knowledge-management.

In 1995 Nonaka and Takeuchi proposed to the international scientific community and to the widest universe of enterprises a vision about something very easy to believe but still difficult to formalize: as the value creation processes increasingly tend to depend on the value of knowledge the competitive advantage of every organization will consequently depend even more on the ability of organizations in learning which means to create, use and accumulate knowledge while accomplishing all business processes. Although a very intrinsic difficulty in formalizing or providing a concrete prove of this such vision produced a very deep impact on the organization and technology field turning the traditional approaches to the information and decisional support systems towards a new horizon represented by the knowledge-management systems. To some extent it could be argued that a cultural change occurred into the concept of information processing system, and a jump has been made towards the higher knowledge-management step.

However, such evolution is actually in progress starting from the same concept of knowledge that should be addressed to achieve the coherent objectives with the improvement of enterprises: while it seems to be clear the aim which is to structure the organization and the information systems for favoring and strengthening the knowledge-creation and -transmission processes, it does not seem to be clear the way for doing so.

I. Scope and Research Questions of the Study

The Study aimed at developing an organizational analysis framework addressing the knowledge-management systems and the possibly related effects produced in terms of increases in the business performances of one organization; such attempt is here made in order to concretely contribute in improving the knowledge-audit process by widening its analysis spectrum as well as by making the analysis to produce more specific outcomes to be applied into the design process of the same knowledge-management systems.

Specifically, the Study's research questions are indicated below :

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1. *Is it possible to estimate the possibly existing relationship among the knowledge-management system, the intellectual capital and the business performances by a related (statistic) correlation based metric?*

2. *Is it possible to improve the knowledge-audit by adding a metric to assess the effectiveness of the knowledge-management systems? and in this case, will this be better supporting the design phase of such systems?*

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Such questions make it then clear the basic aim of the Study: to develop the said analytical framework for estimating the possible relationships occurring between the (business) performances of one organization and the performances of its own knowledge-management systems, from other side. From a general point of view the main Study's expectation can be intended as to advance in the structuring of the organizational analysis processes supporting the design of the knowledge-management systems; that means to outline an operational path for estimating the performances of such systems and to individuate both the technological and organizational lacks that must be addressed to structure every possible improvement strategy and intervention.

Furthermore, the experimenting part of the Study also aimed at outlining an overview about the progress achieved today in the development of the knowledge-management systems by different kinds of real organizations; to this, the empirical analysis has been conducted by comparing a samples of subjects that can be presumed to be advanced (i.e. high-tech consulting companies) with another samples of subjects that can be presumed to have not been involved yet in the needed deep change-processes in technology and organization towards the knowledge-management (i.e. the public organizations) - that made it possible to define a range of the already reached progress levels in the design and implementation of the knowledge-management systems.

The said metric has been expected to give the chance of establishing a quantitative relationship between an indicator addressing the knowledge-management system and its way of working , from one side, and another indicator addressing the presumably capability of the system to concretely support the organization and increase its performances. And at the same time that has been expected to provide a reference-term for precisely (i.e. quantitatively) defining the needed improvements on the knowledge-management system for achieving such increases in the business performances.

II. Related Works

The problematic approached into the Study mainly lies in some of the possible limits to be attributed to the knowledge-audit process and particularly: i) the organizational knowledge-management capabilities out of the analysis spectrum; ii) the weak relationship between the (knowledge-audit) outcomes and the available knowledge-management technologies to be applied; iii) the lack of a systematic frame for organizing the operational information to be used into the design process of the knowledge-management systems.

In particular, basing on the most widely known methods and approaches [Wiig, 1993; Debenham e Clark, 1994; Sahah, 1998; Delphi e Dataware, 1998; Liebowitz, 2000; 2002] the *knowledge-audit* process seems to be merely focused on the organizational knowledge and consequently to be missing a well structured process addressing the organizational capabilities of managing such intangible resource of organizations: as conducted the knowledge-audit process one organization is supposed to be aware about its own available and missing (and needed) resources in terms or knowledge but cannot be aware at the same way about its own capability of acquiring or manipulating or diffusing such knowledge throughout its own organizational units. That can lead to a deep lack of the knowledge-management system design process as the knowledge-audit process cannot give operationally usable information about the needed functions that a knowledge-management system should be provided with.

Although many knowledge-management technologies have been developed and are easily available today it seems to be missing any criterion or standard method to establish the suitable matching between the knowledge-audit outcomes and the design of the knowledge-management systems. In particular, such technologies are commonly classified by the different possible kind of (recognized) forms of knowledge to be managed [Nichols, 2000]; and following such classifications the Study distinguishes three main families of technologies that respectively are conceived to manage: (1) explicit knowledge under structured form - e.g. databases, data-warehouses, OLAP, knowledge-discovery in data (data, web, log usage, mining); (2) explicit knowledge under semi-structured form - e.g. natural language processing, information-retrieval, knowledge-discovery in text (KDT), document- and content-management, case-based reasoning; and (3) tacit knowledge - e.g. knowledge acquisition applications, communication collaboration system, group ware, adaptive systems, multimode and multi-channel interfaces.

However, as a knowledge-audit process has been conducted then it remains up to the single responsible analyst to freely interpret the possible meanings of the obtained outcomes in terms of technological and organizational need; and consequently it is up to him/her to decide about the adequacy of every possible technology (maybe basing on the difference addressing the said kinds and classes of recognized forms of knowledge) as no formal support or guidance is provided for designing the knowledge-management systems. That proves to some extent the global lack of operational criteria for proficiently matching the outcomes of the knowledge-audit with the available technologies for designing and implementing an operational knowledge-management system. Neither indication comes from the traditional structure of the knowledge-audit in terms of suitable organizational solutions to be applied.

Therefore, it can be argued that such organizational analysis process and the related practices and methods can be considered to be missing of standard as widely accepted criteria that could guide the design of the knowledge-management system from both technological and organizational point of view. That is, the specific problematic approached into the Study is given by the necessity of making the knowledge-audit process able to provide an operational guidance criteria for concretely supporting the design of the knowledge-management systems and particularly to lead the structuring of these forward the effectiveness; in other words, this lies in the need of obtaining from the knowledge-audit clear and direct indication addressing the organizational capabilities of handling with knowledge (to be boosted) and the key-technological and -organizational factors to be focused for structuring more effective knowledge-management systems.

Although belonging to the knowledge-management and the design of the related support systems, such problematic addresses to a more specific area where few contributions have been provided from the literature on this field (because of the very young interest in this). To better define such area it could be useful to recall by different specific topic some of the most addressed related works :

topic 1 - knowledge-managament system design and organizational analysis

[Wiig, 1993; Debenham & Clark, 1994; Sahah, 1998; Delphi & Dataware 1998; Liebowitz, 2000; 2002; Migliarese e Verteramo, 2003; Migliarese et al. 2005]

topic 2 - knowledge-management support technology VS business performance increases

[Davenport e Prusak, 1998; Nickols, 2000; Schiuma, 2001; Bonifacio et al., 2002; Heisig, 2003; Straker 2002; 2005]

topic 3 - adequacy of the knowledge-management technologies to organizational needs

[Alavi e Leidner, 2001; Earl, 2001; Zyngier, 2001; Corso et al., 2003; Heisig, 2003; Malhotra, 2004; Edwards et al., 2005]

It should be finally noticed that such problematic also addresses the estimate of the intellectual capital of organizations as here is specifically recalled because of the Study's aim of defining an effectiveness-oriented analysis framework for the knowledge-management, and then, as already introduced in Iazzolino, Pietrantonio, Ruffolo, Verteramo [2004] from the aim of designing an operational support instrument that could to increase the organizational concrete capability in handling with its own intangible assets generated by the organizational knowledge.

III. The Innovative Contribution of the Study

The Study's innovative contribution mainly lies in the extension of the structure of knowledge-audit models [Laybowitz, 2001; Dataware, 1998; Wiig, 1993] which is here added with a specifically focused process on the knowledge-management systems. In other words, as the knowledge-audit process can be considered to be mostly an inventorying process of organizational knowledge [Laybowitz, 2001] this is here widened in the analysis spectrum by introducing a specific assessment process regarding the organizational capabilities in managing the same organizational knowledge.

Such extension is here proposed to increase the effectiveness of the knowledge-audit process since the *status-quo* merely regarding the organizational knowledge (i.e. target of knowledge-audit processes) cannot be considered to be sufficient to base the final advise that organizations can use for improving its own knowledge-management activities. To make stronger such advise, and to increase the effectiveness of knowledge-management systems design and implementation phases it is also needed in fact to be aware about the *status-quo* regarding the organization capabilities of handling with knowledge. Then, the true contribution of the Study lies in the attempt at bridging the supposed existing divide (i.e. a weak matching) between the organizational knowledge as represented by knowledge-audit analysis reports and the knowledge-management key-factors to be used for building-up a knowledge-management system (e.g. knowledge-management technologies, training, etc.). No suitable strategy for selecting the available specific technologies or other possible support-system constituting factors seems to be well structured for conducting proficiently the design and implementation plans of the knowledge-management systems.

The here proposed knowledge-management assessment strategy then tries to answer to the following question: " ... *how can the knowledge-audit process be improved in order to produce a clearer operational outcomes to design a* knowledge-management system*?* ... " where the proposed answer is: " ... *such* *improvement can be taken by extending its analysis spectrum to the organizational knowledge-management capabilities, and then by estimating the coherent changes that must be part of the knowledge-management system design strategy ...* ".

The Study then develops the idea presented in Iazzolino, Pietrantonio, Ruffolo, Verteramo [2004] and then recalled in Iazzolino, Pietrantonio [2005a; 2005b] regarding the extensions of the knowledge-audit models to the assessment of the knowledge-management organizational capabilities by a grid where the intellectual capital structure is crossed with the balanced scorecard [Kaplan, Norton, 1996; 2001]. In particular, such concepts are here further developed and organized within one rating scheme of knowledge-management systems; such framework is specifically based on a metric which is here developed by combining different values of the correlation occurring between the business-performances addressed ratings with the knowledge-management efficiency addressed ratings. Specifically, where the first ratings are calculated by a group of balanced-scorecard extracted parameters the latter are calculated by three main design factors: the available technologies, the training activities, and the economic incentives.

The here developed metric allows to establish a quantitative relationship among: (a) the knowledge-management system provided support to intellectual capital's intangible assets; (b) the constituting factors of the system (i.e. technology, personal motivation and personal competencies); and (c) the increases in the business-performances. That makes it possible not only to estimate the effectiveness of the knowledge-management system (which is here intended against the performance increases) but also to individuate the needed interventions to be accomplished in terms of technological and organizational changes.

IV. Basic Assumptions

Here are following the main assumptions by which the Study has been developed around the idea of adding an assessment phase addressing the organizational knowledge-management capabilities in order to extend the knowledge-audit.

1. *the intellectual capital of organizations and the business performances are related somehow*; that is, such relationship could be then indirectly estimated addressing the effects of the knowledge-management system against the business performances;

2. *the knowledge-management systems should be designed and implemented in order to strengthen the said relationship*; to do so the matching between the knowledge-audit outcomes and the needed improvements in the knowledge-management systems should be strengthened by defining a quantitative-based assessment tool focusing not only on the lacks but also on the expected improvements of the knowledge-management systems;

3. *the strength of the said relationship in one organization can be estimated by calculating the statistical correlation occurring between the impact of the knowledge-management system on the intellectual capital and the business performances*; to do so, a series of related ratings can be combined in one metric to be statistically tested by using two groups of different subjects respectively characterized by a strong and weak relationship between the said categories.

V. Main Results and Further Developments

In conclusions, the Study achieved two main results: first, this has outlined a metric establishing a relationship between the performances of a knowledge-management system, against the intellectual capital of the same organization, and the organization's business performances; and second, as successfully tested such metric on real organizations this has proved that such metric can be used to define the needed interventions for improving a knowledge-management system, and consequently for extending the knowledge-audit and strengthening the design phase of the knowledge-management systems.

However, although both the basic research questions of the Study have been positively answered these can be just considered as prior results that need to be further analyzed and tested on other different real subjects as well as the same theoretical framework should be further strengthened in its fundamentals. Then, two main directions at least should be followed for further developing the Study's research: the first is given by the extension of the correlation based metric; and second, is given by the design oriented model of the knowledge-management systems.

The fundamentals of the metric should be further and more precisely defined against different possible kinds of real organizations to be analyzed and classified. In particular, the set of indicators addressing the balanced-scorecard model that has been here used to assess the business performances should be better specified so that a more rigidly group of indicators could be established for precisely individuated organization. The indicators used along this Study were definitely individuated in fact following the guidance of the representatives of the involved organizations because of the lack of standard set of indicators in the literature of the field. At the same time the set of indicators addressing the intellectual capital should be better defined to obtain more deeply meaningful information about the impact produced by the knowledge-management system. That requires further and deeper analysis on real cases of different organizations.

The here defined theoretical model to extend the knowledge-audit should be further specified and experimented by a wider analysis including either the organizational knowledge and the knowledge-management capabilities of the same organization. Contemporary, another more highly focused analysis should be conducted on the design phase of the knowledge-management systems which follows to the application of the here proposed model of knowledge-audit; in particular, the knowledge-management design strategies outlined by such should be better analyzed and tested on real cases. That requires also that further and deeper empirical applications of the model should be implemented on real cases.

VI. Structure of the Study

The Study consists of three main parts; while the first part contains the theoretical premises and presents the problematic approached, the second part illustrates the proposal of extending the knowledge-audit process from the methodological point of view, and finally the third part illustrates the empirical analysis of the subjects to test the knowledge-management assessment process.

First Part - Theoretical Premises and Approached Problematic

Constituted by four chapters the first part of the Study provides a non-extensive overview about the theoretical premises and its fundamentals. In particular, the first chapter illustrates the whole theoretical framework addressing the knowledge-management systems and briefly introduces the concepts of intellectual capital and specially that of knowledge-audit which represents the main focus of the Study; indeed, this presents some of the main models and configurations of the so called knowledge life-cycle - e.g. the Nonaka's and Takeuchi's model, and the Fraunhofer Institut Model, etc. - focusing on the main functions that a knowledge-management systems is expected to be provided with as proposed in the literature of the field. The second chapter instead presents a brief overview of the mostly known technologies that have been developed and are commonly applied to implement the knowledge-management systems within real organizations today. The third chapter finally presents the main schemes for conducting the design and implementation of the knowledge-management systems specifically illustrating the basic architecture of these systems and the use of the outcomes of the knowledge-audit analysis to structuring such systems.

Second Part - the Metric for Extending the Knowledge Audit Models

The second part of the Study illustrates the main proposal for extending the knowledge-audit models to the assessment of the knowledge-management systems basing on a series of correlation coefficients between the ratings addressing the business performances and the efficiency of the knowledge-management system.

In particular, this part is consisting of three chapters. The first highlights the main specific approaches and instruments that are commonly used to conduct the knowledge-audit in the real organizations and then emphasizes some of the possible weaknesses that are approached from the Study; the second of these chapters illustrates the whole development of the here proposed methodology for extending the knowledge-audit process structuring a knowledge-management assessment based on the said series of the rating-based correlation coefficients; and finally the third chapter illustrates the way of applying such methodology for assessing the knowledge-management capabilities of organizations and coherently base the knowledge-management design or improvement strategy.

Third Part - the Empirical Analysis

The third and last part of the Study describes the empirical analysis that has been conducted to test the here proposed metric for assessing the knowledge-management system effectiveness. In particular, this part is organized by three chapters; the first illustrates the main results obtained from the analysis of the subjects by directly interviewing the representatives of all organizations; the second chapter instead describes in a detailed way the application phase of the proposed assessment model on the knowledge-management systems of the subjects and then the main results obtained in terms of correlation rates are discussed; in the third and last chapter is then conducted the final discussion about the results obtained from the empirical analysis against the whole framework of the Study, the possibly related implications and the further suitable next research to be conducted starting from such results.

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Chapter 1

Fundamentals of the Study's Theoretical Framework: Knowledge Management and Intellectual Capital

1.1 Introduction

The interest of hundreds of scientists, researchers, business-men as well as economists, philosophers, and sociologists has been increasingly attracted from the theme of knowledge and knowledge-management so that a vast literature has been very quickly produced along the last decade. However, the "Access Era" [Rifkin, 1992] seems still remaining in a status of general confusion among hundreds of different definitions attempting at catching what is to some extent one of the most ancient interest of men: knowledge.

Scientists and practitioners all agree that knowledge is becoming the most important economic resource and that in the future (many say today) the competitive advantage of enterprises will be given from their ability in handling with knowledge as this flows through all business processes that every organization perform: being able to effectively control that knowledge means effectively controlling the internal processes and consequently performing them in a proficient way achieving good performances. That is, many theoretical models have been proposed to represent either how knowledge flows throughout one organization following the so called "knowledge life-cycle" and how such, to some extent natural, knowledge-flow should be supported by the organizational systems especially by those based on the information and communication technology. Although the several different contributions outlined on this theme have not been definitely synthesized yet - there is no one-vision on knowledge-management but several visions often coherent with the specific research field where these have been defined - two main approaches arise from the literature addressing the epistemological meaning of the knowledge-concept, from one side, and the possible application of knowledge into the business processes as an economic resource, from other side. One of this specifically leads to an increasingly attractive concept individuated by the Intellectual Capital: the theoretical representation of what is actually perceived to be (and to become even more) the new form of worth of organizations. The intellectual capital expresses in fact how the knowledge can give form and then determine the organizational abilities in developing the competencies by learning or by aggregating knowledge created within the same business processes; and most important, the intellectual capital lies in the organizational ability in continuously innovate which gives the ability of being adaptive and consequently of being competitive.

Anyway, most of the concepts related to the knowledge-management have not been yet fully developed into a practical vision or a practical framework coherently constituted by an organizational and a technological aspects and then, a great lack of effectiveness is still affecting the actual ongoing knowledge-management solutions. From one side, the traditional technology-driven approach seems to have been not overcome so that big interventions are fully implemented from the technological point of view only and are not achieving the expected results because of the consequent intrinsic lack of coherence with the organizational aspects. From other side the highly complex dimension represented by the social context as well as the human behavior makes it very difficult to develop an operational design framework since it is not easy at all to follow a design-based approach into a social context. That makes it partially ineffective the top-down (technological-based) approaches that are commonly followed to implement the most sophisticated technological solutions (e.g. the group wares, the expert systems, the database-management-systems, the data warehouse systems. etc.).

This Chapter attempts at providing a very synthetic review of the most famous and widely definitions and models regarding the concept of knowledge as it has been analyzed (and applied) into the managerial context along the last decade. That is, a small number of approaches to this topic are here recalled and briefly analyzed highlighting the basic differences occurring among these. In particular, as reviewed the most well known definitions of the concepts of knowledge and knowledge-management it is listed the main classification systems of the forms and kinds by which the knowledge can be recognized within one organization. Then, the main aspects lying in the dynamic nature of knowledge are distinguished by those addressing the static nature of knowledge and consequently a very brief description is provided about the concept of Intellectual Capital as it comes out from the static perspective of knowledge.

Finally some applicative model of knowledge-management is here recalled and then in conclusions are presented the main open issues that remain to be further approached by the next researches and studies in the future about the knowledge-management.

1.2 Evolution of The Modern Organizations: Knowledge and Knowledge-Management

1.2.1 Knowledge and Knowledge Management. Key-Characteristic and Knowledge-Sharing

The aim of knowledge management is even more trusted to be creating the company value and improving its business performances [Davenport, Prusak, 1998]. In this sense, knowledge management can be intended not just as managing the possible knowledge sources *per se* or managing the knowledge workers but instead it should be considered as a very complex activity to be performed within and involving the whole organizational context (strategy, goals, etc.) where knowledge is created, shared and used. When organizations are really able to exploit different information and knowledge by using technological and social connections and to provide access to that knowledge through such links there is still possible to them to create real business value. That is, the knowledge-management initiatives should be *embodied into the business environment* as these generate real value when formal and informal networks within the same organization are supported and integrated; knowledge must be effectively identified and shared within a socio-organizational context through such networks. There clear business objectives are to be structured in an implementing and measurable way in order to produce positive outcomes [Knownet, 2000]. Within such networks people are the main generators and consumers of knowledge so that the human-factor has to be considered to be as a key-factor of knowledge management; supporting (human) communication are then one of most critical aspect of every initiative.

The possible characteristics of knowledge were since a long time ago the subject of many philosophical discussions so that many answers were given from many philosphers and scientists of different fields. From the field of Logic it comes the assumption by which an agent *knows* a sentence either where he consciously assents to it or immediately sees it to be true when the question is presented; that is, the epistemic-logic provided the notions of *knowledge* and *belief* as bases for much work in the area of Artificial Intelligence [Meyer, van de Hoek, 1995] - a typical example of a formal modal logic of knowledge is described in Hintikka [1962].

However, pragmatic notions of knowledge are mainly used in social and organizational researches; Peter Drucker said : *" ... knowledge is information that changes something or somebody either by becoming grounds for actions, or by making an individual [agent] (or an institution) capable of different or more effective action ... "* [1989] while West Churchman stated: *"... to conceive of knowledge as a collection of information seem to rob the concept of all its life… knowledge resides in the user and not in the collection. It is how the user reacts to a collection of information that matters ..."* [Churchman, 1971].

Although it is very difficult to individuate any more trustful definition of knowledge among the several available it could be somehow important to look at some of the characteristics that should be considered within every knowledge-management initiative:

- *Persistency :* knowledge does not leave as its carrier has been left since knowledge does not move but spreads by flowing; knowledge can be considered as a sponge: *"... information, the raw material for producing knowledge and wisdom, cannot be bottled up for long: it leaks. (...) The competitiveness of an organization depends on their being a sponge for inventions, innovations and applications elsewhere ... if a company or a country keeps its ideas secret ... it will attract that much less knowledge from others ..."* [Cleveland, 1997] so that the knowledge-management should be implemented by a saturation of that sponge which means that knowledge should be leaking and absorbed;

- *Non-Determinism:* although knowledge can, and should, be evaluated by the decisions or actions that leads to as knowledge processes are always performed by one actor targeting a specific objective [Davenport, Prusak, 1998] however knowledge is owner- and context-sensitive or in other words *non-*

deterministic: two different agents holding the *same*-knowledge can act in totally different way because of different effect produced by their individual background (experience, skills, etc.) or also further casual factors;

- *Individuality*: to many extents knowledge remains a personal worth and cannot be completely duplicated or reproduced because of factors such as personality and subjectivity; however, what can be shared is the potential-knowledge: a combination of explicit knowledge (i.e. information for some author) and application-context including insights, lessons learned, applicability and other factors considered important by the generator; so that by determining whether and how apply that knowledge the receiver will make it its own, creating his own new knowledge based on the shared potential knowledge.

- Knowledge Sharing -

One of the main objectives of knowledge management is to provide an environment for optimal sharing (of knowledge) between its users, both people or machines; this basically develops by two ways: articulation and socialization [Nonaka, 1991].

- *Socialization*: addressing the sharing-process of tacit knowledge between two agents where knowledge moves from tacit to tacit and does not become explicit and cannot easily be used by the organization as a whole;

- *Articulation:* addressing that process by which an individual formulates his/her own tacit knowledge in a communicable way others making that as explicit and then sharable within the organization.

Socialization has always represented the most easy (and natural) way of learning: this is the way by which apprentices learn from his/her master. However, there is no master to directly approach into the distributed organizations; moreover, learning cannot be easily controlled by the organization so that the related outcomes tend to be diffused infrequently and randomly. Enterprises even more concerned with the optimal use of knowledge held by every employee; however although usually yielding good results sharing knowledge through socialization processes is not easy (because of people lack of willingness) and articulation solutions are in such cases the most appropriate. Consequently, knowledge management efforts often focus on the articulation (i.e. formalization) of knowledge which represents a form of converting the personal tacit knowledge into organizational explicit knowledge.

The knowledge-representation issues lead the information technology which gives the ability of defining technical instruments supporting the same representation process; however the solutions provided till today are not always optimally applicable to all situations because of the intrinsic difficulty of making formal a vague and still personal representation of any knowledge. That is, only some part of the corporate knowledge can be computer-processed as formalized while other parts to be just understood by individual can be left informal [Abecker et al, 1998].

1.2.2 State of Art of Knowledge-Management

A great interest arose along the last decade from the managerial literature around the role of knowledge as strategic resource of enterprises [Leonard-Barton, 1992; Hamel, Prahalad, 1990] which is even more widely recognized to be crucial within the acquisition of long period competitive advantage [Barney, 1991; Druker, 1988; Grant, 1991]. The actual turbulence and the increasingly fast changes of the modern social and economic global contexts made dramatically increased the competition levels all enterprises have to face to survive. No far the change can be considered as a temporary phenomenon: change is a permanent status of markets which imposes all enterprises to be adaptive to continuously changing in their strategies, action-plans, as well as in their own competencies and technologies. That strongly forces all enterprises to be continuously searching for those economic resources that (over the traditional production factors) can yield a dynamic and persisting efficiency through the time [Porter, 2001].

As embedded into the organizational structure of enterprises knowledge is even more widely and deeply trusted as the critical (new) resources to sustain and improve one enterprise's ability of innovating. That mostly lies in the intrinsically strong relations existing between the knowledge and the competencies of both individuals and organizations [Leonard-Barton, 1992; Hamel, Prahalad, 1990]. Although differently characterized by the specific features of the social context where it is generated, the knowledge still constitutes the basis of every organizational competence whose development can be specifically sustained by a specific cognitive-domain; it must be noticed to this extent that every cognitive competence is resulting from a combination of two groups of activities: those performed by individuals and those performed by the organizational structures. While the first ones address personal knowledge, skills, and attitudes the second ones address procedures, routines, and organizational culture as well as technological infrastructures and networking relationships.

It is then possible to argue that knowledge constitutes the key-factor concretely leading the business processes of all organizations [Bontis, 1999] and is then affecting their abilities in creating value [Savage, 1990]. That led to the concept of "learning-organization addressing the modern organizations that are even more committed in structuring them-selves and the way of performing all internal processes focusing on the cognitive processes, and consequently in strengthening continuously their own cognitive capital and the related organizational competencies [Senge, 1990]. Therefore, the cognitive capital of one enterprise does represent a critical means to leverage the use of all economic resources and increase the business performances [Marr, Schiuma, 2001; Guthrie, 2001; Quinn, 1992].

To plan and implement effectively every strategy one organization must then understand what the competitive advantage is consisting of and consequently which shape of its own cognitive capital is or can be sustaining that advantage. That is individuates a new field of researches related to the knowledge-management which is recently grown, and which is specifically focusing on the assessment of the cognitive capital of one organization. A great contribution is basically expected from such researches given that a good management of one resource is possible just where such resource has been assessed.

Although the increasing importance of this topic and the great amount of studies and researches conducted it is not easy at all to outline a clear state-of-art regarding the works produced all over the worlds by the hundreds of scientists, researchers and practitioners interested in knowledge-management. The European ISSS CEN project, "European Guide to Good Practices in Knowledge-Management", [Mertins, Heisig, Vorbeck, 2003] represents one of the most recent survey conducted to estimate what has been produced in this field around Europe along the last few years.

However, the literature on this topic remains very huge focusing on so many different aspects than any attempt of synthesizing all in a only-one framework appears to be very difficult. That is, the few insights and definitions described till now are then integrated with the following descriptive frame which has been outlined focusing on the elements indicated below:

- the evolution of the knowledge-management concept (from the genesis to on with particular attention on the social, organizational, and economic aspects regarding the enterprises);

- the knowledge-management solutions proposed along the last few years from a theoretical and practical point of view;

- the main actual perspectives, achieved results, and open issues;

- the main aspects of the possible future evolution.

1.2.3 *Several Research Domains on Knowledge-Management*

As above told a very wide research field has been growing around the concept of knowledge-management along last ten years attracting even more increasing interests of researchers and practitioners from several different fields. Starting with studies proposed in the business field [Stewart, 1997] and in strategy literature [Hedlund, 1994] then many other more articulated and structured proposals were following in economics [Ba et al., 2001; Rivkin, 2001] organization theory [Hargadon and Fanelli, 2002] or also through researches regarding the innovation [Galunie and Rodan, 1998] as well as information systems [Massey et al., 2002; Schultze and Leidner, 2002] or also the marketing [Madhavan, 1998] the entrepreneurship [Yli-renko et al., 2001] and the management strategy [Grant, 1996; Dyer and Nobeoka, 2000].

Probably due to the so wide spectrum of different fields where researches and studies on knowledge-management come from, no consolidated understanding seems however to be arising from the scientific community or that of practitioners. Any one-vision of the knowledge-management still appears to be missing while a certain confusion tends to be associated to the intrinsic vagueness of this topic; and that can limit the chance of establishing any synergic relationships among the several ongoing studies and researches.

In an attempt of avoiding this risk Subraimi et al. [2004] proposed an interesting analysis of the literature pointing out that researches and studies conducted on the knowledge-management by the most cited authors can be organized around eight main domains (depending on the frequency of the co-citations occurring among the same authors' works):

Tab. 1.1 - Knowledge Management Research Domains [Subraimi et al., 2004]

1. Knowledge and Firm Capability
2. Organizational Information Processing and Information-Technology Support for Knowledge-Management
3. Knowledge Communication, Transfer, and Replication
4. Situated Learning and Communities of Practice
5. Practice of Knowledge-Management
6. Innovation and Change
7. Philosophy of Knowledge
8. Organizational Learning and Learning Organization

Such classification of the possible heterogeneous domains addressing the knowledge-management lets arise how the information and organization sciences can be considered to appear as the fields where this topic has been explored first as well as the management can represent today that where most of interests lies in the suitable increases achievable by a right strategy of knowledge-management in the business performances. Contemporary with this, the philosophy and the sociology do constitute important disciplines from which several strong contributions come and can be expected to come again in the future.

- Domain 1 : "Knowledge as Firm Capability"

Such domain expresses a predominant focus in the knowledge-management literature: the role that knowledge can play in providing organizational competitive advantage as critical intangible asset of the enterprise. This research-stream basically focuses on the organizational competitive strategies by which to increase the business performances of the enterprise [Porter, 1985] and is then based on a broad range of studies addressing the core-competencies of the enterprises [Prahalad, Hamel, 1996] as well as the combinative capabilities [Kogut and Zander, 1998] the resource based view [Grant, Barney, Prahalad, 1998] the social capital [Ghoshal, 2001] the knowledge articulation within the enterprise [Sanchez, Hedlund, 1999] and the dynamic capabilities [Teece, 1987].

Researches addressing this theme then regard all activities and integrating mechanisms by which to coordinate, transfer, and deploy the knowledge embedded in both individuals and organizational-network as well as the social context enabling the knowledge creation and the use of knowledge into the business processes; in other words, these regards those knowledge intensive processes mostly giving the enterprises the ability of facing the challenges of our even faster times.

- Domain 2: Organizational Information Processing and IT Support for KM

Basically correlated with concepts of organizational-learning and learning-organizations this area of researches regards the organizational information processing [Simon, 1966; Weick, 1968] as well as the organizational memory [Walsh, 1982] the media theories [Daft, 1981; Weick, 1968] the information processing behaviors of managers [Mintzberg, 1983] the structuring of organizations [Mintzberg, 1983; Orlikowski, 1973] and the information systems [Walsh, 1982; Orlikowski, 1973]. Such domains specifically folds those researches focusing on the uses and potentialities of information and communication technologies from the organizational point of view (i.e. in the organizational theories); specifically, that addresses the expected support that the knowledge-management can give in enhancing the decision-making processes by the use of information systems as one organization's memory. There are also addresses the studies and researches on the communication media and their role as medium of knowledge-management.

- Domain 3 : Knowledge Communication, Transfer and Replication

This domain basically addresses the researches regarding the *intra-organizational-knowledge transfer* which is specifically intended as the replication and diffusion of knowledge about the manufacturing and operational processes (i.e. sharing of expertise among individuals); in particular, such studies generally focus on all social, structural and cognitive barriers that can limit the knowledge-sharing within the organizations. Indeed, these researches specifically approach the knowledge recombination and reconstruction which is needed to transfer knowledge and skills across different organizational sub-units rather than just simply transmitting data or information. That makes this domain different from that regarding the communities of practice where the knowledge-transfer is mostly focused from a personal point of view (i.e. knowledge transfer by individuals); further, the communities of practices can be also distinguished from this domain because of the different consideration about the knowledge-sharing and -creation processes viewed as emergent phenomenon while this domain is more strictly related to the organizational initiatives aiming at sustaining the knowledge-transfer across the organizational sub-units.

- Domain 4: Situated Learning and Communities of Practice

This research area bases on the ideas regarding the communities of practice, the situated learning, the social cognition, and the legitimate peripheral participation as these were primarily contributed in the knowledge-management related studies by Lave [1992] Wenger [2001] and Brown [1997]. The related conceptual framework is characterized by a vision of knowledge-phenomena as bottom-up processes basically driven by individual motivations and interests - in spite of those addressing a view of top-down processes driven by organization's perceived need to disseminate throughout the organization knowledge on best practices, efficient routines, and innovations [Hansen, 1994; Szulanski, 1996]. This domain then folds those researches on the situated-learning and communities-of-practice where a consensually formed group is viewed as a knowledge-repository whose partial and overlapping shapes or subset are belonging to the individual participants: personal interactions represent the medium favoring both knowledge-creation and -sharing by exchanging experiences among community members. Here are also grouped studies regarding the acquisition of tacit and socially complex skills through apprenticeships and other forms of legitimate peripheral participation. In few words, the general perspective of researches in this domain assumes that learning and knowing are activities strongly related to the characteristics of the specific context and consequently, the processes of learning and knowledge-creation are to be considered as social phenomena whose outcomes can be determined by the dynamics of interaction of individuals in groups.

- Domain 5: Practice of Knowledge Management

Significantly related to the learning-organizations' domain this reflects a secondary emphasis in managerially oriented knowledge-management research on the informing managerial practice as it has been contributed by Davenport [1996] Tom Stewart [...] Peter Drucker [...] and James Quinn [...]. This reflects the researches focusing on descriptive, rich, anecdotal accounts of knowledge-management initiatives providing inductive insights that can contribute to theory building as well as informing practice.

- Domain 6: Innovation and Change

This represents a key domain of research in knowledge-management involving works about different aspects of innovation, organizational change, and economic growth of enterprises. Firts of all, the ideas of Teece [...] can be here included - the complexity of knowledge constitutes a basis of the competitive advantage as well as new knowledge can both enhance and destroy the competencies - as well as Schumpeter's [...] and Romer's [...] concepts reflecting the importance of incentives for innovation and knowledge creation. Similarly, Nelson's [...] and Winter's [...] contributions can be here considered about the organizational routines that are proposed as a key conceptual mechanism to describe the ongoing repeated action within organizations; and also Cohen's [...] and Leventhal's [...] notion of absorptive capacity suggested as a major determinant of learning and innovation. Finally, Von Hippel's contribution [...] can be included in this domain as it highlighted how the locus of innovation and problem solving can be influenced by the stickiness of knowledge.

- Domain 7: Philosophy of Knowledge

This domain folds those researches in knowledge-management extending the tradition of philosophical inquiry into the nature of knowledge; researches of this area thus investigate the foundations of human knowledge to identify different types of knowledge and then to explicate the possible relationships and interactions among them. Leading proponents of this area of research are Tsoukas [...], Blackler [...], Spender [...], Von Krogh [...], and Polanyi [...] who investigated the origin and nature of knowledge; with the exception of Spender these authors are largely from Europe and reflect the constructivist approach to management research on the continent as opposed to the predominantly positivistic approach to inquiry in the US.

- Domain 8: Organizational Learning, Learning Organizations

This domains comprises researches about the role that apprenticeship and the organizational ability in learning can play making the same organization able to learn from the performed processes. Prior researches on this were conducted by Peter Senge [...] Cris Argyris [...] and David Garvin [...] and in particular, the work of Senge elaborated on the notion of double-loop learning, mental models and defensive reactions, proposing that effective links between cause and effect in organizations need to incorporate "systems thinking" and "team learning"; moreover, several models of organizational learning and also evolved practical guidelines for managers were proposed by Argyris [...] and Schon [...]. while finally, Garvin contributed to the application of the principles of learning organization to organizational practice.

1.3 Knowledge Forms and Kinds - Main arising Concepts and Definitions

1.3.1 Possible Definitions about the Concept of Organizational Knowledge

The organizational context of enterprises is generally characterized by several different definitions about the possible forms recognized to the organizational knowledge which can in fact be individuated using several different classes of categories leading to different forms and kinds as well as embedded into several sources like people and automatic systems. Therefore, just few of most relevant distinctions about the concept of knowledge as agreed by the huge literature in the knowledge management field are here presented.

A basic very ancient distinction related to the concept of organizational knowledge was proposed by Ryle [1949] who specifically introduced two key-concepts within the literature on knowledge-management :

- "*know-how*", as the practice knowledge, or knowledge used in a operational way; this is task-specific and related (but not similar) to the individual ability in applying tasks;
- "*know-that*", as the theoretical knowledge related to the deep (and often hidden) causes of the phenomena; in particular, the know-how is essentially different from the theory because it is expressed in a formal and practical form or rules to apply that knowledge.

Therefore, a widely agreed classification about the concept of organizational knowledge was primarily due to Polanyi [1966], [1997] whom definition was later reprised and deeply extended by Nonaka and Takeuchi [1994], [1995]:

- "*implicit knowledge*": concerning that knowledge resulting from the personal learning processes as applied by each organizational actor; this specifically addresses all personal knowledge forms which is in this case strictly related to practical actions within the organizational processes; this form of knowledge is normally characterized by individual aspects like *know-how* and *know-that* addressed as well as social aspects internally and externally involved into the human relationships;

- "*explicit knowledge*": this addresses that form of knowledge which is generally shared within the organizations and is publicly accessible by specific storing and processing infrastructures; such form of knowledge can be also classified under the following categories: a. *structured*, as available into electronic databases; b. *semi-structured*, as available by intranet and internet web sites (e.g. HTML pages, XML documents, etc.); and c. *unstructured*, as available into textual documents like project documents, procedures, white papers, etc..

Traditionally used within the artificial-intelligence field instead some other categories to classify other possible classes of knowledge are the following:

- "*detail knowledge*": addressing effect-cause models and relationships based on natural laws;

- "*surface knowledge*": regarding those practical rules that people can learn applying his own task in efficient way; this is often considered under form of professional expertise;

indeed, such difference addresses another complex feature that can be associated to the nature of knowledge: the *dynamic* and *static forms of knowledge*. While specific facts, concepts, constraints, and states not-related to ongoing actions or processes can be considered as static-forms of knowledge, then the (ongoing) processes and procedures can be considered as dynamic forms of knowledge - such distinction is better and deeper analyzed in the follows of this Chapter.

A further classification distinguishes between *internal-knowledge,* as that part of knowledge belonging to the enterprises and/or its own members and systems, and *external knowledge* which is that knowledge not present inside the enterprise while available by external systems and people or by Internet.

As already said it seems to be very difficult to individuate one standard definition of "knowledge" that has been accepted from the fields of management, information and organization science as well in philosophy or sociology; several definitions instead were proposed contributing to some extent in boosting the said confusion within the wide research field on the knowledge-management.

Since it seems to be very difficult (where ever possible) to provide a very synthetic vision of the wider frame of researches and studies on knowledge-management and specifically on the possible interpretation of the concept of *organizational-knowledge* here are following just few (draft) definitions about such concept as proposed from some of the most famous researchers and practitioners in this field:

Tab. 1.2 Possible Definitions on Organizational Knowledge arising from the Literature on Knowledge-Management

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"... knowledge is a mix of experience, values, information about the context, and judgments of experts that provides a framework inside of which new experience and information can be valued and embodied ..."

~ Davenport (1998)

" ... knowledge is personal and justified awareness that increases individuals' ability in making decisions ..."

~ Barnes (2002)

"... knowledge is the main source of power and competitive advantage ..."

~ Hamel, Prahaladal (1994)

" ... knowledge represents the most important resource of our time ... "

~ Druker (1988)

==

Most of the above recalled definitions of knowledge address a form of knowing which is intimately related to the individual human-being; first of all, knowledge is thought to be embedded in human-being who can use it to accomplish his/her own assigned task. Then, knowledge is fundamentally thought to be a general means by which several human abilities can be enabled in accomplishing any kind of duty, and that generally gives the form to any knowledge-management attempt. What organizations basically try to do is in fact to acquire people's knowledge and making that fully available to the same organization breaking any possible dependence on a single people (i.e. the knowledge-holder) or in other words making the organization free from the single human-being.

To some extent that represents the basis of every knowledge-management function which can be implemented by different technological and organizational infrastructures: i.e. database management systems, OLAP, expert-systems, group-wares, or any kind of processes, routines, practices and norms. To build one organization's memory is the way for making knowledge survive over his/her own basic creator.

A couple of short definitions and very simple considerations about the possible meaning of knowledge are here recalled in order to better sharpen how the same concept of knowledge is generally recalled and applied in the managerial field.

I- Knowledge arising from People's Beliefs [Nonaka, 1993]

As proposed by the ancient Greek philosophers: " *... knowledge is a certain justified belief...* " and must be then considered to be not-static, absolutely not-objective but instead dynamic and still subjective; in few, knowledge must be considered to be depending on people by whom it has been created (i.e. formulated). Knowledge then regards one individual's personal perspectives and intentions, and organizations consequently can learn that knowledge through that individual only.

II- Knowledge as Structured Set of Information [Zack, 1998]

Knowledge is beyond data and information. Data are generally produced by observations on facts and are then not-necessarily meaningful while information through widely understandable messages come out from an aggregate of data including the (social) context. That is, knowledge can be considered to be a logically structured aggregate which is produced addressing a precise set of data.

III- Dynamic Aggregates of Knowledge

Different processing ways and accumulation processes occurring at both individual and organizational levels can generate several different basic forms of knowledge aggregates [Metcalfe e Gibbons, 1989]. In every organization the knowledge dynamically flows through all routines, procedures along the whole implementation of strategies and application of technologies; inside of this a complex system of beliefs, instruments, paradigms, codes, cultures and other forms of knowledge is dynamically contained and applied [Levitt, March, 1988]. That is, where conducted systematically the process of knowledge-accumulation can still constitute a source of competitive advantage to every organization [Dogson, 1993]; basing in fact on the above said statements, knowledge can widely and deeply affect the main fundamentals of one enterprise's strategy either by boosting the generation of the economic resources [Penrose, 1972; Wernerfelt, 1984; Rumelt, 1984; Barney, 1991; Peteraf, 1993; Collis, Montgomery, 1995] and by strengthening the specific core-competencies of the enterprise [Hamel, Prahalad, 1994]. Further, knowledge does constitutes a key-component of any organizational learning process; it can be recalled to this extent Cohen's and Levinthal's [1990] concept of "adsorbent capacity" which specifically expresses the organizational ability of understanding, generating, accumulating, and reusing the critical knowledge by the pertinent knowledge priority levels [Bhatt, 2001; Teece, 1990].

IV- Knowledge Spread throughout the Organization

The knowledge diffusion through a community is the basis of every learning process as well as generation process of new knowledge. People is not learning by staying alone; it is within a community in fact that a language can be created as communication-vehicle; within a community people is generally pushed to create new ideas, giving forms to the same community perspectives and prejudices or also to the practices [Kuhn, 1962]. And that is important to every organization since such processes can be facilitated by coordinating the communication and the mutual teaching [Dogson, 1993].

1.3.2 Proposed Differences among the Concepts of Data, Information, and Knowledge

A widely discussed (traditional to some extent) confusion in managerial field regards the three critical concepts of data, information, and knowledge. Some time this can lead to designing and implementing less efficient and effective knowledge-management solutions. Some idea is here following proposed to face such confusion sharpening the possible meaning of each concept and highlighting some possible interconnection among each others.

First of all, it is here proposed a possible definition of "data" and "information" and then one more definition of "knowledge" which is more strictly related to the first two than the precedent ones.

- *Data*. This definition addresses objective facts and then precise events and real situations. Data are normally used in every organization to perform all activities and business processes (e.g. supplying, production, marketing, sales, etc.) All organizational analysis is thus based on data. However, data overload can yield confusion and reduce the effectiveness of their application (i.e. analysis obtained results less meaningful). Instead, where data retrieval and application is well supported it can produce a positive impact on the business processes increasing the performances. Against this Study's point of view, it is important to emphasize the nature of data as expression of explicit-knowledge: data objectively express a known fact and is then independent from the context and every possible observer's interpretations.

- *Information*. This is to be intended as the product of combining data or also as data aggregation which can be made by relevance of the same data by activitity (where data are generated from or applied in) or aim (to achieve which data have been defined). Indeed, here is addressed the possible interconnection among different data which makes the difference between simple data and information as a logically structured aggregate of data. The above reported consideration is valuable also to the information: within the organizations to keep always easily retrievable and accessible the information is still important to avoid any dangerous information overload.

- *Knowledge*. Out of the precedent definitions knowledge can be intended in this phase as a set of those information that are specifically needed (and then valuable) to the organizational processes and are often embedded in the same organizational actors (i.e. knowledge workers); behind this Study's theoretical framework such definition is also aiming at contributing into the effort commonly made by the researches in knowledge-management for drawing the boundaries among the concepts of data, information and knowledge as precise as possible.

Such distinction however does not give light enough on the intrinsic nature of the possible lien existing among these concepts. This frame in fact just assumes that a logical consequentiality exists through the concepts: information can be produced by processing data as well as knowledge can be generated by aggregating information. Then, this is just assuming that data, information and knowledge cannot exist independently each others, and also that every generation process is activated for each of them by the organizational need to perform the business processes: data are collected and processed as well as information is synthesized and knowledge generated to better) perform all business processes. And the organizational actor is the pivot element within this frame since all of the said actions are performed by a person who generally uses the generated knowledge to accomplish his own assigned tasks and then keeps (holds with him) that knowledge.

The data-information-knowledge logic chain can be characterized differently as read from data to knowledge and *vice versa*. In the first case, the increasing value is the issue: data are more valuable where combined in a logical aggregate as well as information is more valuable where basis of a usable knowledge. In the second case, the necessity is the issue: information cannot exist without specific data as well as knowledge cannot be consistent without information.

1.3.3 Some Model to Classifying the Organizational Knowledge

Given the above insights regarding the very challenging issue about the definition of a operationally sustainable concept of knowledge, here is following a short description of the most widely known models that were proposed to classify the several possible forms and kinds of organizational knowledge.

One of the most widely recognized model in literature on knowledge-management is represented by Nonaka's and Takeuchi's where Polany's [1966] distinction between the concepts of *tacit-knowledge* and *explicit-knowledge* is reprised and more deeply developed. In particular:

- as for *Explicit Knowledge* it is intended the codified knowledge that can be easily described and transferred (also in real-time) by a specific formal language (structured by digits) which gives the possibility of memorizing knowledge by single units in sequential databases and other forms of electronic (or digital) documents;

- as for *Tacit Knowledge* it is addressed instead that part (often most) of knowledge which tends to stay in forms that cannot be codified: " ... *this fact appears to be trivial as enough but it is not easy to say what is the meaning ... we know the face of a person and we can recognize it among thousands of people but we cannot say how we recognize that face* ... " [Polany, 1996]; such an analogous consideration comes from Nonaka's insights [1993] where based either on cognitive elements (mental models including schemes, paradigms, and people's common beliefs) and technical elements belonging to organizational contexts (know-how, human abilities and skills) it is reprised that most part of knowledge is generally present in organizations under tacit form.

As intangible and difficult to be replicated the (organizational) knowledge potentially represents a critical resource to the enterprises in achieving the competitive advantage ´[Wernerfelt 1984; Rumelt 1984; Barney 1991; Peteraf 1993; Collis e Montgomery 1995; Meso e Smith 2000] since this contains more than the potential of all individuals constituting the same organization in terms of skills and competencies. To achieve the economic growth and strengthen the capabilities of one organization in learning it is then essential to enhance the natural exchange of knowledge among those individuals. That is where the interest on knowledge-management of many scientists, researchers and practitioners come from: how to codify tacit-knowledge in order to favor the knowledge-transferring by different individuals (and then to make the organization independent on the single individual who can be the only-one holder of a needed knowledge).

Several possible dimensions have been proposed to this extent as knowledge features to distinguish and classify the different forms of knowledge; in particular, here is following a system which is structured by five main criteria [Cainarca et al., 2002]:

1- the Nature of What is Already Known [Quinn, Albino]

a. declarative knowledge (to know what);

b. procedural knowledge (to know how);

c. causal knowledge (to know who);

d. self-motivation creativity (to care about who);

2- the Diffusion Level

a. individual-level knowledge;

b. group level knowledge;

c. organizational level knowledge;

d. inter-organizational level knowledge;

3- the Genealization and Abstraction Level [Arora, Gambardella, Zack, 1999]

a. abstract and general knowledge; b. specific knowledge;

4- the Capitalization Ways within Organization [Argyris, 1978; Fiol, Lyles, 1985; Snegel, 1990]

a. brain-derived knowledge; b. consciousness-derived knowledge;

c. culture-derived knowledge; d. internal knowledge;

e. knowledge under codified form;

5- the Chance of Knowing [Henderson, Clark, 1990; Handerson, Cockburn, 1994]

a. component knowledge; b. architectural knowledge.

As for the organization knowledge representation model, a very important contribution in the theory was given by Nonaka and Takeuchi [1995] whom proposed SECI model of knowledge life-cycle is very widely known and agreed. In such model the whole process of generation and application of organizational knowledge is described by a spiral where tacit and explicit knowledge circulates alternating through four mutually interdependent and complementary phases: Externalization ; Combination; Internalization; and 4. Socialization of knowledge. Specifically, along the externalization knowledge turns from the tacit to the explicit form by models and metaphors; then, along the combination phase knowledge stays under explicit form and circulates within the organization; along the internalization knowledge turns back to tacit form through the personal acquisition of individuals by learning, and finally along the socialization knowledge is transferred by the exchange of personal experience.

Another very widely known and agreed model for representing the knowledge life-cycle is the Fraunhofer Institut's of Berlin (IPK) [Heisig, 2003] which is centered on the business process as context of the whole knowledge-generation and -application process. In particular, this model represents the knowledge flows through all business processes by four main functions: 1.the knowledge-generation; 2. the knowledge-memorization; 3. the knowledge-distribution; and 4. the knowledge-application. Each of these functions must be supported within the organization by using a set of specific means as the following: a. organizational processes; b. information-technology; c. leadership; d. human resource management; and e. control-functions. Such model is particularly important within this Study as it is clearly addressed as basic theoretical-scheme; in particular, the here proposed design framework of the knowledge-management systems has been in fact developed basing on the above recalled main functions (i.e. knowledge-generation; -memorization; -distribution; and -application) and further, structuring the whole design process by the same effectiveness-oriented structure of this model.

All references and models recalled till now just represent a very short collection of the most widely known and accepted works (among several from all over the world) on the knowledge management. Although these constitute a consistent part of the basis of the here proposed Study it is important to notice to this extent that such recalled models just provide a very partial vision of wider issues related to this matter, and that even much of this could be modified in next few years since the knowledge-management still constitutes a very wide and not-consolidated research field.

1.4 Static and Dynamic Aspects within the Knowledge-Management

1.4.1 The Knowledge-Management - What is the KM Process ? -

Similarly to what has been done about the possible definition of "knowledge" the knowledge-management cab be directly and more strictly approached by recalling some of the most well known definitions related to the most widely agreed works on the field:

Tab 1.3 - Possible Definition of "Knowledge-Management" arising from the Literature

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1 - *" ... planned and ongoing management of activities and processes for leveraging knowledge to enhance competitiveness through better use and creation of individual and collective knowledge resources ..."*
~ CEN European Committee for Standardization (2004)

2 - " *... it is the process to capture, distribute, and effectively use knowledge ...* "
~ T. Davenport (1999)

3 - *" ... knowledge-management means to get that tacit knowledge at the sources, transfer it in the most accessible form, and to promote its continuous generation and growth ... "*
~ J. Birkett (1998)

4 - *" ... the knowledge-management is a systematic, explicit, and calculated way of using, renewing, and applying knowledge in order to maximize the effectiveness and the possible returns derived from the knowledge assets ... "*
~ T. Wiig (1997)

5 - *" ... knowledge-management means to have the right knowledge about the right people in the right moment so that they can make the right decisions ... "*
~ A. Petrash (1996)

6 - *" ... it is the process to capture all experience and intelligence within one organization and use it for generating innovation through a continuous organizational learning ... "*
~ I. Nonaka (1991)

7 - *" ... the knowledge-management is a set of actions, procedures, and technologies applied to make a continuous update associated to database network ... "*
~ B. Athens (1991)

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These are just few of the several proposed definitions of knowledge-management by the researchers and practitioners from different fields. Anyway, the belief that one organization's competitive advantage is depending on its own abilities in exploiting the knowledge is even more strong. It becomes even more strong the awareness about the central role that knowledge play in creating the same value of the whole enterprise because of the value of both tacit and explicit knowledge within the organization. That is, knowledge is becoming even more clearly a critical part of the traditional assets of one enterprise; this makes it necessary to create and set new instruments for controlling and estimating such new asset of the modern enterprise. The effectiveness and efficiency in dealing with such asset can be in fact as a great source of competitive advantage to one organization yielding cost-economies as well as increases in the business performances either at intra-organizational level (i.e. inside one organizational unit) and inter-organizational level (i.e. among different organizational units). Everything can be positively affected by the strategy and plans related to the knowledge-management: innovation capacity, time-to-market, data- and information-retrieval, new business-opportunity, answer to the customer specific expectations.

Those enterprises that first realized the importance of centering the organization of the business processes around the knowledge-management are leaders today in several sectors and are followed by other that seem to be still far from reaching the same evolution state in structuring their organization around the knowledge. A deep change occurred along the last ten years within the enterprises affecting the work-organization as well as the management of the human resources or also the new-product development process and the learning systems; everything seemed to turn towards the processes of knowledge-generation, -sharing, and -valorization processes. So that the same research and interest field on knowledge-management has grown around several issues related to such occurring big organizational change. The researchers then have been focusing on those interventions and activity-plans aiming at favoring the same knowledge-related processes (i.e. generation, memorization, and circulation of knowledge); such interventions were intended to be specifically implemented affecting either people's competencies and work-organization, communication and cooperation technologies, and culture and behaviors within the organizations [Morici, 2000].

That is, four classes of objectives are here presented to synthesize the main features of most knowledge-management possible interventions.

Objective Class 1 - To provide an only-one (prevalently explicit) knowledge-base of the enterprise that could be fully and fast accessible for better supporting either the design, development, and production activities - e.g. archives containing internal structured knowledge; archives containing external knowledge; archives containing internal informal knowledge, best practices and lesson learned;

Objective Class 2 - To facilitate either the access to internal knowledge and the use of available knowledge so that people can be better supported in both operational and decision processes by the easier exchange of tacit knowledge - e.g. expert networks, discussion forum, etc.

Objective Class 3 - To favor the knowledge circulation within the organization to favor the innovation processes by individuating the needed knowledge as available within the organization and establishing an effective internal/external communication network;

Objective Class 4 - To manage knowledge as an intangible asset of the enterprise by maximizing the economic value of knowledge (i.e. producing high-innovative products and services) and then valuing the intellectual capital in terms of human resources and organizational structure.

1.4.2 Knowledge-Management Foundations through Three Generations of Researches

A great interest around the knowledge-management was born at beginning of 1990 and it was soon considered to be important as well as the business process reengineering and the total quality management. Started from information system area that passed through the topics of the organizational change, the intellectual capital and the competence management (end of '90) also including other topics like the social learning, the organizational sense-making, the systemic innovation [cfr. Ilkka Tuomi *The Future of Knowledge Management*, Lifelong Learning in Europe (LLinE), vol VII, issue 2/2002, pp. 69-79].

The whole interest in knowledge-management developed through three main generations of researches and studies; in particular, as organized through the four following disciplines the *First Generation* developed focusing on three main concepts: the information-sharing, the information-repositories, and the intellectual capital accounting.

1. *Organizational Information Processing*. Basically the knowledge-management concept has been associated along the last ten years to the information systems; several of the prior initiatives approaching this topic were consisting of information-technology-based applications, specially for memorizing (storing) and sharing information. After the success of '50s and '60s the interest of the researchers in artificial intelligence changed in '70s leaving the belief that knowledge could be both stored and shared by that technology; the cognitive processes were then approached searching for new ways for representing knowledge. The '80s are mainly dominated by the expert systems and the knowledge-based techniques for diffusing knowledge throughout the organization. Anyway, the modern hypertexts leading to the World Wide Web were reached thanks to the knowledge-representation techniques developed by the artificial intelligence. Basing on further developments of these technologies these were created more sophisticated instruments for managing information and knowledge like the Management Information Systems and the Enterprise-Information-System or also other cooperation tools like the group-ware, the computer-mediated communication and the collaborative-systems.

2. *Business-Intelligence*. A very important applicative domain of the knowledge-management is represented by the creation of competitive advantage as it can be achieved by understanding, synthesizing, and disseminating the right information throughout the organization as well as avoiding the risk of information-overload. This then widens the organizational context where knowledge must be diffused

flowing from the higher levels of organization (i.e. the strategic levels, where traditionally the most important information and knowledge were considered to be concentrated) towards the lower levels (i.e. operational); further, this overcomes the objective of merely storing knowledge (as knowledge-management prior objective) towards that of creating and supporting the knowledge-flows throughout the organization including in these the persons and not only channels and repositories (i.e. technological infrastructure) - this aspect was still strengthened by the world-wide-web which diffused worldwide the actual standard for representing information and then facilitated all information and knowledge exchanges both inside and outside of the enterprises.

3. *Organizational Cognition*. At the beginning of '90s the business intelligence was expanded by the corporate competitive intelligence including into the knowledge-management activities the sense-making; this occurred as the organizational knowledge was recognized to be generated not only by rightly managing the data-bases but more than this through the efforts that individual commonly make to give sense to their surrounding environment (i.e. the sense-making).

4. *Organizational Development*. This represents the attempt of synthesizing all precedent areas in order to bring balance into the development of the organizations between its two main components: first, the technological development and second, the human development.

The *Second Generation* of researches and studies on knowledge-management started about 1997 when the interaction among those four disciplines became stronger and the integration easier through the knowledge-management plans. All routines were then implemented within the enterprises to favoring the explicating of tacit knowledge as well as sustaining the social learning and the sharing of embedded knowledge into the same routines and processes; this was in fact more strictly focusing on the (organizational) change-management and its implementation bared by sustaining a right co-evolution of the management-practices, the developing performance measurement systems, and incentives and instruments for the content management.

From a general point of view, it is easy to clearly distinguish the different steps made in the whole progress of the researches on knowledge-management through the said generations; the first one was mainly focusing on the information technology and reached a very high development level which can be characterized by the practical applications: the knowledge-storing and -sharing can be efficiently performed by the data-warehouse and the data-mining systems. Coherently with the evolution of the information systems the second generation was instead focusing on the social capital: the potentialities of exploiting the knowledge as economic resource are even more seen as dependent on people's abilities and people's interactions.

Finally, the *Third Generation* is focused on the knowledge-base building ways and precisely on the possible connections existing (or to be established) between knowledge and human-action; such connections should in fact be facilitated (i.e. made more flexible) to enhance the knowledge-creation process as it is bared by a true and deep social change. That is becoming even more important to acquire the competitive advantage as the actually needed organizational ability in changing is considered to be strictly depending on such knowledge-creation processes: that gives in fact the organization the ability of continuously (and effectively) updating its own competencies.

1.5 Some Applicative Model of Knowledge Management

1.5.1 Conceptual Frame and Evolution of Knowledge-Management: social, organizational, and economic reflexes through the Nonaka's Model

The knowledge-management basic aim is supporting the management of the business processes within the enterprises and then increasing their performances. Although some work like Bonifacio's [2002] sharpen the genesis of knowledge-management the epistemological dualism approached by Nonaka [Nonaka, 1994; Nonaka, Hirotaka, 1995] about the nature of knowledge has not been solved yet on the theoretical point of view neither on the technological point of view. Instead, the objectivist approach remains still opposed to the subjectivist approach; in particular, where knowledge is considered within the first approach as general and abstract matter as well as independent on the observer (i.e. knowing subject), this is instead considered within the second approach as a specific and concrete matter intimately related to the experience of knowing conducted by the subject. In particular, where the description about the (described) object is independent on the (describing) subject, within the first approach, *vice versa* knowledge comes out within the second approach through a producing description of the relationship connecting the object-to-be-known to the knowing-subject; indeed, knowing means in the second case to affect what is in the knowing process (the object to be known) and to produce the same existence conditions of the known object.

Although across the Western countries a wide development has occurred in the philosophical field specifically involving the constructivist field [Berger, Luckman, 1996] and then the social analysis and the symbolic interactions [Blumer, 1969] as well as the organizational version proposed by Weick [1979] the subjective nature of knowledge is proposed by Nonaka as a merely eastern conquest not only from the philosophical (or cultural) but also from the organizational point of view. The (Nipponese) enterprises are considered behind this frame as big entities mostly consisting of people who continuously produce subjective (tacit or implicit) knowledge, and it is that knowledge that can bring improvements in the business activities as well as innovation where turned in explicit (and then objective) form. Under explicit form in fact knowledge can be considered to be abstract and general which means both independent on a specific context and applicable to many different contexts: as embedded in a product or a service this can create value by its own replication. By Nonaka [1995] is given the example about the bread-makers who is able to produce the best bread of the city thanks to a personal and not-codified knowledge: through a coupling process such knowledge can be separated by the context (i.e. bread-makers) and made applicable to several contexts (i.e. every bread production process) by codifying the process into the product (the production machine). Thanks to such scheme Nonaka's model can give the knowledge a basic prerequisite to the management: the duplicability. This is a very general character not only into the traditional scale economy but also to the cognitive based economy [Rullani, DiBernardo, 1990].

In general, the above said elicitation of knowledge - turning from the tacit to the explicit form - develops through a process where all specific and concrete elements of the subjective knowledge are erased; and then, by doing so knowledge is made general and abstract or in other words is made again objective. To this extent, the subjectivity can be considered as the basic condition of knowledge (as it is generated) but is not a needed condition of existence: through the subjective experience a certain knowledge is produced which can be usefully made it objective without loosing any meaningful shape or element. As for Nonaka's example bread-makers this is embedded into the machine producing the bread; in particular, such machine does not loose any personal knowledge of the bread-makers but enrich it by the chance of duplicating: as codified the production process and embedded into the machine everyone will be able to produce the best bread in the city.

The apparently simple Nonaka's model is weak against the provided definition of the knowledge explicating which is proposed as a difficult process especially on large scale. This is in fact implemented by coupling a manager and an operative staff: by communicating to the second one (i.e. socialization mechanisms) the first can bring in explicit form his/her own tacit knowledge (i.e. socialization mechanism) and then transfer it to the second one (i.e. combination mechanism); as made it objective knowledge can be further duplicated and diffused (i.e. externalization mechanism); finally, this can create value by being incorporated in people (under forms of know-how) and in the production process (i.e. internalization mechanism).

A very great amount of different forms and kinds of knowledge are generated, stored, distributed and applied within all business processes that are normally performed by all enterprises and organization. Such forms can be synthetically represented by the so called knowledge life-cycle; this is particularly an organizational knowledge representation framework by which the design process of a knowledge-management system can be supported in individuating the knowledge-based services to be technically implemented. As designed basing on the knowledge-life-cycle a knowledge-management system can more easily and effectively contribute in managing the business processes, improving the business performances, and increasing the value creation capabilities of the organization: per each phase of the knowledge-life-cycle it is provided a specific representation regarding not only the knowledge to be managed but also all specific services and functions to be implemented to support the management of such knowledge. One knowledge-management system has then to provide suitable knowledge-based services to support the functions of generation, discovery, capture, store, distribution and application of organizational knowledge.

Based on the Fraunhofer Instititut Model [Mertins, Heisig, Vorbek, 2003] there are four main knowledge-processes through which the knowledge life-cycle develops:

1. "*Generate Knowledge*", aiming at making available the (new) knowledge as generated in several ways at individual (training, learning by doing, problem solving, etc.) and social (communities of practice, project team, etc) level. Just a part of it is directly available under explicit form while the remaining implicit part

requires proper capturing methods (questionnaires, lessons learning writing, best practices writing, etc.). When embedded under explicit form in huge amount of structured, semi-structured and unstructured data and information it can be made available through knowledge discovery and classification methods. To realize this phase the KMS knowledge-based services must be based on knowledge discovery, content management, information retrieval, reasoning, etc.;

2. "*Store Knowledge*", focuses on knowledge extraction and acquisition from all different sources distributed across the organization structures. Knowledge representation methods provided by the framework facilitate the storing of both declarative and procedural knowledge into knowledge bases. In particular the structure of these is provided by the top level ontology while knowledge sources description is provided by the second level ontologies For each kind of knowledge the related sources are specified. To realize this phase the KMS knowledge-based services must by based on ontology and workflow management functionalities and on wrapping, crawling, data warehousing techniques, etc.;

3. "*Distribute Knowledge*", concerning the knowledge distribution to organizational knowledge workers. The framework represents individual and group profiles in term of required knowledge to be shared within the organization among the several different actors with respect their own specific competencies and needs. To realize this phase the KMS knowledge-based services can be based on two main approaches: the stock approach (adding to databases and distributing documents) and the flow approach (share and public knowledge by synchronic and asynchrony communication system, chat, forum, blog, etc.);

4. "*Apply Knowledge*", concerning the use of the codified knowledge into the business processes where required. To realize this phase the KMS knowledge-based services can be based on business intelligence, decision support, customer relationship management, etc.

All knowledge forms flowing through the business processes tend to naturally realize the said knowledge life-cycle so that each of this must be efficiently supported by the knowledge-management system in order to improve the knowledge management capabilities of the organizations. To this, the knowledge life-cycle represents behind the here proposed knowledge-management analysis methodology something like a main development-line of all knowledge-management functions to be designed and implemented as these have in fact to precisely and specifically support each phase of the knowledge life-cycle like creation, memorization, application and so on.

Moreover, it must be noticed that although a great number of available operational tools has been created till today based on the information and communication technologies but no specific methodology has been outlined to precisely analyze and assess whether the adopted technology and the applied uses are coherent within the organizational contexts: the need of measuring the real effectiveness of the applied information and communication technology tools is going to become even more strong. This consideration opens a specific (and hard) problem which lies in how measuring the technological and organizational solutions (for implementing the knowledge-management) can be more adaptive to the given organizational contexts - that represents the main problem faced by this Study.

It should be further noticed to this extent that two meaningful features can be associated to the knowledge forms and kinds: the *static dimension* and the *dynamic dimension* of knowledge.

Where knowledge represents an asset to be converted in economic value [Edvinsson et al., 1996] it can be also argued that the knowledge-management activities can be considered as the electrical power flowing through the intangible assets belonging to one organization's intellectual capital, and by doing so valuing the same assets [Chatzkel, 2000]. This type of categorization introduces a pair of critical features regarding the organizational knowledge which leads to two different area of research and interest: first, the economic assessment of the intangible assets existing within the organization around the organizational knowledge; and second, the analysis of the operational functions that flow the organizational knowledge through the business processes. Although not easy at all, this Study tried to base its own theoretical framework on the most trusted insights available in the literature about both of such concepts and the related approaches. That is, in the following paragraph (as in the next chapter) some description will be given about the Intellectual Capital and the related possible connection with the concept of knowledge-management in the managerial literature.

1.5.2 The Communities of Practice

Parallely with Nonaka's oriental approach arose and wide spread across the western countries the "Communities of Practice" concept within the organizational learning which was introduced by Julian Orr [1987; 1990] and the Xerox Park scholars [Brown, Diguid, 1991]. Also in this case knowledge is considered to be subjective matter but differently to Nonaka this is individuated as belonging to the whole social context (i.e. interpersonal relationships within a community) rather than in a single individual.

Following Tommasini's definition [1983] the communities of practice can be more specifically considered to be informal and small aggregations of people generated within wider organizational contexts where the members (of such communities) share the way of behaving and interpreting the reality. The main features of one community of practice are then:

- common enterprise to be carried-out (i.e. common aims to be achieved by a common way to be continuously negotiated within the community)
- reciprocal commitment (i.e. one identity, common values, self-support, sense of one-action)
- common resources as languages, acting ways, etc.

The introduction of the community-of-practice concept is considered by some researcher as a milestone in the knowledge-management researches since it extended the focus including the community's identity as well as the informal organizations. The communities of practice can be considered in fact as informal networks (naturally) generated by the common willingness of its own members, and that represents to the enterprises' management an opportunity to contribute in the generation, socialization and making explicit processes of the tacit knowledge produced within the same network. Therefore, a new double objective is given to the management: to individuate and enable the internal channels naturally created within the network by the individuals' need of socializing with others, from one side; and to capture the knowledge produced within the community and to wide spread it throughout the organization, from other side. That objective then makes it necessary to introduce the role of knowledge-manager whom duty is to facilitate the intra-community interaction and to capture the naturally arising knowledge through a codifying and structuring process of knowledge.

In conclusions, the community-of-practice concept not only widens the organizational horizon of the management but also changes the nature of the organizational actor. It is no more possible thus to focus the organizational strategy on single individuals but it is necessary to consider a collective point of view expressing the same community aim, objectives, way of behaving, and specifically the knowledge (collectively) consumed and produced. That is why the management must keep in the right account the existence of the communities of practice as well as the opportunity of creating new communities; where coherently integrated into the whole organizational plan the communities can in fact represent a powerful instrument to effectively manage the organizational knowledge as well as to produce positive increases in the business performances.

1.5.3 *Some Applicative Model of Knowledge-Management (towards KM oriented Services)*

This paragraph provides a synthetic overview on some (among the several) knowledge-management models that have been proposed till today highlighting the main results as well as some possible critical weakness. Further, this also shows few cases where such models were applied. Against the already recalled vast amount of works outlined on this topic here are proposed just few works that have been selected for their meaningfulness in order to describe clearly and widely as enough both the problems faced and the related solutions proposed.

I. The SECI Model

Proposed in 1995 for the first time by Nonaka and Takeuchi this model (whose acronym means Socialization, Externalization, Combination, and Internalization) had got quickly a great consensus all over, and was then used as a rigorous approach to describe the organizational process to be implemented to generate, transfer, and recreate knowledge within the organizations. The basic elements of this model are listed below:

- two basic recognized forms of knowledge (i.e. tacit and explicit);

- dynamic interaction of knowledge-transfer;

- three possible levels of social aggregation (i.e. individual, group, and context);

- four processes individuating the knowledge life-cycle (i.e. socialization; externalization; combination; and internalization)

The vision of the enterprise as proposed into this model is the *knowledge-creating-company* which means an enterprise that could be able to facilitate the reciprocal interaction between the two said main forms of knowledge (i.e. tacit and explicit) through the technological systems, the organizational structures, and the culture (of the same enterprise) to easily and effectively implement the (already recalled) processes :

1. *Socialization*. The knowledge-sharing is naturally occurring through the physical proximity of people while they can be working together;

2. *Externalization*. This is consisting of the tacit knowledge codifying process into a explicit (formal) structure that could be then accessible to everybody (through the said code);

3. *Combination*. This consists of the explicit knowledge diffusion process through the complex structures facilitating the related communication, dissemination, and systematization;

4. *Internalization*: This is consisting of the conversion process of (external) explicit knowledge into tacit knowledge belonging to both the single individual or the same organization by actions, practices and strategic initiatives.

Of course, one of the most critical elements of the Nonaka's model is given by the dynamic interactions occurring between the recognized forms of knowledge and the organizational levels. The alternative exchanges continuously occurring throughout the organization between tacit and explicit knowledge happen through the different organizational levels so that a spiral-based scheme is used to describe how knowledge moves through; such spiral-scheme can therefore be considered as a key for analyzing and favoring the same knowledge exchange processes. As realized the importance of such dynamic interaction continuously developing between different forms of knowledge at different levels of the organizations the enterprise must facilitate every organizational process or mechanism that could facilitate and strengthen such spiral.

To strengthen the analysis potentialities of this model Nonaka and Konnoi introduced in 1998 the "BA" concept addressing the general concept of arena which means a wide logical space where the dynamic conversions between tacit and explicit knowledge could easily happen and where knowledge could easily arise from the relationships existing among the organizational actors. In particular, four specific contexts are proposed for the "BA":

- BA originating: a space is created where people share their own experience and thinking models;

- BA interaction: a space is created where tacit knowledge is made explicit (two key-elements of this are dialogs and metaphors)

- BA automation: a space is created where it is possible to interact through a virtual reality; past and new explicit knowledge are combined to generate new explicit knowledge and diffuse it throughout the organization;

- BA exercitation: a space is created where the conversion of tacit knowledge in explicit knowledge could be easier.

The BA concept is focalized on the dependence *lien* existing between the knowledge and its own context since it is not possible to separate them. Every knowledge-creation process strictly requires a specific space or context to develop in; such space can exists if recognized by the same organization. That is why all organizations have to care about the development process of their own possible BA keeping in the right account the external environment where these are operating and the related influence on the same BA generation.

Although critiqued Nonaka's model is the most widely known, and is commonly adopted either in the practice to analyze the organizational context and in theoretical researches to deeper the analysis and to conduct new studies on the knowledge-management.

II. The N-Form Organization Model

Named as N-Form Corporation and introduced by Gunnar Hedlund from the Stockolm School of Economics this model [1994] this model specifically approaches the knowledge-management merely from an organizational point of view focusing on the knowledge flows generated at different hierarchical levels (within the organization). In particular, this proposes such an analysis model based on two concepts: "*tacit VS explicit knowledge*" and *"four levels of social aggregates*". These concepts are used as basis of a whole dynamic representation system which describes the creation, development, transferring, and application of knowledge by distinguishing among different types, forms and levels of knowledge per each different social level. In brief, the tacit knowledge VS the articulated knowledge are classified in this model by different levels of social aggregation (i.e. organizational levels). Here following are recalled the main parts of this scheme:

1. Two main forms of knowledge (tacit and articulated) and three other specification of each of them (i.e. cognitive, attitudinal, and internal);

2. Four levels of carrier (i.e. individual, small groups, organizational, inter-organizational domain);

3. Dynamic knowledge-transferring and transformation both articulated by the following processes:

- articulation and internalization (i.e. reflected interaction);
- extension and appropriation (i.e. interaction to dialogue);
- assimilation and dissemination (knowledge import and export through the environment).

The knowledge-transferring and -transformation processes are then described and analyzed in Hudlund's model as basing on these fundamentals; associated with the knowledge-storing these processes are presented as mutually interacting through different kinds and levels of knowledge with a special focus on the knowledge-creation. With specific regard to the above recalled terms, "reflection" addresses the articulation of the tacit knowledge as well as the internalization of the articulated knowledge: both processes are strictly related to the different social level where occurring (i.e. the carrier and interaction levels) and that represents either a perspective of the analysis and a reference term for facilitating the knowledge-management. The term "appropriation" addresses instead the acquisition of tacit knowledge as articulated at the low levels of the organizational hierarchy. Both these terms address the knowledge moving through different levels of the organizational structure and then represent the core of Hedlind's study still aiming at sustaining both knowledge-creation and -transferring processes through the different organizational levels.

III. Knowing VS Knowledge Model

Michael Earl from the London Business School is widely known for his work on the role of *Information Systems* within the organization [Earl, 1998] and specifically on the roles of the Chief Information Officer and the Chief Knowledge Officer. His most recent works propose a set of heuristics identifying activities and organizational functions strictly related to the knowledge-management that have to be accomplished by the chief knowledge officer. Further, Earl makes an important distinction about data, information and knowledge based on two possible status of organizations that are relevant to the knowledge-management:

1. *knowing*; and 2. *knowledge*.

In Earl's vision one organization is supposed to use four main functions for creating, protecting, and valuing its own knowledge-based assets:

1. to create an inventory (to map individual's and organization's knowledge);

2. to review (to assess the nature and the extent of the knowledge-gap, and then to develop the missing knowledge through the teaching activities);

3. to socialize (to create events favoring the tacit knowledge-sharing among people);

4. to favor the exchanges of experience (to face the knowledge-gap through the experience-based teaching).

IV. The Organizational-Knowledge Network Model

A "*... synergic symbiosis among information technology, managerial and organizational cognition processes ...*" was proposed by Carayannis [1999] whose convergence is focusing on the knowledge-management. Specifically, the information technology is approached in this model as the main medium for making within the organizations a coherent use of the infrastructures with both the managerial and cognitive processes: basic aim of this model is then to individuate and define concrete systems and infrastructures that can be useful to enhance both the efficiency and the effectiveness of the cognitive processes. This is made by a limited number of concepts and key-elements addressing the meta-cognitive, the meta-learning and the meta-knowledge paradigms. In particular, specific and critical relationships are individuated in this model between knowledge (K) and meta-knowledge (MK) by a matrix: " .... *consisting of continuous knowledge-cycles through which one individual or one organization can pass increasing or decreasing per different stages of higher / lower awareness* ..." [1999]. The here addressed four possible organizational stages of knowledge-management are indicated below:

- ignorance of ignorance (K, MK)
- awareness of ignorance (K, MK)
- ignorance of awareness (K, MC)
- awareness of awareness (K, MK).

One organizations can then assess its own status among the above said four stages and consequently to make the needed effort to pass through the different stages. Ideal stage is "awareness of awareness" but where at a lower stage one organization must improve its own condition by two possible steps: 1. connection; and 2. interactions. The first one is favored by the use of the information technology while the second develops through socio-technical phenomena activated by the reciprocal action of both tacit and explicit knowledge which is made by the human interaction.

V. The Ecology-based Model of Knowledge-Management

A cognitive-oriented approach to the implementation of the knowledge-management was developed by Snowden [1998] which is specifically based on the semiotic and pragmatic epistemology. In particular, this regards an action oriented system including four main elements:

1. tacit and explicit knowledge;

2. cognitive set;

3. trust

4. certainty and uncertainty in decision-making with respect to objects and casual relations.

The model was developed focusing on actions and interactions since : " ... *the value of knowledge comes not from its existence but instead from its application ...* " [1999]. Such interactions are specifically individuated into the organizational context where trust acts as a trigger of the knowledge-creation process: where individuals are a recipient containing tacit knowledge then the infrastructures are the support to apply the explicit knowledge.

In general, the knowledge-based approach is motivated in every organizational context by the decision-making perspective with particular regard either to the certainty of the addressed meanings and to the causal relationships. Then, the first step there proposed in order to activate and sustain the knowledge creation processes is to map the organizational knowledge as available at every organizational unit under both tacit and explicit forms. And further to push all identified (and assessed) explicit knowledge into the knowledge-bases.

To implement the conversion process of the tacit knowledge into explicit knowledge it is then proposed a specific decisional matrix which provides a starting point to evaluate how the tacit knowledge can turn in explicit through the management of four classes of transactional activities:

- to share the explicit knowledge through systems and structures;

- to share the tacit knowledge through psychosocial mechanisms;

- to transform the tacit knowledge in explicit through the business process reengineering, documents and relationships;

- to expose the tacit knowledge through the trust and its dynamism.

It is then the adaptive and balanced management of the tacit and explicit knowledge that takes to the ecology of the knowledge-management within the organizations.

1.5.4 Short Synthesis of the Presented Solutions

Here is following an attempt at synthesizing the critical elements arising from the presented (short) review of the main models of knowledge-management. To this extent, some useful insight can be obtained by comparing, on one hand, the common elements and, on others, the different activities implemented in the different solutions. Then, the common shapes arising through the above recalled models can be listed as follows:

- the knowledge-management processes: 1. creation; 2. mapping; 3. acquisition; 4. codifying; 5. storing; 6. application; 7. transformation;

- the nature of knowledge (mainly intended as tacit or explicit);

- the organizational levels (mainly addressing the different social aggregation levels);

- the application context (addressing the sense-making and then the strong relation existing between the knowledge and the social context that belongs to).

In particular the logic class above individuated as "knowledge-management process" addresses the operational activities that are normally performed within the organizations as well as the decision-making processes. Analogous considerations can be taken about the other class "nature of knowledge" addressing the possible differences established through the models among the proposed meaning of "knowledge": a certain continuity can be found through the several definitions proposed in each model although Nonaka's remains as the most widely addressed in all studies and researches. The last two classes can be considered together as these represent the modalities by and the place where to concretely handle with knowledge; these can in fact deeply characterize all knowledge-management initiatives implemented in one organization so that a great contribution can be taken to the effectiveness of such initiatives by taking these classes in the right account along the design phase of the related knowledge-management solutions.

1.6 The Intellectual Capital Concept

1.6.1 Reviewing the Intellectual Capital in the Literature

New concepts for not only for managing but also for identifying and classifying the cognitive resources of organizations have been defined by researchers and practitioners on knowledge-management behind the whole common attempt of turning in operational terms the concept of organizational knowledge. In particular, two main approaches to knowledge can be mainly distinguished within the literature.

The first approach focuses from an epistemological point of view on the meaning of "knowledge" particularly distinguishing between the concepts of knowledge and information. Knowledge is then interpreted as one information whose meaning has been defined by interpretation from a cognitive system like an individual, an individuals' groups or also one organization [Albino et al. 1999; Davenport, Prusak; 1998; Liebowitz, Wright, 1999]. Such approach aims then at providing the management of one organization with a knowledge-management implementation guide-lines based on the possible different features of knowledge [Albino et al., 2001; Spender, 1996; Winter, 1987]. The same distinction between tacit and explicit knowledge was reached following this approach as these constitute alternative forms through which knowledge can flow through one organization [Nelson, Winter, 1982; Nonaka, 1991; Nonaka, Takeuchi, 1995].

The second approach is based instead on that assumption by which knowledge can be considered as a multiform organizational resource or in other words as a resource arising through several organizational components; consequently, knowledge is considered as a basic fundamental of the same value of one organization. The researches and analyses related to this approach proposed several assessment models of the enterprises' intangible assets [Edvisson, Malone, 1997; Stewart, 1997; Williams, Bukowitz, 2001] and one of the most valuable contribution provided is represented by the concept of "Intellectual Capital". This is widely recognized as a key-concept into the process the management of one enterprise should perform to identify and classify the cognitive components of the same enterprise as this allows to identify the single components of the whole organizational knowledge.

However, several different formalization proposals can be found in the literature about the assessment of the (economic) value of organizational knowledge as based on the intellectual capital concept. Following Bukh's [2001] this mainly addresses the meaning of capital from the economic and accounting point of view. The concept of intellectual capital is also applied to address instead the knowledge held by a social community like one organization or a professional team [Nahapiet, Ghoshal, 1998] and further, to address the information technology [Davenport, Prusak, 1998] or also it is used in a correlated way to the concept of human resources [Boudreau, Ramstad, 1997; Liebowitz, Wright, 1999]. Finally, this concept is mainly interpreted in the managerial practice as a portfolio of organized knowledge to be used into the organizational processes for creating economic value [Chase, 1997]. More recently, intellectual capital has been proposed as the critical antecedent for the sustained performance of a firm [Bierly and Chakrabarti, 1996; Bontis, 1996, 1998, 1999, 2001, 2003; Brennan and Connell, 2000; Grant, 1996; Kogut and Zander, 1992; Spender, 1996]. Indeed, some have gone farther to say that knowledge assets have become more important to business success than the traditional factors of production [Choo and Bontis, 2002; Drucker, 1993; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997].

Anyway, the above said approaches are to be considered to be not opposite but complementary as these represent two fundamental references to define new managerial models for identifying, assessing, developing and managing the organizational knowledge; and the of course the introduction of the intellectual-capital concept still contributed in structuring new models for assessing the economic value of the cognitive capital of enterprises.

1.6.2. Models and Representation of the Intellectual Capital

The first and most famous model for representing the intellectual capital and assessing the value of the intangible assets was developed by Edvinsson for Skandia enterprise [1998] and was based on the following four main classes:

- *Human Capital,* addressing the enterprise human resources and knowledge and know-how they are holding;

- *Structural Capital*, addressing the technological and support infrastructure of organizations and involves either the physical infrastructure (i.e. computers, networks) and the intangible infrastructure (i.e. history, culture, management style);

- *Business Assets*, addressing the structural capital used by one organization to create value through the trade and commercialization process (e.g. processing facilities, distribution networks);

- *Intellectual Property*, addressing the intellectual assets that are under protection of Law.

The main aspect of this model is the emphasis on the value creation which is here modeled through the use of two main resources: 1. innovation, as it can be generated from the human resources of the enterprise and legally protected by the intellectual property right; and 2. innovation-based products and -services to be trade.

The Van Buren's Model also known as Effective KM Working Group [1999] comes from the Research & Enterprise Solution Unit at American Society for Training and Development (ASTD). This is specifically oriented to the management of the intellectual capital and similarly to a benchmarking it is based on a set of measurements to assess the knowledge-management activities through different organizations. In particular, such model includes two sets of measurements:

- Measure Set 1: addressing the constitutive elements of the intellectual capital: a. human capital; b. innovative capital; c. process capital; d. customer capital;

- Measure Set 2: addressing the financial performances and the business effectiveness of organizations.

All said measurements start by identifying the components of the intellectual capital of enterprises and specifically what is needed as input to perform the same knowledge-management processes; although the difficulty of obtaining objective estimates this model is an attempt to identify the " ... *critical point to enable the knowledge-management ability of enterprises* ... " [1999]. Such measurements are to be performed following the logical structure individuated by the critical knowledge-management processes that in this model are the following ones: 1.knowledge-definition; 2. -creation; 3.-capturing; 4. -sharing; and 5. -use. Specifically, the performance measurement is to be conducted per each of the said classes by a combinations of measurements addressing both the financial results and constitutive elements of the intellectual capital. To this is proposed a range of measures which lies in the market-to-book-value, the return on equity, the revenues per employee and the added value per employee; in brief, fifty indicators and measurements on the intellectual capital organizaed per four categories: 1. human capital; 2. innovative capital; 3. process capital; 4. customer capital and finally some more indicator addressing the educational levels within the organizations as well as the number of copyrights and trademarks obtained.

Another widely agreed way of classifying the Intellectual Capital resources is given by Bontis' model [2004] which proposes a representation consisting of three components: human capital, structural capital, and relational capital [Bontis, 1999, 2001; Edvinsson and Malone, 1997; Nahapiet and Ghoshal, 1998; Petty and Guthrie, 2000; Sveiby, 1997]. Such proposal lies in Stewart's definition of Intellectual Capital [1997] as intellectual material – knowledge, information, intellectual property and experience – that can be put to use to create wealth. Thus, Bontis extends the concept of Intellectual Capital including " ... *the possession of knowledge, applied experience, organizational technology, customer relationships, and professional skill that provide a competitive edge in the market* ... " [Edvinsson, Malone, 1997] and then emphasizes how the Intellectual Capital be capturing both stocks and flows of an organization's overall knowledge base [Bontis, 1999; Bontis et al., 2002].

Mostly based on Bontis' model the classification of intellectual capital here developed within the theoretical scheme of the Study distinguishes among: a. the individual component, b. the organizational component, and c. networking component of the intellectual capital. Such categories in particular are here developed to address that support which can be given or expected from the knowledge-management system; indeed, these will be applied into an assessment-oriented theoretical framework for emphasizing the structure of the analysis process and its needed focus on the possible different components of the same intellectual capital of one organization.

1.7 Conclusions and Open Issues

As arising from a brief review of the most widely known fundamental of the literature in this field the knowledge-management seems to be basically considered as an independent (and self-consistent) technological and organizational solution similarly to the Sale-Force-Automation and the Customer-Relationship-Management. In other words, this appears to be considered as one of the several (critical) aspects constituting the organizational context of enterprises; and further, this seems to be approached in order to leverage the organizational changes (and improvements) that could be measurable by performance indicators. So that a knowledge-management system is then expected to work for directly and better controlling the knowledge flowing through the business processes and consequently for increasing the organizational abilities of one organization in being adaptive, managing the risks, and continuously taking innovation into the same business performances. In brief, a knowledge-management system is expected to positively affect the social, organizational, and economic life of every organization. These constitute then the frame to be targeted within the design and implementation of a knowledge-management system.

Basing on these few statements (and assumptions) it is possible to individuate some of the most common elements by which the concrete projects and initiatives on knowledge-management are structured (and implemented):

- *communication infrastructure* (i.e. Internet) : this is implemented to maintain and boost the internal communication within the network;

- *on-line interaction tools* (e.g. discussion groups, forum, chat, etc.) : these are adopted to favor the communication among individuals and (possibly) to make it explicit the tacit knowledge belonging to the communities;

- *knowledge-repositories* (e.g. knowledge-bases, enterprise knowledge portals): these are created to collect, organize, and diffuse the explicit knowledge of the organizational structured communities;

- *specialists* (e.g. knowledge-managers): they are appointed with the duty of facilitating the intra-community communication and keeping update the knowledge-bases;

- *tassonomies and firm categories*: these are commonly defined to classify and codify the organizational knowledge (possibly under explicit form);

- *personal contributing processes*: these are adopted by the single members of one organization to explicit the personal tacit knowledge under a form widely shared within the enterprise (by the common *thassonomy*);

It must be noticed that a certain double-vision (i.e. practical *VS* abstract) on knowledge-management seems to arise from the literature and this probably motivates some of the possible here recalled open issues that remain to be faced from the next researches and studies. To support such double-vision here are taken two main considerations about: 1. the practical technology-limited approach of the most widely spread knowledge-management solutions; and 2. the potential (not-overcome) contrast between the centralized approach to the knowledge-management and the natural decentralized location of the organizational cognitive systems.

No far the knowledge-management solutions have not obtained the expected good results in terms of increases in the business performances where these have been applied: most of these have been just implemented to update or create big information-systems as intranets or some time a document work-flow management systems or also a (often not fully used) discussing group. Many systems revealed to be no more than a wide and very expensive technological infrastructures that were often used not correctly neither effectively as expected; that also occurred because a very poor usefulness was perceived by the potential users within the organizations [Bonifacio, 2002]. Moreover, it appeared to be very difficult to modify and improve the ongoing indicators to measure the business performances and the related possible ties into the knowledge-management systems: the commonly used parameters as the number of documents contained into the knowledge-bases or the number of internet-connections have often revealed to be ineffective to say whether the knowledge-management had been really introduced into the organization (i.e. whether the knowledge-management had yielded the expected changes into people's way of work). In brief, the knowledge-management has been to the knowledge-managers as a way for justifying those huge investments in information technology that were conducted thanks to the endorsement of many consulting companies and technology-producers: where the first ones were led by the aim of entering the private and public organizations and then proposing the organizational changes to be implemented, the second ones were led by their confidence that technology could contain (and necessarily develop) the bases of the deep needed organizational changes to achieve the knowledge-management. In many cases the reality shown that both were wrong.

As generally followed within the organizations till today the knowledge-management implementation is characterized by a centralized approach; this means: one organization then one knowledge-management system to be implemented top-down controlling all business processes. In spite of this perhaps the distributed nature of the cognitive processes (to be considered as a part inside of every knowledge-management initiative) weakened such centralized approach. About the communities of practices for instance it is normally assumed that just by technologically supporting the communication flows inside of the community it could be either possible to strengthen the internal relationships and to stimulate the self-generation of new communities. However, although very powerful the technology seems to be not effective enough to activate the social processes leading to generate a community because such processes are depending on the mutual social-negotiation on the models for interpreting the reality; that is, the modern communication and information technology can still represent a concrete support but cannot substitute those models as well as the traditional medium of establishing the interpersonal relationships that every community is based on [Daft, Lengel, 1984].

Therefore, a basic limit in the implementation of the knowledge-management solutions can be lying in the organizational architecture assuming a centralized-dynamics of the knowledge-process as knowledge-generation, -codifying, and -diffusion, while the cognitive processes normally develop within the real communities and organizations by a decentralized way. The common technological and organizational architectures are based on that hypothesis: as a tacit knowledge is produced by individuals and diffused to the rest of the organization by the socialization process then such knowledge can be more easily diffused throughout the organizations where formally codified. It is then assumed in other words that a certain common and abstract knowledge is produced within the organization and can be always codified in a objective form accessible to everybody. However, there is a strong limit in such assumption which is often confirmed by the experience [Bonifacio, 2002]: the true knowledge of one enterprise cannot be easily codified in a transparent and widely shared form while it is represented under a strict locally shared form: symbols, social relationships, stories and people represent the means by which every community or local organizational system expresses its own values and subjects in a very specific way. And that still happens through the several communities or organizational subsystems that can constitute every enterprise or a big organization. That is, the centrally-designed systems based on an homogeneous and unambiguous representation of knowledge cannot manage the several representations of knowledge generated by the local knowledge-systems existing within the same organization.

In conclusions, the knowledge-management still represents a very wide and still open field to be explored, and although great efforts have been done it seems to be far from a whole and coherent vision of both the critical issues and the possible suitable approaches or solutions either from the theoretical and practical points of view. Many definitions and approaches have been formulated and can be organized by two main classes of researches and studies respectively addressing the possible intrinsic meaning of the theoretical concept of knowledge, from one side, and the acceptations of knowledge as new economic resource to be applied into the business processes and then to be considered as base of the intangible assets of every organization.

Chapter 2
Technological Solutions for the Knowledge-Management Systems

2.1 Introduction

Following the precedent synthetic review of literature about the most widely known models and theoretical approaches to knowledge-management this Chapter mainly focuses on the available technological solutions that are commonly applied into the organization to implement the knowledge-management as these constitute the concrete bases of the actual available knowledge-management systems. A certain emphasis will be given to those solutions provided along the last decade by the computer science in terms of new information and communication technologies; it is important to recall to this extent that before attracting researches and practitioners from several fields a prior interest on knowledge-management came from the scientists and researchers in computer science (see Chapter 1).

The role of technologies in the knowledge-management has always been a debatable topic, both in academia and industry. The general perception is that technology was a driver in many of the KM projects in the late 1990s but nowadays organizations are treating the process and people aspects as critical success factors; the majority of the actual existing knowledge-management systems has been implemented for capturing, searching, and distributing knowledge (e.g. search engines, portals, collaboration systems, intellectual capital reporting tools). However although it is widely agreed the idea that information technology can accomplish a lot more than mere storing and retrieving data, tools and systems that really foster the accumulation and valuing of intellectual capital seem to be rare. Over the decades, advancements in artificial intelligence and other information processing techniques lead to the verification and generalization of stored data, as well as the discovery of new actionable knowledge; therefore, many organizations have heavily invested on the technologies related to the knowledge-management. Unfortunately, based on experience gained in the last ten years, most of these organizations failed and very few become a truly real-time enterprises [Malholtra, 2002]. One of the lessons learnt from these failures is that technology alone should not be the primary driver for one knowledge-management project or initiative but instead an appropriate balance of technology, process, people and content is instrumental to the continued success of its full deployment. Technology, however, can act as a ‘‘catalyst’’ (i.e. an accelerator) for the introduction and initial buy-in of a knowledge-management program but, in order to be successful, this accelerated adoption has to be aligned with a defined knowledge-management strategy and supported by a change program.

This Chapter then presents a brief overview of the mostly known technologies that have been developed and are commonly applied to implement the knowledge-management systems within real organizations today. Further, there are shortly discussed some possible critical reasons that can lead in some case to the failure of the implementation or work of such systems. And finally some brief description is provided about the different organizational contexts where the knowledge-management is implemented as the public organizations and the private companies.

2.2 State of Art about the Knowledge-Management Solutions

Davenport and Prusak [1998] describe the knowledge-management as involving organizational, human and technical issues, with the advice that the technical should be treated as least important of the three. Dieng et al. [1999] add financial, economic and legal issues to this list. A brief literature review can similarly center on technology, and on knowledge management systems, again without wishing to imply that this is therefore the most important aspect of knowledge-management. Many authors have written about the use of various types of software in knowledge management, including Junnarkar and Brown [1997], Offsey [1997], Liebowitz [1998], Borghoff and Pareschi [1998], Dieng et al. [1999], Alavi and Leidner [1999], Hendriks and Vriens [1999], Earl [2001] and Alavi and Leidner [2001]. Since the early days of knowledge management there has been a particular stream of thinking that stresses the use of knowledge-based systems software in knowledge management. Strapko (1990) was discussing this point even before the term knowledge management came into common use, while Liebowitz has been one of its main proponents, arguing that expert systems have a crucial role in institutional memory, because of their ability to capture business rules. Becerra-Fernandez [2000] gives a different kind of example, a people-finder system.

It is clear that expert or knowledge-based systems software, and artificial intelligence (AI) software more generally, does have a role to play in supporting knowledge management, but in addition, so does more conventional software. Table 2... shows the most common forms of both AI-based and conventional software that have been suggested by various authors as offering support for knowledge management. It is noticeable that different authors address this discussion in terms varying from the very general (such as knowledge based systems and databases) to the very specific (such as genetic algorithms and workflow). Table 2... shows the terms as authors have used them.

Surveys of the use of knowledge management systems include those by Alavi and Leidner [1999] and Zyngier [2001] and a less formal one by Edwards et al. [2003b]. Intention of this Study is not to go into detail about the various types of supporting software here, discussing their advantages and disadvantages but just try to outline a state-of-art in the developments of information and communication technologies towards the knowledge-management.

Table I Different types of support for knowledge management

Tab. 2.1 Available Technologies for Knowledge-Management

AI-based	*Conventional*
Case-based reasoning	Bulletin boards
Data mining	Computer-supported co-operative work
Expert systems	Databases
Genetic algorithms	Data warehousing
Intelligent agents	Decision support systems
Knowledge-based systems	Discussion forums
Multi-agent systems	Document management
Neural networks	Electronic publishing
‘‘Push’’ technology	E-mail
	Executive information systems
	Groupware
	Information retrieval
	Intranets
	Multimedia/hypermedia
	Natural language processing
	People finder/‘‘Yellow Pages’’
	Search engines
	Workflow management

2.2.1 Main Architectures and Functions of the Knowledge-Management Systems

To provide a clear and wide vision about the main architectures and functions of the knowledge-management systems here are used the Zack's classification [1999] distinguishing among :

Tab. 2.2 Main Functions of the Knowledge-Management Systems [Zach, 1999]

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- integrative functions;
- interactive functions;
- bridging functions

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and the Hansen's which was specifically proposed to classify the knowledge-management strategies basing on the two following concepts:

- *Personalization*: addressing the knowledge strictly related to individuals developing and sharing knowledge through interpersonal relationships; in this case, the knowledge-management technology must be supporting that kind of knowledge processes as formulating and transferring personal knowledge;
- *Codification*: based on computers and information and communication technology that addresses the codification process of knowledge that leads to create the digital form of knowledge as it can be stored into the data-bases and then made fully accessible to the organization;

Address the personal and digital aspects of the organizational knowledge such classifications make it possible to some extent to address the implicit and explicit knowledge that are respectively focused by the interactive and integrative processes. Some other function cannot be classified as integrative neither as interactive as their true aim is to create a certain bridge among the different systems based on the integrating functions or on the interactive functions only. Then coherently with Hansen using both these strategies make it possible to gain the benefits of both and then building a wider and more highly complete knowledge-management system - i.e. provided with both kinds of functions.

Here is following a deeper description of the single said knowledge-management functions highlighting the architecture of several types of systems and their own functions and logical schemes.

Integrative Applications

Integrative applications exhibit a sequential flow of explicit knowledge into and out of the repository. Producers and consumers interact with the repository rather than with each other directly. The repository becomes the primary medium for knowledge exchange, providing a place for members of a knowledge community to contribute their knowledge and views. The primary focus tends to be on the repository and the explicit knowledge it contains, rather than on the contributors, users, or the tacit knowledge they may hold.

Integrative applications vary in the extent to which knowledge producers and consumers come from the same knowledge community. At one extreme, which I label *electronic publishing*, the consumers (readers) neither directly engage in the same work nor belong to the same practice community as the producers (authors). Once published, the content tends to be stable, and those few updates that may be required are expected to originate with authors. The consumer accepts the content as is, and active feedback or modification by the user is not anticipated (although provisions could be made for that to occur). For example, the organization may produce a periodic newsletter, or the human resources department may publish its policies or a directory of employee skills and experience.

At the other extreme, the producers and consumers are members of the same practice community or organizational unit. While still exhibiting a sequential flow, the repository provides a means to integrate and build on their collective knowledge. I label these *integrated knowledge-bases*. A best-practices database is the most common application. Practices are collected, integrated and shared among people confronting similar problems.

Regarding the organizational roles for managing integrative applications, acquisition requires knowledge creators, finders, and collectors. Capturing verbal knowledge requires interviewers and transcribers. Documenting observed experiences requires organizational "reporters". Surfacing and interpreting deeply held cultural and social knowledge may require corporate anthropologists. Refining requires analysts, interpreters, abstractors, classifiers, editors, and integrators. A librarian or "knowledge curator" must manage the repository. Others must take responsibility for access, distribution and presentation. Finally, organizations may need people to train users to critically interpret, evaluate and adapt knowledge to new contexts.

Interactive Applications

Interactive applications are focused primarily on supporting interaction among people holding tacit knowledge. In contrast to integrative applications, the repository is a by-product of interaction and collaboration rather than the primary focus of the application. Its content is dynamic and emergent.

Interactive applications vary by the level of expertise between producers and consumers and the degree of structure imposed on their interaction. Where formal training or knowledge transfer is the objective, the interaction tends to be primarily between instructor and student, or expert and novice, and structured around a discrete problem, assignment or lesson plan(22). I refer to these applications as *distributed learning*.

In contrast, interaction among those performing common practices or tasks tends to be more ad hoc or emergent. I broadly refer to these applications as *forums*. They may take the form of a knowledge brokerage - an electronic discussion space where people may either search for knowledge (e.g., "Does anyone know…") or advertise their expertise. The most interactive forums support ongoing, collaborative discussions. The producers and consumers comprise the same group of people, continually responding to and building on each individual's additions to the discussion. The flow continually loops back from presentation to acquisition. With the appropriate structuring and indexing of the content, a knowledge repository can emerge. A standard categorization scheme for indexing contributions provides the ability to reapply that knowledge across the enterprise.

Interactive applications play a major role in supporting integrative applications(23). For example, a forum can be linked to an electronic publishing application for editors to discuss the quality of the contributions, or to offer a place for readers to react to and discuss the publication. Best practice databases typically require some degree of forum interaction, so that those attempting to adopt a practice have an opportunity to discuss its reapplication with its creators.

Regarding the organizational roles for managing interactive applications, acquisition requires recruiters and facilitators to encourage and manage participation in interactive forums so that those with the appropriate expertise are contributing. The refining, structuring, and indexing of the content often is done by the communicators themselves, using guidelines and categories built into the application, supplemented by a conference moderator. Assuring the quality of the knowledge may require quality assurance personnel such as subject matter experts and reputation brokers. Managing a conference repository over its lifecycle usually falls to a conference moderator. Others may be required to work with users to help them become comfortable and skilled with accessing and using the application.

B*ridging Functions*

The fourteen bridging functions both integrative and interactive whose objectives are: first, to create a link between knowledge-elements and knowledge-networks; and second, to add the considerations of the participants into that to be used as framework for searching and presenting the knowledge by using integrative functions. Then, the bridging integrative and interactive functions of the knowledge-management systems can be organized by three classes:

- knowledge search and presentation (functions);
- knowledge acquisition, publication and organization (functions);
- administration (functions).

2.2.2 The Knowledge-Management Systems within the Organizations

The actually available infrastructures provided by the information and communication technologies offer several functions oriented to support the knowledge-management that are commonly wide spread in all kind of actual organizations. Many examples of this can be given by the group-wares, or the intranet based solutions, and others .... that are commonly applied in big organizations. That is, many of such big organizations can be considered to be right today provided with several knowledge-management technologically supported functions.

However, in many cases such functions are not fully or proficiently exploited. Just in few cases that is due to technological problems or lacks while in most of cases these are occurring because of organizational problems as the lack of specific responsibilities assigned against the knowledge-management functions and the business processes or also because of the lack of active participation into the knowledge-processes from the organizational actors. It is still remarkable that the knowledge-management are not used as expected because of human barriers limit individuals - i.e. lack of motivations or lack of abilities in using the knowledge-management technical solutions.

In most of cases the implementation is carried out in the real organization focusing mostly on the integrative functions while the interactive functions are less frequently implemented or very poorly used (when implemented) except for some few applications like e-mail, chat. Finally, the bridging functions tend to be implemented just for monitoring the organizations.

The potential of several knowledge-management oriented function seem to be high but not fully exploited yet because of the said reasons. Many technical functions (i.e. semantic analysis, automated classification, knowledge-element linking, or 3D visualization) are not largely implemented. And that support to some extent the hypothesis that the most powerful element can be given by the combination of the integrative and interactive functions as well as in the personalization of contents. Through the implementation of the available technical solutions for the knowledge-management these have to be vary carefully managed in order to avoid the very high risk of information overload.

Basing on the above said reasons and the Zack's theoretical approach the main parts of a knowledge-management architecture can be then synthesized as follows:

- *Basic Functions*: these are normally implemented by groupware platforms and intranet solutions which give the systems the abilities of performing e the basic interactive functions like e-mailing and chatting as well as also the basic integrative functions that are normally implemented by retrieval and content-management systems;
- *Integrative Functions*: these represent advanced functions to be implemented to support the knowledge-codification as well as the knowledge retrieving or also the management of knowledge-repositories and -structures;
- *Integrative Functions*: these address other advanced functions supporting the expert seeking throughout the organizations as well as the communication among the experts located in different places by specifically supporting the knowledge-sharing;
- *Bridging Functions*: addressing the combinations of both interactive and integrative functions to provide such a high context-making of the knowledge-repositories that can be also focalized on the expert-seek supporting the matching

.

Basing on the above said main elements and characteristics of the architectures of the knowledge-management systems a synthetic state-of-art could be organized by a short series of following statements:

1. *Intranet solutions and group-ware platforms highly wide spread*: these are available in almost all organizations where these constitute a consistent basis for developing a more sophisticated knowledge-management system; such systems in fact can be found in almost all organizations where these provide the basic knowledge-management functions like document and content management and other forms of internal communication (e.g. e-mail, chat, etc.);

2. *Not-full exploitation of the knowledge-management solutions*: although very widely spread many solutions are implemented but not fully exploited specially in case of the more complex tools like customer-relationship-management or business intelligence solutions since it is difficult some time to carry out all very deep changes in organizations that are requested from such solutions;

3. *High diffusion of ad hoc knowledge-management solutions*: these are in most cases internally developed by combining different kinds of technological available solutions coherently with the particular organizational structures or with the particular business processes; that is possible since there are not rigid or standard solutions to be applied in some precisely organizational context but instead the market of the knowledge-management oriented solutions provided by the information and communication technology is wide and plenty of different tools and instruments (e.g. ERP, CRM, Business-intelligence, etc.): the standard solutions in fact are not always able to meet the particular expectations and requirements of organization so that the customization of the standard technological solutions has become a particular and critical kind of technological

intervention which is performed by the most advanced and specialized consulting companies;

4. *The interactive and bridging functions are increasing*: while at beginning of '70s and '80s the organization were needing a support mostly focused on the integration solutions the importance of communications and knowledge-sharing is today still increasing; as the organizations have become fully provided of the abilities in storing several different kinds of documents and information in wide repositories their needs are turning in the management of knowledge which is embedded in such repositories: these are then recognized even more as core-parts of every knowledge-management system;

5. *Weak integration within the information and communication technologies*: a wide spectrum of technological solutions for knowledge-management has been developed along the last decades which however misses any effective strategy or tool to integrate these in a only one knowledge-management systems covering all organizational and business processes performed by the same organization: most of the results obtained by applying the commonly available technological tools and instruments are depending on the use made within the organization but there is not yet a standard way of using such large amount of solutions and consequently very different performances of the knowledge-management systems throughout different organizations;

6. *High intrinsic complexity of the knowledge-management systems*: the application of the available the technological solutions within the organizations to be made contemporary with the needed changes in the organization arises to be still a very difficult and complex issue; that is possibly for different reasons as: a. such technological solutions tend to be characterized by a higher level of intrinsic complexity since these are conceived to perform more sophisticated functions than the traditional data-bases; b. the expected impact on the business performance yields the need to deeply change the organizational structure in terms

of roles and responsibilities to make effective the knowledge-management functions; c. to implement a knowledge-management system require a very high and diffused level of technological knowledge and competencies as well as a high level of personal motivation throughout the organization among people.

2.3 Main Characteristics of the Knowledge-Management Systems

2.3.1. The Knowledge-Based Approaches

Where intended as *knowledge-based* the knowledge-management systems are commonly designed and implemented by two main approaches [Benjamins et al, 1998]:

- the *Vertical Approaches:* guiding the design of task-specific and performance-support systems; normally restricted to a narrow application area such approaches are followed to implement systems providing high value solutions in particular business situations by incorporating (and formalizing) application specific knowledge (e.g. expert systems);

- the *Horizontal Approaches:* guiding the design of general systems providing useful corporate information in wide areas of applications; in practice, this approach essentially leads to document management or information retrieval systems;

2.3.2 Requirements for the Knowledge-Management Support Systems

To some extent the above systems increased the levels of information availability within the organizations but have not always reached the goal of providing an efficient support in terms of higher abilities of knowledge management. Some of the major weaknesses of such systems can be summarized as follows [Dignum, Heimannsfeld, 1999]:

- Concepts and solutions mainly concentrate on the explicit knowledge while the tacit knowledge of humans is left out of the system; thus an important part of organizational knowledge is not integrated into these systems;

- Knowledge is normally considered out of the context within which it is created, and that limits its reusability to employees who have background knowledge about the same context;

- The systems are not designed to be an integral part of knowledge creation so that additional tasks have to be performed to extract added value from the stored information;

- The meaning of terms, part of structured or unstructured information, is not always explicitly stored in the system: as the meaning of words might change over time, the stored knowledge might be misunderstood;

- Most systems focus on knowledge management within a specific area of application; as result of this these cannot provide a generic solution neither provide a support for knowledge combination across organizational boundaries as departments or functional areas; existing solutions thus apply the conventional paper-based knowledge management concepts without adapting them to the potential of the new medium.

Indeed, a strong competence on the above said systems is always required to maintain a proficient use of such technological infrastructures. Usually, in fact the organizational knowledge is embedded within the information systems in such a way that knowledge cannot sometime be easily shared through the system. Although users need to easily access or be provided with knowledge using the information system like these is not always easy as management of implicit knowledge through such systems requires a specific knowledge about the same systems that increases the whole complexity within the organization. Furthermore, newer information systems such as Intranets and the Internet also do not simplify organizational behavior since these tend often to generate an increasingly complex web of information and knowledge continuously changing into an open and dispersed environment.

While the information systems are commonly developed to simplify and fix organizational behavior the people-system interaction is not always coherent with expectations as resulting from the human behaviors. The information-systems can be cosidered to some extent as an attempt to concretize concepts, tacit understandings and social process as well as to provide an objective description of the organization, and algorithmically compress the elements of the organization into a form in which the maximal informational content can be communicated through the shortest possible description. That still requires that all people should be holding a strong and specific competence in order to make the systems correctly work and produce the expected results in terms of increases in the business performances.

2.3.3. Distributed and Heterogeneous Environments

Although traditional information systems support the (so called) knowledge-workers in their daily work their support is often provided *off-line* which means a not-integrated support into the primary processes. To make it easy and useful to use and add to heterogeneous knowledge sources [Staab, Schnurr, 1999] the organizational environments need the business process be integrated with the active support provided in the knowledge-work. Moreover, dynamic relationships are also needed between knowledge-intensive business processes and their knowledge sources.

Distributed computing frameworks have been developed at symbolic level to support distributed computing in heterogeneous environments and provide an interface description language and services that allow distributed objects to be defined, located and invoked. The most popular of such distributed object paradigms are OMG's (Object Management Group) TCommon Object Request Broker Architecture (CORBA),T Microsoft's TDistributed Component Object Model (DCOM)T and JavaSoft's TJava/Remote Method Invocation (Java/RMI)

[Burghart, 1998]T. Such frameworks encapsulate the heterogeneity of legacy systems and applications within standard, interoperable wrappers.

These frameworks are defined and are well suitable at *data-level* of communication; these presuppose a relatively stable environment and some common grounds of understanding. However, while the distributed object paradigm integrates systems at the data level a higher level of integration is needed at the knowledge level [Newell, 1993] basing on the semantics of the problem at hand. In particular, integration can be achieved at that level through the *Knowledge Management Environments:* these provide in fact uniform access to several knowledge and information sources characterized by different formal levels. To support the knowledge intensive tasks as accomplished by using the knowledge extracted from heterogeneous sources, coherently with user preferences, a common knowledge description must be made available as well as a means for translating the domain concepts and relationships between heterogeneous participants. This can be achieved by separating the use of knowledge from the specific characteristics of the knowledge source so that an environment like this should include:

- Loosely connected heterogeneous, multimedia sources;
- Dynamically defined goals;
- Virtual, dynamic links between knowledge needs and knowledge sources;
- Adaptable, intelligent personal assistants, providing support to users.

A powerful concept to create and implement such knowledge-management environments is given by the said organizational memories that ideally can be thought as a shared, cooperative information system or also as a space including meanings, terminology , practices, understandings, cultural norms, and shared values in an essentially human oriented network where an consistent support is given by artificial-agents and -technologies [Gammack, 1998]. This view implies an extension of the concept of information systems by keeping the consideration about people and technology as a whole cognitive-system. That is, an organizational-memory can be considered as: "... *a complex information processing system that perceives, solves problems, learns, and communicates. Cognitive systems can evolve naturally or be intentionally designed, or both, as in the case of human computer cognitive systems ..."* [Webster, 1995]. Such system should then actively support users working on knowledge intensive tasks by providing them with all the necessary and useful information for fulfilling that task.

To outline a practical knowledge-management solution however some critical methodological and organizational aspect has to be kept in the right account: first, the need for methodologies and tools supporting and guiding the needed processes of memory-creation and -dissemination; and second, to make effective the organizational-memories then deep organizational changes are to be made for specifically creating and strengthening the right awareness that knowledge-creation and -sharing are not just a byproduct but an essential part of the organizational effort and strategy. Further, such systems should be both *proactive* (i.e. able to take initiatives in a goal-oriented way) and *reactive* (i.e. able to respond to user requests or environment changes).

The main goal of a knowledge-management environment can be then considered to be providing relevant knowledge to assist individuals in accomplishing knowledge intensive tasks: such environments must provide users at the right time with relevant knowledge which is that knowledge enabling users to better perform their tasks. However, to be accepted the environment must be adaptive to the different needs and preferences of users as well as it must naturally integrate knowledge-oriented tools and processes with the traditional methods. of work The knowledge management environment relies in an explicit modeling of business processes, such as conventional business process models and workflow management systems.

2.3.4. Dealing with complexity in Knowledge Management

The nature of many business processes appears to be even more widely distributed throughout the organizational units; likewise the organizational knowledge flows and spreads within all business processes. An increasing complexity characterizes all business environments leading to a distributed organizational network of responsibilities and authorities; that make different systems (either human or automated) in charge of different parts of the same process; consequently the outcome to the whole process is holistically determined by a combination of the effects produced by its own different parts. By the way, as users expect a dedicated assistance from the applications they use, these should intelligently anticipate, adapt, and actively seek ways to support users [Sycara et al. 1998]: software-agent technology is an example of joint development from several fields in response to these requirements.

Heterogeneous knowledge-environments are open and might change rapidly over time; as knowledge is embedded in a multitude of different sources, knowledge management systems should be able to handle formal and informal knowledge representations, as well as heterogeneous multimedia knowledge sources. Therefore, the available knowledge-assets within a knowledge management environment are to be considered as more than just ‘traditional’ information systems; such assets include structured and unstructured information, multimedia knowledge representations and links to people (e.g. through knowledge maps or yellow pages – personal directories). Besides using existing knowledge sources, the environment should be able to create (and store) new knowledge based on its observation of the user’s task performance [Leake et al, 1999].

2.4. Main Families of Technological Solutions for Knowledge-Management

Considerable efforts have been made along the last years in computer science to develop new and more powerful methodologies and applications to support the knowledge-management both in the area of intelligent information gathering and storage as well as in the area of task specific support systems. Here are briefly described some of these current developing-lines.

To classify the knowledge-management technological solutions here are used two possible critical categories that can be further specified by a series of possible specific configurations: the *knowledge sources* and the *knowledge representation forms*. In particular, two main related configurations could be identified against the knowledge-sources: people and systems; while three configurations could be identified as knowledge representation forms: the implicit and tacit knowledge, the explicit-unstructured/half-structured knowledge and the explicit-structured knowledge (see the Pyramid Metaphor).

As the knowledge-management technologies can be then considered as basic infrastructure systems implementing a great number of available technological solutions (e.g. *intranet-Internet technologies, knowledge-grids, service-oriented architectures, the Intelligent Agents and the Enterprise Knowledge Portal)* then in the following list some of the most common technologies are specifically classified and organized basing on the knowledge representation forms [Nichols, 2002]:

1- Knowledge-Management Technologies for Explicit Knowledge (under Structured forms): e.g. : *Database, Data Warehouse and OLAP, Knowledge Discovery in Data (Data, Web, Log, Usage, Mining);*

2- Knowledge-Management Technologies for Explicit Knowledge (under Unstructured/Half-structured forms) - e.g. : *Natural Language Processing, Information Retrieval, Knowledge Discovery in Text (KDT), Document and Content management, Case Based Reasoning;*

3- Knowledge-Management Technologies for Tacit Knowledge (also as Implicit forms) - e.g. : *Knowledge acquisition applications, Communication Collaboration System, Group-ware, Adaptive Systems and multimode and multi-channel interfaces;*

Such technologies were developed to support the main phases of the knowledge life-cycle - i.e. creation, memorization, distribution and application - by one hand; and to facilitate the same knowledge life-cycle in developing by turning from the tacit-form to the explicit and structured forms. Indeed, a number of newer technologies related to the knowledge-management must be also considered as :

a - the *extraction and integration technologies*: e.g. heterogeneous information source integration, Wrapping Crawling and Information Extraction;

b - the *arising technologies*: e.g. Ontology and Knowledge Representation and Reasoning, Workflow, Agent-based Models;

c- the *advanced systems*: e.g. Help-desk applications, Customer relationship management, Business process re-engineering, decision support systems and the e-learning.

2.4.1 Further Knowledge-Management Technologies

Many other classifications have been proposed about the knowledge-management technologies; some of these are indicated below by the main functions that are accomplished with respect to the organizational knowledge:

- the extraction and integration technologies: *heterogeneous information source integration, Wrapping Crawling and Information Extraction;*

- the arising technologies: *Ontology and Knowledge Representation and Reasoning, Workflow, Agent-based Models;*

- the evolved systems: *Help-desk applications, Customer relationship management, Business process re-engineering, decision support systems and the e-learning;*

Tab 2.3 The Main Families of Knowledge-Management Technological Solutions [ref. CEN, 2004]

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Main IT-based Support Tools / Processes:

- Corporate Intranet and Extranet
- DB management systems
- multimedia repositories;
- messaging and e-mail
- DSSs (executive information; expert systems)
- Web-based Training
- search engines - Intelligent Agents - Information Retrieval Systems
- data mining tools - knowledge discovery tools
- knowledge mapping tools
- group-ware (e.g. Lotus notes)
- online chat
- teleconferencing (shared applications, whiteboards)
- desktop computer conferencing
- communities of practice
- communities of purpose (common interest in a project/task)
- mentoring / tutoring
- story telling
- best practices repositories
- corporate yellow pages (directory of expertise)

Main Technology Applications:

- Expert Finding
- Collaborative Technology
- Knowledge Capture
- Global / Enterprise Information Pull
- Document Organization and Management

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Finally, since a number of technologies is commonly thought of when the term "knowledge management" is intoned here is a list developed by Dataware Technologies.

Tab 2.4. The Main Families of KM Technological Solutions [ref: Datawere Technologies]

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• Intranets
• Document Management Systems
• Information Retrieval Engines
• Relational and Object Databases
• Electronic Publishing Systems
• Groupware and Workflow Systems
• Push Technologies and Agents
• Help-Desk Applications
• Brainstorming Applications
• Data Warehousing and Data Mining Tools
• Technologies that should be included knowledge management

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2.4.2 The Information Systems for Knowledge-Management

The concept of information-systems normally address structurated aggregates of inter-related components that are able to perform a series of information-management related tasks - i.e. collecting, retrieving, processing, storing and distributing information; these are baisically aiming at giving a concrete support into the decision-making processes of every organization ane then into the coordination and control of the same business processes. Such systems are thus conceived (and implemented) to help the organizational actors like managers in analyzing problems, building simple visualization of complex subjects, and facilitating the new product development.

However, the role of information systems has deeply changed along the last decades turning from the mere support to single users by specific functions to a wider form of support the whole organization by facilitating the collaboration and the business processes as developing in a decentralized and distributed social environment [Verharen, 1997]. In such a way these appeared to turn in instruments for carrying-out the knowledge-management by providing tools for storing and sharing the organizational knowledge. As the information was interpreted as basis on which to build an explicit representation of someone’s or one organization’s knowledge then a great number of new methods and tools as well as technological packages and solutions to facilitate the implementation and use of information systems were created and spread to support the knowledge-management processes. The growth of the information systems produced a great amount of available information so that a considerable and increasing amount of time has been required to every organization to find relevant information from which to create relevant knowledge. By a spiral effect, this increased the need for systems supporting the workers in specific complex tasks as expert systems, decision support systems, workflow management systems and transaction transformation systems. Direct examples of information systems specifically designed to support the knowledge management within an organization are the Document Management Systems (DMS), the GroupWares and the Intranets and Extranets [Schmid, Stanoevsk-Slabeva, 1998]. In particular:

- the *Document Management Systems* mainly provide database-like storage, management and accessibility of documents as well as these provide access to already available documents without further adding value to them; these are developed by applying the concepts of management of structured information to such unstructured information;

- the *Groupware* is designed and basically used for informal communication during co-operation and normally supports the coordination of cooperative work by capturing a repository of (unstructured) pieces of information created by a team during their common work (a well-known example is Lotus/Notes); even though GroupWare can enhance the teamwork it is not a sufficient solution for knowledge management as it does not capture the context and there is no added-value summary of the created knowledge - the GroupWare tends to turn the informal knowledge in explicit but generally fails to create or manage coherent team or organizational knowledge;

- the *Organizational Memory Information Systems (or Corporate Memories)* are motivated by the desire to preserve and share the knowledge and experiences residing in one organization as these represent a means to coherently integrating the know-how spread throughout the organization facilitating its access and reuse and leading to a shared model of the world; such know-how relates to problem solving expertise in functional disciplines, experiences of human resources, and project experiences in terms of project management issues, design technical issues and lessons learned; in particular, these integrate context, documents and structured information and are usually developed for a special application area; indeed, there is no integrated support for the needed processes creating memory and disseminating it while practical implementations of these mostly fail as these are not a natural extension of the knowledge creating process but require additional efforts, which do not provide immediate value to the primary business process, and are often not provided for in the organizational structure [Stein, Zwass, 1995].

It finally remains to consider the *Intranet and Extranet* technologies whose application to the information and knowledge management within organizations is increasingly more and more: intranets and extranets apply the basic principles of both the database-management systems and the organizational memory information systems and can still be enhanced by the GroupWare functionality and have brought the multi-media aspect to knowledge management.

2.4.2.1. The Business Intelligence Systems

Similarly to the data warehouses the Business-Intelligence systems have been designed to mainly support researches in economics and by statistical application focusing on the processing of large amounts of structured data, such as in databases; the specific expected support of such applications lies into the decision-making processes [Sas, 1999].

The business activities are increasingly performed within environments where people gather information from various sources as structured and formal data-sets and semi-structured and non-formal documents that are commonly organized by distributed, even more often web-based, infrastructures; then, the business-intelligence systems are particular infrastructures supporting a variety of decision-makers, with different goals and different backgrounds by making it easier to analyze such large amounts of data about their clients extract from different departments or organizational units and use them to develop new business strategies: as different departments or business units often use different information systems it is not always easy to conduct synthetic analyses on data to be extracted form different places so that much of those data can be lost. And that is what the business-intelligence systems do: these integrate the different existing data-sets and make synthetic analysis on. Differently than data-warehouses such systems are not restricted to store data by the same only-one format while similarly to data-warehouses containing information about clients and their insurance policies can be used for example to discover previously unknown relations and characteristics for developing new businesses.

2.4.2.2 The Experience-Factories in Software Engineering

A very similar concept to the knowledge-management to some extent comes from the area of Software Engineering which is the *Experience-Factory*

[Basili et al, 1994]; this specifically addresses those processes that were developed to formally structure and facilitate the phases of storing and reusing documents, designs, code and other artifacts into the learning-software-organization.

Similarly to the intrinsic strategy of the business intelligence systems such processes the experience-factories are based on the observation that semi-structured and non-formal documents play a prominent role in an organization knowledge management efforts, and are then to be geared towards a formal and structured representation of knowledge. So that in recent implementations the case based reasoning has been used to deal with non-formal, unstructured types of knowledge while only very stable, useful and worthy knowledge has been codified into formal representations [Althoff et al, 1998].

2.5 Knowledge-Management Implementation: Some Key-Issues

In time the mere technological approach to the knowledge-management systems has been revealing not effective as expected against the crucial relevance of social and organizational aspects strictly related to individuals and social context within the organizations; in particular, a possible devide arose to be potentially existing between the real conditions of the social context within the organizations and those addressed behind the design of the same systems. That is, the knowledge management systems can fail because of the lack of coherence existing between the design addressed inputs (e.g. data, information technology, best practices, etc.) and the real business processes; particularly, such inputs are often missing of critical elements characterizing the social context as individuals' attention, motivation, commitment, creativity, and innovation. Indeed, it not enough considered how such factors are deployed within the implementation of the knowledge-management systems and that can leads to lower performances.

That is, to avoid some potential limits certain critical issues must be faced along the implementation of the knowledge-management systems; precisely, these can be organized in terms of : a. business and technology strategy; b. organizational control; c. information sharing culture; d. knowledge representation; d. organization structure; e. managerial command and control; and, f. economic returns.

- Business and Technology Strategy

The global economic competition even more requires all organizations to be able to redefine their *business value targets* as competitive survival and ongoing sustenance would depend on the ability to continuously redefine and adapt organizational goals, purposes. Therefore, the business models must be developed keeping in account the increasingly quick obsolescence of traditional concepts throughout industries, organizations, products, services and channels of marketing, sales and distribution [Mathur, Kenyon, 1997]. And coherently with this, the knowledge-management systems have to support such organizational ability in changing and being adaptive which means ability in continuously making dynamic changes either in business models and information architectures. Efficiency and optimization in handling with the organizational knowledge has to be concretely implemented in terms of higher organizational flexibility against the said innovative business models. That has to be then carried out by coupling the evolution of the business models with the evolution of the knowledge-management systems. Greater technological integration will help in achieving more efficient optimization of for knowledge harvesting. There will be, however, a critical need for ensuring rapid adaptation of the business performance outcomes to the dynamic shifts in the business environment while keeping them loosely coupled with pre-specified technology architectures. The new paradigm of flexible, adaptive, and scalable systems will accommodate real time changes in information and data across the business ecosystems network.

- *Organizational Control*

As for organizational control here are specifically intended all pre-determined meanings, pre-defined actions, and, pre-specified outcomes directly and indirectly regarding the business processes. That is then often based on rules and hence difficult to maintain in a world where competitive survival often depends upon questioning existing assumptions. Further, as consistency is imperative for ensuring homogeneity of processing of same information in the same way to guarantee same outcomes and is achieved by minimizing criticism and questioning of the *status quo*, that can however decrease the organizational ability of innovate. Even despite organizational control that demands absolute conformance, knowledge workers' attention, motivation, and, commitment may moderate or intervene in its influence. Given the needed radical and discontinuous changes in the global world, the survival of organizations and then its business performance outcomes are even more deeply depending on the market conditions, consumer preferences, competitive offerings, business models, and, industry structures. That is, the knowledge-management systems should then overcome the risk of constraints given by the said control-related consistency. These have then to be based on the continuously changing dynamics of the new business environment requiring few rules business models against the traditional business logic based on rigid controls. That means that such systems have to make the knowledge workers really free to define problems and generate their own solutions as well as evaluate and revise their solution-generating processes. By explicitly encouraging experimentation and rethinking of premises, such knowledge-management systems must promote reflection-in-action, creation of new knowledge, and innovation in order to ... make organizations comfortable with the *dialectic* of harvesting their existing knowledge *while* being able to rethink and redefine their current models of success before they are marginalized by environmental change. The integration of data and processes across inter-enterprise value networks has to be faced as critical challenge of organizational control. On one hand, the players in the inter-enterprise supply chains and extended value chains need in fact to share information and collaborate with their upstream and downstream partners to ensure streamlined information flows. Ironically, they may also perceive the upstream and downstream players as potential competitors vying for the most attractive and dominant position in the value chain networks. While sharing of accurate information related to goods or services flowing across the supply chain will be necessary, it increases the peril inherent in the paradoxical roles of collaboration and competition adopted by various players in the same supply chain.

- Information Sharing Culture

Another critical issue is represented in the knowledge-management system implementation by the integration of decision-making and actions across inter-enterprise boundaries over the integration of data and processes across inter-enterprise supply chains and value chains. The effectiveness of the integrated information flows depends in fact on the accuracy of information shared by the stakeholders across the inter-enterprise boundaries. The information-sharing results from the competitive nature of enterprises across the value chains as the chance of accessing privileged information may often determine the dominant position in the inter-enterprise value networks. Similarly, accessing customer and supplier data residing in databases or networks that are hosted on the infrastructure of outsourcing providers may pose increased privacy and security challenges. This is particularly important in situations where sharing of proprietary strategic or competitive information about customer or supplier relationships needs to be safeguarded from third parties - such issue is particularly relevant as the vendor's knowledge of the company's customers or specific customer relationships can be used against the best interests of the company. A basic need of trust about the vendor(s), however, is given by the changing business environment so that trust must overcome the contractual agreement. Often, individuals may not willingly share information with their departmental peers, supervisors or with other departments as they believe that what they know provides them with an inherent advantage in bargaining and negotiation. Despite the availability of most sophisticated *knowledge-sharing* technologies, such human concerns may often result in sharing of partial, inaccurate, or ambiguous information. Even more critical than the absence of information is the propensity of sharing inaccurate or ambiguous information because of competing interests that may not yield true integration of *information flows* despite very sophisticated integration of *enabling* information technologies. Integrated information flows depend upon motivation of people to share accurate information on a timely basis across intra-enterprise and inter-enterprise information value chains. Motivation of employees, organizations, customers, and suppliers to share accurate and timely information is based on trust, despite the potential of use of information in unanticipated ways. This in turn depends upon the overriding inter-enterprise and intra-enterprise information sharing cultures. As community and commerce paradigms increasingly intermingle, business enterprises are challenged to inspire trust and motivation for sharing needed information with their stakeholders on which they may often have little control. Given the lack of these enabling factors, it will be almost impossible to ensure that accurate information is available for integration despite presence of *enabling* technologies that can facilitate such integration.

- *Knowledge Representation*

Static and pre-defined representation of knowledge are particularly important to facilitate the *knowledge re-use* but not sufficient to perform for *knowledge-creation* which also requires a specific support to the dynamic representation of knowledge - the support given by a digital memory is exclusively valid for a business environment characterized by routine and structured change. The digital logic and databases facilitate real-time execution of the inter-enterprise information value chains but these have to be adaptive to effectively face the real-time changes requested by the continuously changing business environment; in particular, as such changes cannot be recognized or corrected *automatically* by computerized systems as they cannot be *pre-programmed* to detect an unpredictable future, then the adaptability of a knowledge-management system must be carried-out in terms of ability in sensing complex patterns of change in business environments *and* using that information for adapting the digital logic and databases to guide decision-making, actions, and resulting performance outcomes. The knowledge-management systems based on artificial intelligence and expert-systems can provide the "right information to the right person at the right time" *if* it is known in advance what the right information is, who the right person to use or apply that information would be, and, what would be the right time when that specific information would be needed. Detection of non-routine and unstructured change in business environment still depend on the sense-making capabilities of knowledge workers for correcting the computational logic of the business and the data it processes. To this extent, a related issue has to be considered to be tapping the tacit knowledge of executives and employees for informing the computational logic embedded in the knowledge-management systems. It may be possible to gather information about the decision-making logic from human experts if such decisions are based on routine and structured information processing. Artificial Intelligence and expert systems related technologies enable complex computation of specific and clearly defined domain expertise areas by compiling inferential logic derived from multiple domain experts. The challenge of *scanning the human mind and its sense making capabilities* lies in the problem that most individuals may know more than they think they know. This is particularly true about their information processing and decision-making capabilities related to non-routine and unstructured phenomena and to knowledge that spans multiple domains. The meaning making capacity of the human mind facilitates dynamic adaptation of tacit knowledge to new and unfamiliar situations that may not fit previously recognized *templates*. The same assemblage of data may evoke different responses from different people at different times or in different contexts. Hence, storing explicit *static* representations of individuals' tacit knowledge in technology databases and computer algorithms may not be a valid surrogate for their *dynamic* sense making capabilities.

\- *Organization Structure*

Developing an information-sharing technological infrastructure is an exercise in *engineering design*, whereas enabling use of that infrastructure for sharing high quality information and generating new knowledge is an exercise in *emergence*. While the former process is characterized by pre-determination, pre-specification and pre-programming for knowledge harvesting and exploitation, the latter process is typically characterized by creation of organizational cultural infrastructure to enable continuous information sharing, knowledge renewal, and creation of new knowledge.

Organizational routines embedded in standard operating procedures and policies can become formalized by their implementation in computer programs and databases as the firm's dominant business logic becomes reinforced. Such formalized information systems become inflexible when they are based upon *static* assumptions about the business environment. With increasingly rapid, dynamic and non-linear changes in the business environment, such systems are increasingly vulnerable because of out-of-date assumptions inherent in their processing logic and the data processed by them. To overcome these vulnerabilities, it is necessary to design technological systems that are sensitive to the dynamic and divergent interpretations of information necessary for navigating unforeseen changes in business environment. Subjecting the extant business logic to critique from diverse customer, supplier, and partner perspectives can help in defining innovative customer value propositions and business value propositions by early detection of complex changes in the business environment. Online and offline communities [Wenger et al. 2002] of customers, suppliers and partners could provide the means for enabling critical analysis of assumptions underlying given business models.

Expanded role of the customers, suppliers and partners includes their involvement in the creation of *content*, in generating product and service reviews, and in helping each other out on shared concerns. It is important to note that such roles *assumed* by *external* communities of customers, suppliers, and partners in the new world have been traditionally *delegated* to *internal* customer service representatives and technical support personnel. Hence, in the emerging business models, virtual communities could be rightfully treated as external extensions of the company's service and support infrastructure. Executives must understand the distinction between the lack of structure and lack of controls characterizing self-selected communities and the command and control systems embedded in their formal organizational structures. Such communities may defy compliance seeking tactics as they represent "self-organizing" ecosystems built upon self-control and autonomy. As knowledge work gets transformed and dissipated across the inter-enterprise value networks, enterprise managers will need to become more comfortable with the model of the enterprise as 'anything, anywhere, anyhow' *dynamic structures* of people, processes, and technology networks.

\- *Managerial Command and Control*

Organizational controls tend to seek compliance with pre-defined goals that need to be achieved using pre-determined ‘best practices’ and standard operating procedures. Such organizational controls tend to *ensure* conformity by enforcing task definition, measurement and control, yet they may *inhibit* creativity and initiative. Enforcement of such controls is essentially a negative activity since it defines "what cannot be done" [Stout, 1980] and reinforces a process of single loop learning with its primary emphasis on error avoidance [Argyris, 1994]. Given the premium on innovation of customer value propositions, business value propositions and business models, organizations in dynamically changing environments need to encourage experimentation. Design of new information architectures thus needs to take into consideration ambiguity, inconsistency, multiple perspectives, and impermanency of existing information. Such architectures need to be designed along the principles of flexible and adaptive information systems that facilitate exploitation of previous experiences while ensuring that memory of the past doesn't hinder ongoing experimentation and adaptation for the discontinuous future. A key-issue for managers to be considered in the forthcoming turbulent environment is cultivating *commitment* of knowledge workers to the organizational vision. As it becomes increasingly difficult to specify long-term goals and objectives, such commitment would facilitate real-time strategizing in accord with the organizational vision and its real time implementation on the frontlines. Knowledge workers would need to take autonomous roles of self-leadership and self-regulation as they would be best positioned to sense the dynamic changes in their immediate business environment. Compliance will lose its effectiveness as the managerial tool of control as managers removed from the frontlines would have less and less knowledge about the changing dynamics for efficient decision-making. Managers would need to facilitate the confidence of knowledge workers in acting on incomplete information, trusting their own judgments, and taking decisive actions for capturing increasingly shorter windows of opportunity. In the new world of business, the control over employees will be ultimately self-imposed. Argyris [1990] has referred to the transition from traditional external control mechanisms to the paradigm of self-control as "the current revolution in management theory." Complementary views have been expressed by other scholars [Bartlett and Ghoshal, 1995; Ghoshal and Bartlett, 1996] to de-emphasize conformance to the *status quo* so that such prevailing practices may be continuously assessed from multiple divergent perspectives. The explicit bias of *command and control* systems for seeking compliance makes these systems inadequate for motivating divergence-oriented interpretations that are necessary for ill-structured and complex environments. Systems designed to ensure compliance might ensure obedience to given rules, but they do not facilitate the detection and correction of gaps between the institutionalized inputs, logic, and outcomes, and those necessary for the organization's survival and competence.

- *Economic Returns*

Some economists [Brian Arthur, 1994] have argued that the production, and distribution of knowledge-based goods and services should create and sustain increasing returns in contrast to diminishing returns that are characteristic of the industrial goods and services. The traditional factors of production are constrained by a threshold of scale and scope as every unit increase in land, labor, or capital results in diminishing returns on every incremental unit beyond that threshold. In contrast, information and knowledge products seem to be governed by a different law of economic returns: investment in every additional unit of information or knowledge created and utilized could result in progressively higher returns. It is important to observe, however, actual realization of such returns requires fundamental rethinking of not only the nature of the product or service, but also its distribution channels as well as the processes underlying its creation, distribution, and, utilization. Increasing digitization and virtualization of business processes without rethinking fundamental premises of the traditional models of products and service definitions has been responsible for the demise of many over-hyped venture-capital funded enterprises. While 'plug-and-play' technologies could enable rapid adaptability of integrated technology infrastructures, success of the business performance outcomes will be still dependent upon sustained business relationships with collaborators as well as potential competitors. Designers of the next generation knowledge-management system would need to understand how enterprise information architectures for intra- and inter-enterprise integration of business processes could enable relationship-building capabilities.

This will facilitate sharing of accurate, complete, and timely information by stakeholders across inter-enterprise boundaries to achieve true integration of information flows. Understanding how information sharing occurs in emergent and self-designed communities of practice such as those supporting open-source technologies could perhaps facilitate this process. A related issue is that of the incentives and rewards that are often used for justifying the economic rationale for knowledge sharing by employees as well as outsiders such as customers and suppliers. Knowledge managers responsible for success of knowledge-management system and knowledge sharing will need to reconcile contractual measures such as punitive covenants with the need for trust and loyalty of customers, employees, partners, and suppliers. This is particularly true about information-sharing environments that *emerge* from self-selection of organizations and entities that cooperate with each other based on shared concerns despite the absence of formal controls, rewards or incentives. These issues will gain greater importance with the emergence of Internet based exchanges and global knowledge economies for knowledge, expertise, skills and intellectual capital in which the free market of knowledge is just a few mouse-clicks away. Design of incentives for knowledge sharing must consider that institutional controls as well as monetary rewards and incentives are not necessary and do not guarantee the desired knowledge sharing behavior.

2.6 Knowledge-Management in Real Organizations: Private *VS* Public

2.6.1 Focus on the Private Organizations

Although these have run sophisticated and long-period programs in knowledge-management usually, private companies have difficulties explaining what Knowledge Management can mean. Each one conceives the concept in a different way. Despite the variety of perceptions, companies identify some common aspects such as the transformation of individual knowledge to organizational knowledge, sharing and applying knowledge, managing and developing personal competences, managing information, measuring the Intellectual Capital and the organizational learning, among others.

The absence of a global and standardized perspective is a real matter and the companies consider that there is an urgent need to reach some minimum agreements in order to define the scope of the concept. Nevertheless Managers agree considering Knowledge Management as a key factor for the success of the company, perceiving it as a competitive advantage. This perspective of the chief executive officers and managers themselves has been one of the driving forces in the development of Knowledge Management projects onto companies.

2.6.1.1 Their expectations

Companies observe many improvement opportunities: the improvement of their customers' and employees' satisfaction, the innovation and the development of new products and services and the improvement of their profitability. They feel that these improvements will be achieved in case these initiatives provide the creation of new knowledge, the consolidation of the existing knowledge, the codification of experiences in the shape of good practices and learnt lessons, and the improvement of external knowledge acquisition processes. Companies have also understood that people have become the main source of future benefits and see that knowledge-management will provide them the tools necessary for it. Its implementation will provide competitive advantages that will assure the benefits in a more extended horizon.

2.6.1.2 Their focus

The responsibilities of the knowledge-management projects are located in different functions: the management team as well as in Quality, Production or Information Systems- Communication and Information Technologies (IS-ICT). According to this, the essential characteristics of the undertaken initiatives can be classified in:

- Focused in the Human Resources department. Connected to competence systems: knowledge, attitudes and skills, closely related to the improvement of the recruitment and training processes. As an example we have the practical use of management tools such as the polyvalence matrix.

- Focused in productive processes. Connected with the organizational processes and their improvement. Some companies include Knowledge Management to their PDCA cycle, as a source of improvement opportunities.

- Focused in information and communication technologies. Related to corporative webs, intranets, collaborative platforms (shared diaries, mail, newsgroups, workers' addresses…), information analysis solutions (OLAP systems) or the application of internet to management integrated solutions (evolution from ERP to solutions associated to concepts such as SCM, CRM, e-Business).

Knowledge-management handles at the same time Strategy, People, the Operational capacity of business processes and these technologies as empowering tools, but the existence of these approaches must be highlighted as starting points when dealing with the first initiatives. Many of the initiatives that are already being run take into account partial visions and approaches. For example, there are many technological projects where technology and knowledge are mixed, that is to say, the means and the end. There is a great difference with American companies on the approach given to knowledge-management, since the perspective used is towards the exterior, in order to recruit talented people, people with a thorough knowledge in certain areas, and sharing knowledge with the exterior; while, on a national level, companies consider knowledge-management as something of their own and internal.

2.6.1.3. Practical development

Referring to the companies implication level in projects, three groups can be distinguished. The first one refers to those companies that have already undertaken activities or projects; the second one consists of companies that not having started projects, they have a special interest in knowledge-management and are thinking of implementing projects; and finally a third group with companies that have not carried out any project and do not see knowledge-management as a priority. The existence of the third type of companies is not the only worrying sign, but also the fact that the majority of the companies that are establishing and the ones that consider carrying out short-term projects have begun with initiatives that correspond to a very specific area of action, the key processes of business, but which do not adopt an integrated perspective. Nevertheless, it should be highlighted that companies with most advanced management culture are the ones that have developed Knowledge Management projects, and have done is shorter than 2-3 years. The most relevant projects are connected to Intranet developments, “best practices” repositories, “e learning” and human resource politics. As it can be seen, the majority of projects have adopted an internal perspective, and do not involve directly customers or other external agents.

Industrial companies have discovered three critical processes: design and deployment of the strategy, product design and relationship with customers. Some other industrial companies identify a fourth one that depends on the automation and complexity of the manufactured product, where the production process requires an expert know-how.

This situation confirms the need to define the concept and its application, so that both the projects being run and the ones to be run are well approached for the benefit of all organizations; it would also be necessary for companies that not having seen yet that Knowledge Management provides them a sustainable competitive advantage, they should integrate it into their strategy.

2.6.1.4. Obtained Results

The results obtained by the companies that have undertaken knowledge-management initiatives can be observed in the substantial improvements of the three aspects that companies indicate as expectations, such as:

- process improvement,
- innovation and new products or services development,
- improvement on the customers' and employees' satisfaction.

It must be noticed that companies have great difficulties when they try to measure the benefits obtained. In spite of it, some of them have used indirect metrics that provide a quite real approximation to the measurement of the progresses achieved. Those indirect metrics are related to quality indexes, costs, workplace climate, customers satisfaction, the reduction of the time needed to solve problems, improvements on the capacity to develop more rapidly new and reliable products and services, etc.

The considerable improvement of these indexes in the companies that have developed Knowledge Management projects allow them to conclude that they have obtained real

benefits. Related to the improvement on the customers' and employees' satisfaction, companies identify a greater commitment of the employees, and a greater awareness and integration of the needs of the customers in every area of the business.

Finally, it must be emphasized that organizations recognize some other implicit improvements that can not be measured because of the absence of suitable indexes and that are connected to the attainment of the strategic objectives.

2.6.1.5. Difficulties

The factors that have made difficult the practical development of Knowledge Management in companies can be classified according to the logical implementation process of a new managing system. First of all, difficulties or barriers associated to the Knowledge Management initiation stage; secondly, the barriers related to the development of Knowledge Management projects or activities; and finally, the ones related to the implementation and improvement:

Tab. 2.5 Practical implementation phases of the knowledge-management projects

Initiation Stage
-Conviction
-Leadership
Knowledge Management activities or projects development in different areas
Progressive implementation of Knowledge Management activities or projects
Revision and Improvement

The difficulties of the initial stages of Knowledge Management projects are closely related to the absence of a minimum consensus on the meaning of the Knowledge Management concept. The scarce and vague information about the objectives, scope, tools, goods and difficulties involve the lack of support provided by Management to projects or related activities. In the development of Knowledge Management projects some other difficulties have been identified:

- Difficulties related to persons: Persons play a prominent role in the development and implementation of projects. The main difficulties have been the lack of qualified personnel to design and transmit the good values of Knowledge Management, the skepticism about a new paradigm, the attitude and values (humility and solidarity) of Management, the difficulties of sharing knowledge when it is considered a source of power and the resistance to change.

- Difficulties related to Work Organization: These projects usually require a systematization of knowledge creation and the information storage, transmission and usage. The absence of this systematization and an appropriate methodology and tools have also become difficulties. Another difficulty is the absence of enough time to get involved in these kind of projects.

- Difficulties related to Technology: Companies that have focused their projects in the development of information systems have pointed out the absence of suitable systems as a difficulty.

Finally it should be indicated that the main cause of problems is the absence of a clear definition of the Knowledge Management concept that would allow the solution of the difficulties mentioned.

2.6.1.6. General Considerations

The perspective of the Managers is one of the most powerful driving forces of the Development of Knowledge Management projects onto companies. They understand that improvement opportunities in processes, the innovation and development of new products and services, and in customers' and employees' satisfaction. Knowledge Management projects usually rely on Human Resources, Quality, Production or Information Systems departments. Companies focus Knowledge Management initiatives on persons, operations or information systems. Internal projects are far more common than those involving customers. The majority of the projects are applied to key processes, such as the design and deployment of the strategy, design of products or relations with customers. Despite measurement difficulties, the obtained improvements are recognized. Companies find many difficulties changing from theory to practice. Due to the lack of an integral concept of Knowledge Management, the difficulties related to persons, the organization of the work and the technology, the development of projects is not an easy task. At last, defined Knowledge Management concept is need in order to build models, tools and methodologies for the implementation of practical projects.

2.6.2 Focus on the Public Organizations

Knowledge Management is in its infancy and under constant development. We do not have good insights into how knowledge – associations, mental models, understanding, and thinking – is used by people to perform work. Nor do we understand how to transfer cognitive skills effectively from one person to another or how to transfer conceptual and tacit knowledge from personal domains to structural intellectual capital within organizations. Technology-based tools for knowledge management are immature and narrow but in rapid development. Nevertheless, existing practices, approaches, methods, and tools are useful and valuable and have assisted organizations to benefit through improved effectiveness. New advancements make implementation of knowledge management practices more focused, less resource intensive, and more effective. These developments are expected to continue.

In the modern society, applications of knowledge-management practices supported by related methods, including information-technology based tools, have become important to pursue societal goals with success. The public organizations in most nations and regions have started to implement approaches to achieve well-defined objectives and this trend is accelerating as experience is gained and new insights of valuable applications of knowledge-management are shared. There is an emerging understanding that for knowledge-management to reach its potential, the knowledge management practices need to be broad and comprehensive – each agency, department, and individual need to incorporate knowledge-management considerations into their daily work life, yet it is important to start small and target clear goals.

Societies consist of entities whose behaviors are determined by personal knowledge or intellectual capital embedded in systems, procedures, technologies, and computer-based systems, to name a few. Knowledge-related entities include knowledge producers (sources), knowledge holders, knowledge transfer agents, knowledge and information distributors, and knowledge consumers. Pathways connect these entities through knowledge flows. The "societal knowledge system" operates as a living organism with multiple goals, resources, information exchanges, flows of many kinds, and self regulating mechanisms. Unfortunately, some, such as the market mechanisms may too often be inefficient. The knowledge system changes and adapts to economic and social demands and it therefore is important to maintain the vision and overview for overall system and how it might operate in the modern, competitive society.

In particular, the need for comprehensive KM within and in support of PA is important. KM plays a central role to make PA function more effectively. More importantly, comprehensive KM governed by PAs in support of societal goals can provide broad benefits that allow the society to prosper and increase its viability by making its people and institutions work smarter and thereby increase the quality of life for its citizens.

2.6.2.1 Overview

The main functions of the public organizations (i.e. public administration central and public bodies, public agencies, public research centers, international organizations) in the modern, democratic society are complex. Ideally, but unrealistically, civil servants should possess the best expertise and collaborate with experts with the most advanced state-of-the-art understanding. While at times being experts, they should also be lead facilitators and knowledge-management moderators. However, communication difficulties in societal knowledge-management may make it difficult to walk the narrow line between: (a) having deep and special insights into how to proceed and (b) involving the public and special needs groups in a collaborating process. Public organizations must provide initiatives, leadership, and coordination to implement the most effective approaches and to ascertain that society as a whole is served appropriately.

The role of guiding and governing society's agendas for public intellectual capital falls to the public organizations: the conceptual leadership for knowledge-management must in part reside with public organizations but must also be shared with all stakeholders. Broad practice must ultimately be the responsibility of each public agency and each civil servant. Without broad agreement on concepts the knowledge-management will not be effective. A separate, but small public organization entity or office should be created to support the knowledge-management practice. Its function must be supportive, innovative, and collaborative. It must avoid being prescriptive and needs to operate on several levels. Part of its work needs to be on the policy level with responsibility to coordinate the knowledge-management activities in accordance with society goals and objectives. It must also communicate with legislatures and public agencies to secure resources required to pursue the knowledge agenda. It must collaborate with citizen groups and the business community to facilitate joint programs, determine capabilities, opportunities, needs, and constraints (CONC) analysis.

The public offices must maintain the broad vision for comprehensive knowledge-management programs and facilitate its adoption across all society's entities. It must secure shared resources that individual agencies cannot justify and provide methodological leadership with ensure common standards to allow interoperability, uniform access, collaboration, and knowledge sharing. These demands lead to needs for specialized expertise in several areas and the KM office staff should have considerable expertise in areas like public policy. In addition they should have – or have access to – KM expertise such as Knowledge Engineering, Management Sciences, Cognitive Sciences, Social Sciences, Library Sciences, Philology or Linguistics, Artificial Intelligence, and Advanced Computer Sciences.

The public organizations have broad responsibilities in pursuit of societal objectives. These govern and can facilitate public aspects of operations and life of public and private organizations and individual citizens. When considering knowledge-related issues, such responsibilities cover not only knowledge-related functions within the public administration. Responsibilities extends to govern and facilitate other knowledge-related and affected areas, particularly preparing effective policy partners, building and leveraging societal IC, and building and maintaining a capable and competitive work-force. Furthermore, the responsibility also includes creating and governing the overall vision, perspective, and strategy for the society's general knowledge-management practice.

Starting any new practice – and a comprehensive practice is not different – requires a well thought-out, deliberate, and small and targeted beginning with clear understandings of expected benefits. However, it is also important to have a flexible blueprint of the broad vision to guide the efforts. Initial and later knowledge-management programs should serve as building blocks and contribute to creating the larger practice. It therefore is important to identify the desired path of activities and resulting benefits that are planned to build a broad and comprehensive knowledge-management practice that reaches all intended areas and parties and produces the capabilities and results that are envisioned.

Some KM potential governing steps to start a broad knowledge-management practice include:

- Identify people who are conceptual drivers for comprehensive KM and rely on them for guidance;

- Develop vision for the public KM practice within the region.

- Create the KM office function.

- Create knowledge landscape map for the region covering the overall responsibility area of the public administration with special emphases on delivery of public services, preparation of the public as effective policy partners, building and leveraging public and private IC, and development of citizens as capable knowledge workers – all considering capabilities, opportunities, needs, and constraints.

- Develop the intellectual capital by related policies and obtain legislative commitments and funding for the overall program.

- Govern the overall intellectual capital by related practice.

As the knowledge-management vision is built, it is important to keep a clear overview of which activities need to be undertaken for which purpose and which ones may serve many purposes. Beyond the general knowledge-management activities, the information-technology related support activities and infrastructures are important. They serve vital functions, are complex, costly, and often take time to design and implement.

Building the infrastructure for a knowledge-management practice within the public organizations requires extensive effort. In addition, technology advances rapidly in many areas and new approaches and capabilities appear regularly. In this environment, it is important to create a flexible technological architecture and maintain a adaptable plan to provide desired versatility. This often requires creating infrastructure elements that will serve most desired purposes but may require replacement within the overall planning horizon.

2.6.2.2 Assure Competent and Effective Public Services

The success and viability of any society depend upon how well its public services are provided. Quality and effectiveness of the public services are influenced by many factors. Organizational structures, responsibilities, capacities, information, civil servant personal expertise, and otherwise available intellectual capital are factors that affect the performance desired from the enterprise. Among these, intellectual capital assets are primary enablers. They are the basic resources that govern nature and directions of actions. Without adequate intellectual capitals, even when given the best information, actions will be based on ignorance – lack of understanding – and will be arbitrary and ineffective. Consequently, it is of importance to manage knowledge to make public services act knowledgeably.

Creating and maintaining competent public services is not simple. The overall effectiveness of public agencies depends on individual effectiveness based on intelligent behavior by its people, their motivation, and freedom to act appropriately. It also depends on the suitability of policies, support systems and infrastructure, and organization of work, to name some aspects. Again, the enabling factor is the intellectual capital. That includes the expertise and understanding that individuals can command to perform immediate work. It also includes knowledge embedded in policies, procedures, organization of work, work aids, and infrastructure. Comprehensive knowledge-management provides approaches to improve and leverage most of these aspects. For example, knowledge-management methods are used to build expertise in people and to influence their motivation through increased understanding of the value of their own roles to society – and to themselves. In general, knowledge-management approaches developed for private organizations are highly relevant for public service organizations. Managing knowledge to make effective the public organizations is not new. Building personal expertise in public servants is traditional. Training programs, qualification examinations, certifications, and other approaches have long been used successfully. They help to develop and control competence, ascertain that the public will be served well, and that public interests and agendas are pursued appropriately.

However, there is room for improvement. Modern comprehensive knowledge-management build upon established practices by adding capabilities and approaches. Different knowledge-management approaches may be implemented to support effective performance. Which options to implement and when, become functions of expectations for performance changes, available resources, support of the overall knowledge-management practice, broader enterprise needs, and other factors. A number of knowledge-management approaches are open to the public organizations to manage knowledge or to create comprehensive knowledge-management practices.

2.6.2.3 Prepare Effective Policy Partners

The public organizations help the public understand needs and direction of public activities, programs, and projects. They inform the public about planned or proposed actions through hearings, town meetings, and informative news programs. Unfortunately, these may be marginally effective. Often, they do not provide in-depth dialog to correct wrongful understandings that many citizens have of proposed actions. Citizens are faced with being engaged in “informed decision making” while having limited understanding of implications. They are not prepared to participate as knowledgeable decision makers on their own behalf. Much resistance against public actions has resulted from public ignorance or misunderstanding. Also, inappropriate public actions may be approved by a public that does not understand its negative sides. Effective and efficient transfer of deep knowledge and understanding can improve the public’s insight by use of knowledge-management methods.

Public governance is more effective when citizens have understanding of directions, options, issues, and opportunities. It is particularly value if value systems and ‘models of the world’ are shared with the public organizations. That, however, does not mean that everyone should agree! No society can expect all its citizens to build deep and shared insights. Nowhere will the complete citizenry be fully educated or of one mind. There will always be legitimately different opinions, knowledge sparse misunderstandings, and value-based disagreements. To have the desired results,

communications must be knowledge-effective and preferably closed loop with feedbacks through

dialog [Wiig 1995]. In dealings with the public, many problems are caused by the wide difference in mental models and resulting understandings that exist in the general population. The public’s insights often are different from those of the public subjects. These may have developed extensive knowledge of proposed actions, although at times from narrower perspectives than those available in the public-at-large which will be aware of circumstances not known to the public organizations. The administration’s views are not always right. In a democracy, special interests may pursue undesirable public actions which rightfully should be modified extensively or defeated by the citizenry as better understandings are developed.

Knowledge-management methods provide opportunities to prepare the citizenry to be more effective policy partners – for conceptualizing, planning, deciding, and implementing public actions as well as for providing general support. To be effective policy partners, citizens need to have breadth of knowledge and understanding of consequences. Among the knowledge-management approaches that are available to public organizations to assist the public to become more effective policy partners, the following should be indicated.

2.6.2.4 Build and Leverage Public and Private Intellectual Capital

A country's viable success depends upon its leveragability of resources. Public and private intellectual capital of all kinds create significant opportunities for success and public organization influences both creation and leveraging of intellectual capital. Also, in today's global economy technology is important. Hence, public support to creation technology and research parks and knowledge flow clusters is important for building environments where world class expertise can congregate and provide environments of synergy. In addition, knowledge-related actions often are complemented with other actions to facilitate the desired results. For example, tax or import-export restrictions may have to be eased to attract external industry that can benefit from a well educated domestic work force.

On a national level, the public organizations influence knowledge-related mechanisms for building and leveraging intellectual capital assets in many ways. These include patent policies and legal support for value realization and protection enforcement of the intellectual capital. Other interventions include international trade agreements and targeted support of individual export or import contracts. On both national and local levels public projects provide direct support to create and leverage public and private intellectual capital. Societies benefit from knowledge-related activities in several ways. Some result in increased trade and economic activity. In particular, developments of intangible assets such as world-competitive expertise and knowledge-based products can result in valuable economic and trade changes.

Larger economic activity leads to increased employment, trade, and area payroll with associated positive economic impacts. However, as for other societal developments, many of these impacts take time to realize. Numerous mechanisms are available to public organizations to create intellectual capital assets directly or to facilitate their creation in the private sector. In the private sector, public knowledge-management need to be governed by the desired national or regional strategy. The intellectual capital asset development must be related to available resources and current conditions. Governments frequently allocate resources to create capabilities to obtain specific results. While providing the desired primary results, such actions often also develop highly valuable secondary intangible assets and capabilities.

2.6.2.5 Develop Capable Knowledge Workers

Societies depend upon the capability of their work forces. An uneducated or unmotivated work force obliges the society to rely on natural resources to be successful, and even that is questionable. In today's global economy where the intellectual capital determines competitiveness, a major objective is to develop and maintain the ability of its citizens to perform skilled and knowledge-intensive tasks. From the societal knowledge perspective, the public organizations needs to play an active role also in this area. To be effective, its role must be based on clear and flexible visions of what should be achieved, which societal results should obtain, and how it should be done.

Developing a competent work force requires decades. Several perspectives should be kept in mind when considering how to envision and manage the work force development:

- **Transverse Perspective** consider work force requirements and developments across industries and societal functions. They cover developing citizens with competitive expertise – in all disciplines and industries required. These perspectives consider the breadth of areas such as: Agriculture and fisheries; Tangible goods industries; Service industries; Educational functions; Research institutions; Civil services; and Defense functions.

- **Longitudinal Perspectives** start with infants throughout childhood, schooling, and preparation of trade workers and professionals. These perspectives consider all stages of personal developments such as: Prenatal conditions, Infant rearing; Kindergarten impacts; Grade, middle, and high school education; Trade school preparation; Associate degrees; University education; Post-graduate work; Industry training; and Life-Long Learning programs and opportunities.

- **Political Process and Resource Allocation Perspectives** consider society's objectives, public opinions, interest group influences, and the time, communication, and other realities of political processes. Also considered are societal priorities, funding capabilities, and availabilities of public and private resources.

- **Methodological Perspectives** consider knowledge-related practices, methods, and activities that can be undertaken to achieve the desired goals.

The public organizations have many options available for developing the work force. Some options provide relatively quick results without great investments. Others, such as public education, can require extensive financing over one or two decades before results obtain. The public organizations must then provide initiatives, leadership, and coordination to bring about the most effective approaches and ascertain that society as a whole is served appropriately.

2.6.2.6 Knowledge Management Activities and Benefits

Knowledge-management can be approached in numerous ways to serve particular needs and conditions. Successful knowledge-management practices typically need to be supported by complementary efforts in different domains. It therefore is helpful to consider the activities needed for governance and infrastructure in addition to the operational activities that normally are center of attention. Effective knowledge-management is expected to provide many benefits. Some are short-term and most often influence performance directly. Others have longer term effects and may develop capabilities that allow new strategies or different ways of operating.

2.7 Conclusions

The role of technology has been still preeminent along the history of the knowledge-management systems as the same interest in such field has come from the information and computer science; to some extent in fact the knowledge-management systems can be considered as the evolution of the traditional information systems created in '70s and '80s. And further, the common consideration about the knowledge management systems is actually so far from that as mostly the knowledge-management systems are often perceived as mere technological infrastructures today by many organizations specially in public subjects; so that in many cases design and implementation are considered and then conducted addressing something like a just more advanced information system: no deep difference is perceived between knowledge and data-information.

That is, a very large amount of technological solutions has been created to provide different kind of support to the organizations in terms of knowledge-management oriented functions. Such technological tools and systems can be classified in different ways basing on the particular kind of focused knowledge [Nichols, 2000] - distinguishing among technologies for tacit knowledge, technologies for explicit knowledge under structured form, and technologies for explicit knowledge under semi-structured form - as well as the functions identified by Nonaka's knowledge life-cycle [Marwick, 2001] - by distinguishing among technologies created for respectively focusing on and facilitating each of the four phases: socialization, externalization, combination, and internalization.

The general structure of a whole technology infrastructure implementing one knowledge-management system can however be characterized by three groups of main functions [Zack, 1999] that express the evolution and advancement of the whole progress of the knowledge-management technology as these were progressively reached in time starting by the functions supporting the simple data processing (i.e. the integrative functions) passing then to the those supporting the people communications and interactions as well as the management of people's knowledge (i.e. interactive functions) and finally the global integration between the two groups of functions within the same organization (i.e. bridging functions).

In conclusions, the evolution of the technology has deeply characterized the evolution of the same knowledge-management systems but today the influence of the organizational aspects related to the implementation of such systems, specially those related to individuals' behavior, tend to become even more critical to achieve a full development of such systems; even more in fact the human abilities in acting in coherently with the knowledge-management is decisive to fully exploit the possible improvements taken by the knowledge-management. So that a certain intrinsic constraint to the growth of the technology seems to arise from the real organizational contexts where the public organizations seem to be late against the private ones, specially in case of technological advanced enterprises, that have still realized the importance of people's behavior to effectively implement the knowledge-management systems against the mere availability of powerful technological infrastructures.

Chapter 3
Development of the Knowledge-Management Systems

3.1 Introduction

As described the main fundamentals regarding the organizational knowledge and the knowledge-management in Chapter 1 and provided a synthetic overview about the main available technologies that have been developed to concretely implement the knowledge-management functions in Chapter 2 here is described the whole development process of the knowledge-management systems. By doing so a new key-element of the theoretical framework of this Study is highlighted: the entire process that has to be followed to provide one organization with a global support system that could give the ability of controlling the even more increasingly valuable resource (i.e. the organizational knowledge).

Such process is here clearly intended as the process through which to achieve two main objectives: 1) to individuate those knowledge-management functions that can increase one organization's business performances; 2) to individuate what technological and organizational solutions can provide such functions; and 3) to implement a real global support system providing such functions by applying the said technological and organizational solutions.

Although such process is commonly accomplished by the technological consulting companies as a mere technological intervention the weakly effective impacts produced on the business activities are going to strengthen the basic need of even more highly performing analysis tools. Mostly, the actual methods of implementing such process are just focusing on the already available technologies to be applied basing on a presumed idea of necessity of technology within the organization; however, the analysis of the organizational context is revealing even more critical as it can reveal whether certain technological means are really effective or not because of the main features of the organizational context - e.g. people's skills and abilities in handling with the more advanced technologies as well as the logical structure of the single business processes to be performed with not-fully adaptive technological solutions.

That is, each of the single phases constituting the whole development cycle of a knowledge-management system is here described; and finally, a particular focus is made about the role of the organizational analysis which is normally conducted to individuate those organizational and technological requirements the same knowledge-management systems has to be based on. Such structure of the Chapter allows to partially approach what is better discussed and analyzed in the follows and which also represents the same topic of this Study: the possible improvements of the knowledge-audit process within the analysis process of the organizational context and the knowledge-management needed functions.

3.2 Implementation Process of the Knowledge-Management-Systems

Many methodologies for developing one knowledge-management system are basically organized around a series of steps specifically addressing :

1. ***Strategy***: which means to plan the organizational support system implementing whole effort by individuating : a. the key-issues to be approached against every business, b. the application areas to be addressed, and c. the priorities to apply to those priorities;

2. ***Analysis*** : regarding the detailed definition of all requirements by which to structure the data structures and the specific support functions per every particular business-area;

3. ***Design***: addressing the application of technology to the said requirements defined during analysis turning the data-structures in database designs as well as the function definitions in program-specifications; specific attention must be paid to the human interface, in the interest of defining the behavior of a prospective system;

4. ***Construction***: which addresses the concrete building of the system;

5. ***Documentation***: addressing the formal outlining of all reference materials to describe the system like user manuals, reference manuals, etc.

6. ***Transition***: addressing the organizational change needed to really integrate the system into the rest of existing organizational infrastructures; this then involves education and training activities as well as definition of new organizational structures and roles, and the conversion of existing data;

7. ***Production*** : which is to be intended as continuously monitoring the system capabilities of meeting the organization needs.

One central issue of knowledge-management is that it becomes a natural part of everybody's daily work. Everybody uses database as well as lessons learnt are an integral part of every project and work flow, and that there is an open knowledge-friendly culture. But when starting off with knowledge-management one cannot expect people working like this right from the beginning. First, they and the entire organization have *to learn the knowledge-management*.

Another possible way of structuring the implementation of one knowledge-management initiative or project can be descried as following; precisely, a general project management scheme for knowledge-management comprises five main phases :

1. Setting up : in the first phase the vision, mission and strategy for the knowledge-management initiative are to be defined as the objectives are to be set;

2. Assessment: the maturity of the current state of knowledge handling should be assessed;

3. Development: the third phase of the development of the knowledge-management solution focuses on the requirement definition; then, alternative solutions should be evaluated and the design of the core elements of the knowledge-management solution (tools and methods) are to be carried out;

3. Implementation: the fourth phase covers the processes of the implementation of the knowledge-management solution into the organization and the training of the users;

4. Evaluation / Sustainability: the project closes with an evaluation of the project and the measurement of the results; but that should not be the end – an ongoing process of integrating the results/findings in everybody's daily work has be initiated.

In parallel to these sequential phases the management has to communicate and involve all relevant stockholders in order to generate openness, foster trust relations and manage the different expectations right from the start (Change

Management) . The knowledge-management implementation process should in fact cover all people related activities aiming at supporting the implementation of the knowledge-management solution by involving people within the planning, analysis and implementation tasks – and of course by training of both the knowledge workers to the new processes and technologies as well as of the staff to take up new knowledge-related roles (e.g. knowledge-manager, knowledge-broker). Knowledge-management Implementation also includes the systematic internal information and communication between the different stockholders about the objectives and envisaged project steps.

3.3 Main Elements of the Knowledge-Management System Architecture

That is, the particular single phase regarding the design of a knowledge-management systems is the to be conducted by defining one possibly effective combination of already available existing technological solutions with further newly *ad-hoc* solutions that can meet the requirements individuated along the analysis phase from the technological and organizational points of view. Therefore such phase can be proficiently organized (and then conducted) following an architectural standard model specifically basing on a combination of four primarily resources of explicit knowledge:

Tab 3.1 Main Elements of the Knowledge-Management System Architecture

- Repositories of Explicit Knowledge
- Refineries of Explicit Knowledge *(to accumulate, refine, manage and distribute that knowledge)*
- Organization Roles *(to execute and manage the refining process)*
- Information Technologies *(to support those repositories and processes)*

- Repositories of Explicit Knowledge -

The design of a knowledge repository reflects the two basic components of knowledge as an object: *structure* and *content* [McKay, 1969]. Knowledge structures provide the context for interpreting accumulated contents. Where repositories are developed following a *knowledge platform* structure then several different visions of the same contents are possible as these can be freely derived from the same particular structure [Meyer, Zach, 1996]. So that the users can be enabled by such chance of viewing the same contents, and that give them also the chance of dynamically and interactively modify their own visions and to new organizational contexts and circumstances. That makes turn the knowledge-as-object towards a knowledge-as-process where the basic structural element of knowledge is consisting of a basic formally defined unit that the observer (i.e. the user) can be freely label, index, store, retrieve and manipulate. Furthermore, such knowledge-units can largely vary in format, size and content depending on the type of explicit knowledge that has been stored as well as by the context in which that is applied. The connecting- and reference schemes of the same knowledge-units are contained into the repository structure: such connections are given in terms of conceptual associations or logical sequences as well as causal-effect relationships among the different shapes of stored knowledge. To make it easily to reference the possible large spectrum of explicit knowledge such repositories must be structured by significant and meaningful concepts, categories, and definitions, (declarative knowledge) as well as significant (critical) processes, actions and sequences of events (procedural knowledge), rationale for actions or conclusions (causal knowledge), circumstances and intentions. The repositories must be indexed by those concepts and categories that directly address the critical organization business processes so that changes and additions to that knowledge (e.g., by linking annotations) can be effectively facilitated by the repository structure. In real cases a several repositories can constitute one knowledge-platform where each of them is provided with an adaptive structure to the knowledge contents to be contained: repositories like this can be logically connected in such a way to constitute a *virtual* repository where contents addressing to or extracted from different contexts can be contained into the same repository which is independent from the particular feature of one context: although stored separately, product literature, best sales practices, and competitor intelligence, for instance, can be contained in one repository.

- Knowledge Refineries -

This concept addresses all logical processes by which the knowledge contained into the above said repositories can be created and distributed throughout the organization; in particular, such processes can be structured by the following five main groups of macro-functions:

1. *Knowledge-Acquisition*: addressing those processes by which information and knowledge can be either created within the organization or otherwise acquired from different internal and external sources;

2. *Knowledge-Refining*: which addresses those *refinement* processes that should be performed before storing the acquired knowledge into the repositories by precisely cleansing, labeling, indexing, sorting, abstracting, standardizing, integrating, and re-categorizing that knowledge;

3. *Knowledge-Storage and -Retrieval*: which addresses those processes that can bridge the creation of the upstream repositories with the distribution of downstream knowledge;

4. *Knowledge-Distribution* : this stage addresses those processes that make the knowledge stored into the repositories as fully accessible;

5. *Knowledge-Presentation*: addressing those functions making knowledge as usefully adapted to different organizational contexts by modifying, arranging, selecting and integrating the knowledge-contents stored into the repositories;

- Knowledge Management Roles -

The commonly given deep importance to the information technology within most of knowledge-management programs represents a dangerous potential weaknesses of these as it seems to be absent a complete and coherent definition of organizational roles directly related to the knowledge-management activities: the traditional organizations' hierarchies do not cover the knowledge management or other cross-functional, cross-organizational processes by which knowledge is created, shared and applied; that then creates a dangerous lack in the organization in terms of missing competencies and responsibility. As a cross-organizational process the knowledge-management should be comprehensively and full-time assigned and managed; that is why first of all, a Chief Knowledge Officer must be created as people in charge of handling this responsibility. Moreover, those responsibilities should be also clustered by a knowledge or expertise centers to be made in charge of a particular body of knowledge-management activities. In real situations such centers are assigned with responsibilities including the championing knowledge-management, the organization educational programs, the knowledge mapping, and the integration of the organizational and technological resources comprising the knowledge management architecture. Finally, such organizational (new) entities should be additionally and explicitly assigned with responsibility regarding the said refinement processes: assigning responsibility for the seamless movement of knowledge from acquisition through use, as well as the interfaces between these stages, will help ensure that knowledge repositories will be meaningfully created and effectively used.

- Information Technologies -

The role of information technology infrastructures, although that is not the one decisive factor, is crucial within the implementation of the knowledge-management systems as this should support all flows of explicit knowledge addressed by the said stages of the refining process by enabling:

- the knowledge-capturing;

- the knowledge-defining, -storing, -categorizing, -indexing and -linking to digital objects corresponding to knowledge units,

- content searching (i.e. pulling) and -subscribing (i.e. pushing);

- presenting content with sufficient flexibility to render it meaningful and applicable across multiple contexts of use.

A potentially useful environment can be provided by the information technologies where knowledge can be stored into a multimedia repository whose inputs can be captured by assigning various labels, categories, and indices to each unit of the contained knowledge. In particular, the modern flexible technologies give the chance of creating knowledge units that can can be indexed and logically connected by meaningful categories reflecting contextual knowledge (i.e. contents addressing factual organization's knowledge) as well as these can be displayed by flexible subsets via dynamically customizable views. To this extent, it must be considered that sharing an interpretative context represents a needed preliminary condition to effectively use information technology for communicating knowledge: the more a similar knowledge is shared by the communicators as well as background and experience, the more effectively that knowledge can be communicated by electronic channels [Zack, 1994]. The dissemination of explicit, factual knowledge within a stable community where the contextual knowledge is highly shared can be accomplished by implementing a central accessible electronic repository. More interactive modes such as electronic mail or discussion databases can be more effective instead where the interpretive context is just moderately shared or the knowledge exchanged is less explicit, or the community is loosely affiliated. Finally, the richest and most interactive modes such as video conferencing or face-to-face conversation are instead represent the best way for supporting communications and narrated experience when the context is not well shared and knowledge is primarily tacit.

3.4 Description of the Single Phases of the Implementation Plan

Here following is detailed described each of the above recalled five main phases along which a knowledge-management should be structured.

3.4.1 Phase 1: Setting-up a Knowledge-Management Initiative / Project

As already stated the knowledge-management can be considered as basically aiming at improving the achievement of organizational goals and company objectives; however, when to start a knowledge-management initiative or to setup a related project the companies often struggle with questions like: " ... *where do we start? what are our aims? here should we invest our efforts? Which knowledge should be managed today and in the future? ...* " [Heisig, 2003].

To answer this questions is not an easy task. Nevertheless, the management team should spent some time to discuss and define a knowledge-management strategy including a mission, vision, strategy, and aims in order to give the knowledge-management initiative an overall guideline.

In particular, the knowledge-management *Mission* should explain the reasons *why* knowledge-management is to be considered important for the company in its specific competitive environment today and in future as well as the link between knowledge and the organizational competencies. The knowledge-management *Vision* has instead to state *what* the company strives for in the long-run with their knowledge-management initiative and how the aimed knowledge-management enabled organization will look like in the future. Finally, the knowledge-management *Strategy* must define the steps and procedures by which or also *how* to accomplish the knowledge-management enabled organization and processes. So that the definition of a knowledge-management strategy must be considered to be an important step to achieve a successful knowledge-management implementation. The large number of different knowledge-management tools and methods offered on the market requires a solid understanding of the own needs and aims in order to choose the right knowledge-management tools and methods. Often, this task is not properly addressed and carried out.

Empirical findings [Heisig et al., 2003] suggest that large European companies started their first knowledge-management initiative mostly in the areas they considered as their core competencies. In the US, nearly all knowledge-management pioneers followed the strategic approach towards the internal transfer of knowledge and best practices in order to achieve business improvements. Another possible approach started from the basic differentiation between the dominant product strategy, whether the company offers more standardized products and services or customized unique products. The standardized products strategy calls for standards in processes and a knowledge-management strategy is suggested which emphasizes the codification of knowledge and its reuse. The orientation towards customized products intends to react flexible towards new and changing customer needs. Within this dynamic market environment knowledge has to be exchanged directly between people. The systems support is limited to enhance the transparency of the knowledge sources and the fast and efficient collaboration between human experts. Nevertheless, such strategies do not imply a either/or decision but the right balance between how much codification is required and how to enable direct exchange of knowledge.

Another key-issue within a knowledge-management initiative regards its possible starting-point. Then, two approaches are proposed which complete each other. One approach starts with the selection of the business area or processes where the knowledge-management should improve the business results; as mapped the overall process the management team should individuate some possible key-process (e.g. . sales, product development , service-delivery) whose related outputs are expected to be improved by the better handling of knowledge.

T6he second approach starts from the future business areas and tries to identify the critical knowledge areas where the knowledge-management is expected to produce the most impact; then, the key performance indicators are to be identified and the impact of knowledge areas has to be assessed basing on two assessments whose outcomes are to be depicted in a knowledge fitness matrix indicating from one side the *current-situation* (i.e. As-is) and from other side the *required-situation* (i.e. To-be in 1, 2 or 3 years).

In conclusions, the setting-up phase of a knowledge-management initiative can be structured by the following tasks:

1. to identify core competencies, core processes and the required core knowledge areas;

2. to assess the core knowledge areas regarding critical dimensions like proficiency, codification and diffusion;

3. to define a knowledge-management vision and -strategy .

3.4.2 *Phase 2: Assessment of the Knowledge-Management Activities*

Although the awareness of organizations today is strong about the importance of being able in proficiently handling with the organizational knowledge their ability in self-conducting the analysis of their own organizational context for starting any knowledge-management initiative. That is, it not easy that organizations be fully aware about the actual efficiency of their own knowledge-management system against the organizational aims as well as the possible existence of a clear related strategy or about the related lacks of organizational knowledge or their own status against their competitors'.

Such issues constitute an essential basis for a further development and implementation of a successful knowledge-management. so that a specific assessment phase has to be clearly structured and the use of specific means by which to conduct such phase is to be suggested for a self-assessment of an organization in terms of knowledge-management. These may be used by organizations to rate themselves against their *as-is* status and *to-be* targets. That is because there is not only one way to implement knowledge-management neither is there one golden way to asses an organizations knowledge-management. On this account there are presented some few methods/tools which have gone successfully through practical application and which are adaptable for any kind of organization.

Several tools and instruments have been developed to conduct the analysis of the knowledge-management maturity and were successfully applied in practice along last years. They differ according to the effort required by the company (number of managers, employees involved) and the methods applied. Diagnostic tools requiring low efforts are mostly applied within a management workshop by a moderated self-assessment of criteria based on the knowledge-management framework which represents the conceptual basis of the tool.

Knowledge-management audit tools using quantitative methods are normally applied conducting a survey by standardized questionnaires of the whole workforce focusing on the management teams or just a representative number of employees of the organization. These approaches also include some items related to the culture and management style which should be gathered not only by single interviews. Knowledge audits often focus more on the knowledge itself which is required and provide a useful basis for knowledge structuring for electronic applications like intranet or document management systems.

MOTEx-Analysis: this tool evaluates internal and external knowledge-management activities, it delivers the current state of knowledge-management and the future needs of the organization. First, an introductory workshop with the responsible staff will deliver the *as-is* situation of knowledge-management in the enterprise. Taking the outcome of the workshop the enterprise is rated along the dimensions man, organization, technique, and external factors in four phases, according to their current state of knowledge-management compared to their knowledge-management aims. The next step of the MOTEx analysis is an in depth knowledge audit to recognize the necessary fields of action for the future and to lay down a detailed action plan. On this grounds the enterprise can set up the project management for envisioned activities.

Startup Workshop knowledge-management: This course last one day. After the clarification of a few basic concepts with regard to knowledge-management four case studies are selected in consultation with the enterprise and discussed. These do not serve as a solution plan but simply as an impulse in the search for their own solution. Based on the stimulus arising from the case studies, the second half of the workshop deals with the potential that knowledge-management can offer to the enterprise. At this point the strengths and weaknesses are to be analyzed. At the end of the day an action plan can be drawn-up. The plan includes some immediate measures as well as some starting points for the ongoing or, more specifically, the renovated internal project.

3.4.3 Phase C: Development of the Knowledge-Management System

The third phase of a knowledge-management initiative or project implementation is constituted by the development of the knowledge-management solution along which the main building blocks of the knowledge-management solution are to be identified, planned, designed and prepared for the following implementation process.

To make this first of all, the outcomes of the Phases 1 and 2 have to be focused on, as the development of the actual knowledge-management solution must be in accordance with, the knowledge-management vision, mission and strategy of the enterprise outlined along the Phase-1. Furthermore, the current state of knowledge-management assessed along the Phase 2 has to be used as starting point of the same knowledge-management project taking in the right account the existing tools and methods.

That is, this Phase also stands in close relationship to the second Phase, depending on the kind of assessment tool applied there. Some of these tools cover more than the mere identification of the current state of knowledge-management also providing suggestions for the development of the needed knowledge-management solutions. Therefore, the phases are not to be seen as separate entities but as a common base of the following on an assessment Phase-2 that covered only the identification of the current knowledge-management state.

Finally, to run this phase it is then needed to precisely individuate the structure of the knowledge-management solution as well as the instruments to be applied which can be also involving the evaluation of the possible external providers of technological solutions, and the related costs. To this extent, here following are listed the main objectives of such phase, some of the most common process to be run, and some of the most commonly used tools to complete such third phase:

a) core business-process analysis : this represents the general and most critical process that must be run for individuating the *status-quo* of every organization about its own knowledge to be conducted following the more general Phase2; as knowledge in fact is contained in and flowing through every business process an in-depth process analysis is to be conducted to reveal the shapes of necessary knowledge as available or also missing or not effectively forwarded;

b) integrated technological-support: as information and knowledge can be stored, distributed, combined, manipulated with computer-aided tools the right information-technology must be individuated and implemented for effectively supporting the several different kinds of knowledge-management activities potentially making the work-, information- and knowledge-flow more efficient; to achieve that however technology is not enough if just by itself but still requires fully convinced and well trained people;

c) secure and use knowledge of leaving experts: to analyze thoroughly, what really should be secured and transferred of the personal knowledge is to be considered still important in every case when experienced people leave an organization (for example because of retirement) bringing away with them their knowledge, know-how, experience; therefore specific measures are to be taken to avoid that; these can be manifold, for example the predecessor and the follower could work together for a certain time or the leaving expert could be hired as part-time consultant;

d) lessons learnt: often achieved by a special organizational database or intranet these have to be implemented to save a systematically evaluation of all stages of a project providing to the project-team members potentially critical information for the development of new (related or similar) projects follow-up;

e) document-management: this must be logically and technologically supported in order to provide solutions for processing, storing, changing, administering, searching, and deleting documents and information that people need for their daily work ;

f) knowledge manager / knowledge-broker: they are to be assigned with the control of all information and knowledge flows in one organization; they have then to overview the whole knowledge-management process identifying, selecting, distributing, storing and updating that;

g) information-centre / coffee-corner: as implemented these can support the information and knowledge transfer between colleagues from different departments and hierarchical levels these are attractively designed as informative meeting points for informal exchange of information and experience;

h) usage of customer knowledge: as present in the organization (e.g. into evaluation of salesman reports, complaints, etc.) the specific knowledge about customers has to be used to actively integrate them in product development or improvement processes;

i) yellow-pages: these should be diffused throughout the organization as instruments for the identification of knowledge sources within the organization showing that knowledge which can be not present and has to be acquired externally; specifically, these can be described as internal branch directories reporting about special knowledge, competencies, experiences, etc. from fellow workers;

3.4.4 Phase D: Implementation of the Knowledge-Management System

Although implementation is some time presented as a separate section that still represents a continuous part within a knowledge-management initiative. The process begins in fact as soon as the need for knowledge-management is identified: further implementation will be required as the project develops and additional areas requiring knowledge-management are defined.

As decided upon the benefits of carrying out a knowledge-management project this has then to be implemented. The most significant factors to take into consideration are people, time and cost. These three factors are crucial and unless the right, enthusiastic core supporters of the project are involved the project can not flow. Further, it is critical that people with positive interest, experience and ideas in knowledge-management give the project some social status. Time is important:. Where motivated, interested people selected have too much other work to do it can become still likely that a second priority is given to the knowledge-management project as well as interest can wane and be extremely hard to regain if the project is too long underway or without any significant demonstrated benefit. Finally the costs: even if the implemented project is estimated to produce positive returns on investments (ROI) then unforeseen expenditure in terms of man/woman hours or escalating costs of achieving the project can generally result in termination of the project as most of organizations are limited in their budgets.

Once these factors are thoroughly investigated and set in place, the process can be undertaken by developing through different action steps that can be summarized as follows:

1. Status-quo Analysis (assessment of needed competencies to the implementation)

2. Identification of Constraints / Facilitators (to the implementation)

3. Internal Communication Plan (design)

4. Definition of Functions / Responsibilities (personal and departmental)

5. Action Plan (i.e. phases, tasks, costs)

6. Selection of Tools

7. Training and Learning Programs

8. Pilot Implementation

The expected result of the implementation phase is the integration of the organizational knowledge as an asset or added value of the products/services, internal processes, client relations, etc. Then, for each of the different above said steps different tools can be applied to facilitate the process and to assure maximum success.

3.4.4.1 Status-quo Analysis

While this phase all possible sources of knowledge have to be deeply assessed in order to estimating the availability level and the gaps in the organizational knowledge which is needed to perform all business processes; then, a specific list of these can be organized as following:

- Human Resources (i.e. individual and teams)
- Organizational Resources (i.e. processes and organizational structure)
- Operational Context
- Technology

then, the first step to be achieved is to assess the results of the former phases and define the competencies necessary for the implementation process of each of these sources.

3.4.4.2 Identification of Constraints / Facilitators

The second step regards those factors that can either limit or facilitate the implementation process in order to know which factors have to be reinforced (i.e. facilitating the process) to reach the goals set out at the beginning of the project; for those factors posing barriers it is needed instead to identify possible solutions to overcome them. Here are listed several possible factors that can be individuated by distinguishing as said :

Tab. 3.2 Possible Facilitating VS Limiting Factors of the Knowledge-Management Initiatives

Facilitating Factors	*Limiting Factors*
Strong support of Management	Distrust towards New Projects
Team Organizational Structures	Organizational Culture *VS* Knowledge-sharing
Available Information Technology Systems	

3.4.4.3 Internal Communication Plan (Design)

Information gaps can be detected in the process, people while looking at the different sources of knowledge mentioned before as well as it is possible to identify “islands” to which the necessary information is not transmitted at the correct point in time. The lack of communication means insufficient flows of contents knowledge or information so that an action plan must be defined describing the processes and who must be involved which can be crucial to the success of the knowledge-management implementation. This can be carried-out by achieving the following steps:

- favoring social events within the organization between people from different units;

- coordinating periodical meetings among people from different departments;

- carrying out coaching and mentoring actions;

- conducting informal interviews to the members of the organization;

- favoring the breakfast meetings.

3.4.4.4 Definition of Functions / Responsibilities (personal and departmental)

The limited resources available within the organization can cause the implementation process to fail. Therefore, in order to guarantee success it is necessary to create a core team of people supporting the correct sharing, application and management of knowledge. In particular, all persons have to be selected and assigned with specific task related to the knowledge-management particular actions with respect to their own skills and competencies that are necessary to assume this function and combine it with their daily work in the organization. The members of the core team have different roles.

3.4.4.5 Action plan

As in every process implementation it is necessary to plan in a coordinated and coherent way all the phases of the process and describe the specific tasks and assign costs to them.

3.4.4.6 Selection of Tools

Having previously analyzed norms, procedures and protocols for an effective use of the knowledge-management system, a decision should be made about the most adequate tools to be applied into the decision-making processes as well as into the communication activities of the organization.

3.4.4.7 Training and learning

One of most important activities within the implementation of the knowledge-management system is represented by learning and training within the organization. Training can in fact constitute an incentive offered by the organization, and therefore intrinsically contains an important component of motivation. Learning de facto moves the creation of knowledge as it develops through (formal) training or through informal learning, by means of exchange and support by other members of the organization.

3.4.4.8: Pilot Implementation

Instead of implementing the project in the whole organization then a pilot implementation can be carried-out by which it is possible to learn from the process and to avoid the pitfalls that can be encountered along the implementation process for the whole organization. Working with less documentation, information, and people the implementation process is simpler and easier to manage.

3.4.5 Phase E: Evaluation / Sustainability

It is generally agreed that the ultimate aim of knowledge-management should be its continuous integration into the work processes of an organization which means to make the knowledge-management *sustainable*. According with Davenport and Prusak [2000] several suggestions can be considered about the identification of successful knowledge-management projects in order to be able to make the right decisions on project evaluation; precisely, a knowledge-management project can be considered to be successful where:

- a growth occurred in the resources attached to the project including staffing and budgets;

- a growth occurred in the volume of knowledge content and usage (e.g. the number of documents or accesses for repositories);

- the project is trusted and considered to be sustainable by the whole organization;

- the whole organization feels comfortable with the concepts of "knowledge" and "knowledge management";

- there is some evidence of financial return either for the knowledge management activity in se and for the whole organization.

3.5 Focus on the Organizational Analysis and the Knowledge Audit

The analysis of the status-quo about the organizational context and its capabilities in knowledge-management still represent a critical issue within the implementation of one knowledge-management systems as this constitutes the starting point of the same implementation process. That is, developing new instruments to conduct such phase as well as improving the already existing ones can lead concrete advancements in the progress of the same knowledge-management system design and implementation.

As the organizational analysis and specifically the knowledge-audit process represents the problem approached in this Study it can be useful to provide some more clearer element about such process which can be intended as a formal evaluation of how and where knowledge is used in business processes. As normally conducted within the organizational analysis the audit aims at identifying the several different forms of knowledge according to some of the precedent discussed forms and agreed labels as the most common distinction between tacit and explicit knowledge. However, the practitioners are arguing that alternatives forms or structures of the knowledge-audit process should be formulated in order to improve the impact of outcomes normally obtainable.

Through the audit-analysis one organization can identify and evaluate all information resources and workflow, and determine user requirements widely varying from wide access (e.g. policies and procedures) to extremely limited access (e.g., payroll information); indeed, this is conducted as a rigorous process, using e.g. questionnaires, interviews, and narrative techniques; this provides the organizational knowledge review as requested by an organization, department or group to effectively carry out its objectives. It normally includes the needs and information analysis where competencies and communication are audited with specific focus on interactions and knowledge flows. The knowledge-audit is then conducted as an assessment of an organization's current achievements in knowledge-management activities mapping all shapes and aggregates of available tacit and explicit knowledge resources.

The term "knowledge-audit" is in some ways a bit of a misnomer, since the traditional concept of an audit is to check performance against a standard, as in financial auditing. A knowledge audit, however, is a more of a qualitative evaluation. It is essentially a sound investigation into an organizations knowledge 'health'.

Among the key benefits of a knowledge audit are the following:

- It can help the organization to clearly identify what knowledge is needed to support overall organizational goals and individual and team activities.

- It can give tangible evidence of the extent to which knowledge is being effectively managed and indicates where improvements are needed.

- It can provide an evidence-based account of the knowledge that exists in an organization, and how that knowledge moves around in, and is used by, that organization.

- It can provide a map of what knowledge exists in the organization and where it exists, revealing both gaps and duplication.

- It can reveal pockets of knowledge that are not currently being used to good advantage and therefore offer untapped potential.

- It can provide a map of knowledge and communication flows and networks, revealing both examples of good practice and blockages and barriers to good practice.

- It can provide an inventory of knowledge assets, allowing them to become more visible and therefore more measurable and accountable, and giving a clearer understanding of the contribution of knowledge to organizational performance.

- It can provide vital information for the development of effective knowledge management programs and initiatives that are directly relevant to the organizations specific knowledge needs and current situation.

A wide variety of approaches exists to conduct a knowledge-audit analysis varying in levels of coverage and detail. As a general rule, most knowledge audits will involve some or all of the following phases:

1) Identifying Knowledge Needs: The first step in most knowledge audits involves getting clear about precisely what knowledge the organization and the people and teams within it need in order to meet their goals and objectives; a knowledge audit provides a systematic way of finding this out to some level of detail. Common approaches taken to collating this information include questionnaire-based surveys, interviews and facilitated group discussions, or a combination of these. In asking people about knowledge needs, it is important to provide a point of focus, as 'knowledge' can be seen as being quite conceptual and therefore difficult to articulate. It is always beneficial to begin a knowledge auditing process with identifying knowledge needs. This enables you to then use your understanding of these needs to guide the rest of the auditing process, and therefore be sure that you are focusing on the knowledge that is important to the organization.

2) Drawing up a Knowledge Inventory: A knowledge inventory is a kind of stock-take to identify and locate knowledge assets or resources throughout the organization. It involves counting and categorizing the organizations explicit and tacit knowledge. In the case of explicit knowledge, this will include things like:

- What knowledge is present within the organization – numbers, types and categories of documents, databases, libraries, intranet web sites, links and subscriptions to external resources, etc.
- Where the knowledge is located – locations in the organization, and in its various systems
- Organization and access – how knowledge resources are organized, how easy it is for people to find and access them

• Purpose, relevance and 'quality' – why do these resources exist, how relevant and appropriate are they for that purpose, are they of good 'quality' e.g. up-to-date, reliable, evidence-based etc.?

• Usage – are they actually being used, by whom, how often, what for?

In the case of *tacit knowledge* the inventory is focusing on people and look at things like:

• Who is available – numbers and categories of people

• Where is located – locations in departments, teams and buildings

• What job is accomplished - levels and types

• What they know academic and professional qualifications, core knowledge and experience

• What they are learning – on the job training, learning and development.

The knowledge inventory gives a snapshot of the available knowledge assets or resources. By comparing such inventory with an earlier analysis of knowledge needs, it is possible to identify gaps in the organizations knowledge as well as areas of unnecessary duplication.

3) Analyzing Knowledge Flows: while an inventory of knowledge assets shows what knowledge resources is available to one organization an analysis of knowledge flows looks at how that knowledge moves around the organization – from where it is to where it is needed; again, the knowledge flow analysis looks at both explicit and tacit knowledge, and at people, processes and systems:

• The relative focus in this stage is on *people*: their attitudes towards, habits and behaviors concerning, and skills in, knowledge sharing and use; this usually requires a combination of questionnaire-based surveys followed up with individual interviews and facilitated group discussions.

• In terms of *processes* it is focused on how people go about their daily work activities and how knowledge seeking, sharing and use are (or are not) part of those activities. In most organizations, there will be pockets of good knowledge management practice (though they may not be called knowledge management). It also needed to look at what policies and practices currently affect the flows and usage of information and knowledge, for example are there existing policies on things like information handling, records management, web publishing ;

- On the *systems* side, some assessment is needed of key capabilities that will be used in any recommended actions or solutions.; this includes the technical infrastructure: information technology systems, content management, accessibility and ease of use, and current actual levels of use; in short, to what extent a system can effectively facilitate knowledge flows, and help to connect people with the information and other people they need;

- An analysis of knowledge flows can then allow to further identify gaps in one organizations knowledge and areas of duplication; it will also highlight examples of good practice that can be built on, as well as blockages and barriers to knowledge flows and effective use. It will show where more attention is needed about the knowledge management initiatives in order to get knowledge moving from where it is to where it is needed.

4) Creating a Knowledge Map: A knowledge map is a visual representation of an organizations knowledge. There are two common approaches to knowledge mapping: (1) the first simply maps knowledge resources and assets, showing what knowledge exists in the organization and where it can be found; while (2) the second also includes knowledge flows, showing how that knowledge moves around the organization from where it is to where it is needed. Clearly the second approach provides the most complete picture for the knowledge auditor. However, the first is also useful, and in some organizations is made available to all staff to help people locate the knowledge they need.

3.6 Gap Analysis

Different kinds of gaps can be occurring along the implementation of a knowledge-management system. Therefore, to fully illustrate the gaps that might occur a number of main classes of possible gaps are here below individuated basing on four different aspects: strategic aspect, perception aspect, planning aspect and implementation aspect.

1. *Strategic Aspect*. The organization should review its own internal and external environment to determine the knowledge required to enhance its competitiveness [Suyeon et al., 2003]; fail to do so may result in a gap between the knowledge required to enhance the competitiveness of an enterprise as perceived by the top managers and the knowledge actually required (i.e. gap 1). Fail to evaluate the performance of knowledge-management may result in a gap between the results of implementation and that perceived by the top managers (i.e. gap 4).

2. *Perception Aspect*. Top managers may not be able to define clearly what they need [Kwan and Balasubramanian, 2003]; so that this may result in a gap between the perception of the top managers and the enactment of the knowledge-management system plan (i.e. gap 2). Within one organization there may be gaps between perceptions of the top managers and that of the employees due to difference in position, role, and professional knowledge (i.e. gap 5). Finally, it may exist a gap between the knowledge required to enhance an organization's competitiveness and that as perceived by the employees when they implement the knowledge-management (i.e. gap 6).

3. *Planning Aspect*. Understanding the enterprise's internal and external environments will enable the top managers to enact a proper plan for the

knowledge-management implementation [Liebowitz et al., 2001]. If top managers cannot convey this knowledge into the implementation, then it may result in gap 2. If employees do not understand the KM plan while engaging in KM, then it may result in gap 3.

4. *Implementation Aspect*. Implementation should fit the plan, or gap 3 will occur. Furthermore, during implementation the employees should have the right perception about what knowledge required to enhance enterprise's competitiveness, or gap 4 will occur. Thus, the definitions of the six knowledge-management gaps can be synthesized as following:

- Gap 1: between the knowledge required to enhance the competitiveness of an enterprise as perceived by the top managers and the knowledge actually required to enhance its competitiveness.

- Gap 2: between the knowledge required to enhance an enterprise's competitiveness as perceived by the top managers and the plan to implement knowledge-management.

- Gap 3: between the plan to implement knowledge-management as proposed by the top managers and the implementation progress of the knowledge-management plan.

- Gap 4: between the knowledge obtained after implementing the knowledge-management system and the knowledge required to enhance an enterprise's competitiveness.

- Gap 5: between the knowledge required to enhance an enterprise's competitiveness as perceived by the top managers and as perceived by other employees.

- Gap 6: between the knowledge required to enhance an enterprise's competitiveness as perceived by employees and the knowledge actually obtained after implementing the knowledge-management system.

3.7 Conclusions

Mostly based on the same logical structure of a technological project development cycle the entire development of the knowledge-management process is commonly conducted by a series of steps focusing on the analysis of the organizational and technological existing context, from one side, and on the selection of the available standard tools to be combined, by other side. As conducted a process structured so the knowledge-management system can be finally designed basing on the information and operational guidance produced by such analysis process; in particular, it is concretely implemented by applying those technological and organizational solutions that should meet the individuated requirements.

Three main fundamentals bear the architecture of one knowledge-management systems: the logic structure by which organize the knowledge and its management; the organization sustaining the knowledge-management processes; and the information (and communication) technology by which to concretely implement either the knowledge-carriers as its generators / stores and the management-functions. That makes it even more evident that the knowledge-management design must be intended as a process which deeply involves the whole organization from the technological and human-social points of view as no technological change can be effectively implemented without taking a coherent change in the organizational structure. That is why the primarily setup step of a knowledge-management initiative focuses on the mission, vision and strategy of the same organization as the knowledge-management initiative must be conceived and planned coherently with those.

Indeed, a large amount of standard technological instruments are actually available and are commonly applied; in particular, such instruments require specific competencies from the organization in terms of individuals' personal skills and knowledge that can make them really able in using proficiently the implemented solutions. In several cases in fact learning and teaching activities are resulting to be crucial to achieve the success of the entire knowledge-management initiative since it by such activities that the needed organizational changes (to carrying-out the knowledge-management system within the organization). It must be noticed to this extent that the organizational analysis is increasingly becoming the most crucial phase within the development of the knowledge-management project as every decision about the technological and organizational change to be implemented is depending on the outcomes of such analysis. That is, the knowledge-audit, which mainly focuses on the knowledge *status-quo*, is to be considered even more crucial as it provides a vision about the knowledge-processes to be implemented as these are needed from the same organization so that its outcomes can be deeply affecting the ways of implementing the specific knowledge-management functions that should be performed by the same entire system.

Many instruments exist to conduct the organizational analysis and in particular the knowledge-audit process; however, there is no way of assessing the effectiveness of such process and the related instruments. Consequently, it appears to be likely that improving such process can contribute in taking concrete increases into the same implementation of the knowledge-management system. So that it can be considered to be an open issue.

Chapter 4
Approaches and Tools for Conducting the Knowledge-Audit

Premise to the Second Part of the Study

This Chapter opens the Study's Second Part where the proposed theoretical model to conduct the knowledge-management system-assessment (knowledge-management system-A) is fully illustrated. Specifically, this part highlights either the fundamentals, AND the features of the knowledge-management system-A as well as the development path followed to carry-out its theoretical structure. This part is then composed of three Chapters: in the first, Chapter V, some of the most used knowledge-audit methods are recalled and some tentative hypothesis (basic reason of this Study) is proposed about the possible arising weaknesses from such methods; in the second, Chapter VI, it is described in a detailed way the whole development process of the knowledge-management system-A methodology; and finally, the third, Chapter VII, illustrates how the knowledge-management system-A methodology can be ran by a precise application scheme.

4.1 Introduction

This Chapter illustrates a number of approaches, methods, and tools that are widely used to conduct an organizational analysis addressing the knowledge audit somehow, and then proposes few basic hypotheses addressing the possible weaknesses of such methods. Such weaknesses are indeed faced by this Study.

Given the intrinsic complexity of the knowledge concept and the consequent wideness of the knowledge-audit (see Chapter 1 and Chapter 2) the spectrum of the available tools for conducting such a knowledge-audit oriented analysis is very huge; that is, the same instruments can be often used in different ways or in different contexts to pursue common aims: to individuate the needed knowledge for (better) performing the business process, and most of all to individuate which technological instruments can be usefully applied to increase the organizational capabilities of handling with a very vague and complex matter: the knowledge.

However, although even better performing knowledge-management systems are nowadays required from many different classes of organizations it has to be noticed that no specific tool seem to be yet widely agreed for conducting a knowledge-audit oriented analysis of organizations in a systematic and generalized way; and specifically, no specific methodology seem to be available for conducting a quantitative assessment of the knowledge-management system - i.e. to estimate its efficiency or effectiveness. What arises from the field is the above recalled large number of different *ad hoc* methods, schemes and approaches that are commonly addressed by the more involved subjects in the knowledge-management system design: the IT consulting companies. Such methods are particularly used to represent the information flows throughout the organization, and hence to design the knowledge-management systems - that are expected to favor such flows and mostly implemented basing on the several available information and communication technologies for knowledge-management.

Most part of the here recalled methods and approaches deal with the knowledge-representation since this issue is to be considered critical within the knowledge-management system design. The knowledge-management systems are normally designed following basing on a network structured overview of organizations representing any organizational unit as well as any related information and knowledge flow respectively produced, acquired, and stored through the business processes. The global knowledge-management system is then structured by combining the knowledge-management technologies in such a way to support and manage such information and knowledge flows as represented in the said schemes. The knowledge-management system is then expected to be an effective connecting network of all information and knowledge flows which is able to support each organizational unit in accomplishing its own processes.

This chapter then briefly introduces a part of the main normally used methods and models that are commonly followed and adopted to analyze the organizations, and specifically to represent and assess the whole organizational knowledge. Among these a longer and more detailed description is provided about the Liebowitz's scheme [2000] which still represents a clear attempt of formally and specifically structuring the knowledge-audit process around the different levels detected of *knowledge-lack*, *needed-knowledge* and *available-knowledge*. Moreover, the Liebowitz's scheme has been used to conceive and structure the theoretical scheme behind the here proposed knowledge-management system assessment (knowledge-management system-A); and that is why such scheme is particularly important within the Study.

Finally, the Chapter ends highlighting some possible weaknesses arising from the recalled knowledge-audit oriented methods, and illustrating how such weaknesses have been kept in account to formulate the main hypotheses this Study has faced.

4.2 Main Models for Conducting the Knowledge Audit

As already introduced in Chapter 1 and following the more widely approaches [Crown, 2005] the knowledge-audit (knowledge-audit) process typically aims at providing an evidence-based assessment of organization KM highlighting the possibly related needs, strengths, weaknesses, opportunities, threats and risks; that is normally pursued by focusing on: the organization's knowledge needs, assets (and place of storing) gaps, flows and related block of knowledge-audited. In few words, a knowledge-audit is an analysis process expected to produce an inventory of knowledge assets that allow them to become more visible and hence more measurable and accountable, and give a clearer understanding of the contribution of knowledge to organizational performance. At the same time this is expected to provide a vital information for developing an effective knowledge-management programs and initiatives that are directly relevant to the organization's specific knowledge needs and current situation.

What is generally expected from a knowledge-audit in terms of benefits is first of all, a clear identification of the needed knowledge to support overall organizational goals, individual, and team activities, as well as the knowledge-management effectiveness and the needed improvements; moreover, a knowledge-audit should make it evident the available knowledge and its flows and uses, and also a map of existing knowledge revealing both gaps and duplication, and finally the possible not currently applied knowledge and the potential advantages.

Although a wide variety of approaches exists to conduct a knowledge-audit with varying levels of coverage and detail, most methods and practices are structured following four basic steps: 1. identifying knowledge gaps; 2. drawing up a knowledge inventory; 3. analyzing knowledge flows; and 4. creating a knowledge map; that can specifically intended as follows:

1. Identifying Knowledge Needs: the first step in most knowledge-audit processes involves getting clear about precisely what knowledge the organization and the people and teams within it need in order to meet their goals and objectives. A knowledge-audit provides a systematic way of finding this out to some level of detail. Common approaches taken to collating this information include questionnaire-based surveys, interviews and facilitated group discussions, or a combination of these.

2. Drawing up a Knowledge Inventory: a knowledge inventory is a kind of stock-take to identify and locate knowledge assets or resources throughout the organization. It involves counting and categorizing the organization's explicit and tacit knowledge. In case of *explicit knowledge*, this will include things like: a) numbers, types and categories of documents, databases, libraries, intranet web sites, links and subscriptions to external resources; b) locations in the organization, and in its various systems; c) conditions of access to the knowledge resources. In case of *tacit knowledge* instead the inventory will focus on people and look at things like: (i) numbers and categories of people; (ii) locations in departments, teams and buildings; (iii) job levels and types; (iv) academic and professional qualifications, core knowledge and experience; (v) on the job training, learning and development.

3. Analyzing Knowledge Flows: an analysis of knowledge flows looks at how that knowledge moves around the organization – from where it is to where it is needed. Again, the knowledge flow analysis looks at both explicit and tacit knowledge, and at people, processes and systems:

- *People*: the relative focus on people involves attitudes, habits and behaviors, skills related to the knowledge sharing and use; this usually requires a combination of questionnaire-based surveys followed up with individual interviews and facilitated group discussions.

- *Processes*: this normally regards how people go about their daily work activities and how knowledge seeking, sharing and use are (or are not) part of those activities as well as what policies and practices currently affect the flows and usage of information and knowledge

- *Systems*: this includes the technical infrastructure, information technology systems, content management, accessibility and ease of use, and current actual levels of use.

4. Creating a Knowledge Map: a knowledge map is a visual representation of an organization's knowledge. There are two common approaches to knowledge mapping: the first simply maps knowledge resources and assets, showing what knowledge exists in the organization and where it can be found; while the second also includes knowledge flows, showing how that knowledge moves around the organization from where it is to where it is needed. Clearly, the second approach provides the most complete information and communication technology use for the knowledge auditor. However, the first is also useful, and in some organizations is made available to all staff to help people locate the knowledge they need.

A first example of clear and interesting classification of specific available means for conducting such knowledge-audit steps is proposed by Wiig [1993] where both basic instruments and more articulated analyses are classified as follows:

- the *Questionnaire-based Knowledge Surveys* : normally used to obtain a general overview of the organizational knowledge;

- the *Middle Management Target-Group Sessions*: used to identify those parts of knowledge that are needed to and applied by the management of enterprises, and to rate (somehow) their importance behind the enterprise's life;

- the *Task Environment Analysis*: which is used to identify such a specific knowledge that can be critical within the business processes, and its potential role;

- the *Verbal Protocol Analysis*: which is used to identify several elements, fragments and shapes of knowledge that are valuable within the business processes;

- the *Basic Knowledge Analysis*: that is used to individuate the knowledge aggregates;

- the *Knowledge Mapping*: which is adopted to outline the knowledge maps in terms of concept network and hierarchies;

- the *Critical Knowledge Function Analysis*: that is used to individuate the critical knowledge areas;

- the *Knowledge Use* and *Requirements Analysis*: this is used to identify how knowledge is applied (and exploited) for business purposes, and to such situations to be potentially improved;

- the *Knowledge Scripting and Profiling*: this is used to identify the specific features within the knowledge intensive-work, and the role knowledge can play to deliver quality products;

- the *Knowledge Flow Analysis*: this is adopted to obtain an overview about the knowledge exchanges, losses and inputs of the task-business processes, and the whole organization.

Although different kinds of tools are here collected (both basic and more complex ones) such classification makes arise from a certain point of view that any knowledge-audit oriented analysis can be focusing not only on the organizational knowledge *in-se* but also on the knowledge-management abilities. In particular, either the *Knowledge-Flow-Analysis* and the *Knowledge-Scripting-Profiling* as well as the *Knowledge-Use-and-Requirements-Analysis* focus also on the organizational abilities in handling with knowledge against the business process performing. That supports such an evidence already recalled in the Study's First Part about the double nature of knowledge, static and dynamic [Reinhardt, 2001]; indeed, different needed classes of specific instruments and tools prove that knowledge cannot be considered exclusively to be *staying* in repositories or people but must be also considered to be *flowing* throughout the business processes; in short, different classes of operational instruments are needed cause different kind of analysis focuses are to be followed to detect either the possible knowledge *forms-of-being* as well as the possible *forms-of-developing* - i.e. static and dynamic.

The knowledge-audit must then produce a clear information possibly expressed in a formal report as proposed in Debenham's and Clark's vision [1994]. The knowledge-audit is there structured as an analysis process by which it is possible to obtain an overview of the whole organizational knowledge specifically focusing on particular sections; particularly, such description is proposed to contain the main qualitative and quantitative features of the detected knowledge sections as well as those regarding the same repositories where those can be contained (i.e. stored). The consequent targets can be considered to be the following ones:

- to provide a high-level vision of extension, structure and detailed targets addressing the whole organizational knowledge or a related section of that;

- to provide a significant data to outline a strategy for processing the organizational knowledge;

- to identify and locate the relevant knowledge repositories within the organization;

- to precisely individuate the qualitative characteristics of the section constituting the whole organizational knowledge inside of particular repositories;

- to provide such a quantitative estimate of the same sections of available knowledge in those repositories;

and consequently, the above said knowledge-audit report is proposed to contain in a structured form at least four parts :

(1.) a two pages executive summary highlighting the main analysis' outcomes:

- a clear statement about the motivations to conduct the knowledge-audit;

- a description of the knowledge-audit process;

- an analysis of accuracy and sensitiveness of the findings;

- the conclusions of the knowledge-audit process in an easy and clear form, and the relations between these and the above said motivations (of the knowledge-audit process);

(2.) a block map: a diagram describing the detected knowledge blocks, the related interconnections and the repositories where these are stored;

(3.) a proforma block: the means for recording all information regarding the quantitative and qualitative features of the blocks;

(4.) the index of the pages of the blocks and the related repositories where these are stored.

From such proposal it is then provided a sophisticated and well articulated frame for conducting the analysis of the organizational knowledge; and most of all for obtaining, although in a not necessarily easy way, a complete formal representation of the organizational knowledge.

Another particularly well articulated way of structuring the knowledge-audit path is proposed from Sahah [1998] through a specific set of key-questions focusing on a number of critical issues as indicated below:

1. the *Business Concept* - this must be addressed by several questions regarding the representing modalities about the business processes, the mission, and the targeted objectives;

2. the *Organization's Know-How* - which must be addressed by questions regarding the modalities for creating, codifying and transmitting knowledge throughout persons and activities;

3. the *Knowledge-Workers* - that must be addressed by questions regarding the individuals' learning as it can be structured by training activities and organizational rules;

4. the *IT-mediated Knowledge* - which must be addressed by questions regarding the role played by the technological infrastructures and the organizational practices for driving the knowledge-management ;

5. the *Organization Design* - that must be addressed by questions regarding the organizational capability of favoring or constraining the knowledge flows that are to be structured throughout all organizational units.

What is there proposed is to structure the knowledge-audit by following such set of key-questions leading to people and the organizational structure since both people and the organizational structure can be considered to be those parts of organization information and communication technology related to (because containing) critical knowledge - i.e. while the first is addressed in fact from the questions in 2. and 3. the second one is addressed from all others.

Another interesting widely known approach to knowledge-audit is provided by Delphi's [Frappaolo C. (1999), "Establishing an Organizational Benchmark for Knowledge", The Delphi Group;] that proposes the knowledge-audit must look at: a) current levels of knowledge usage and communication; b) current state of corporate knowledge management; c) identification and clarification of knowledge-management opportunities; d) identification and clarification of potential problem areas; and e) perceived value in knowledge within the organization.

In particular, what is to be noticed in Delphi's approach is the knowledge-management 2 Methodology. This is in fact conceived for evaluating either the knowledge-use and the knowledge-sharing by individuating critical elements to the knowledge-management and potential obstacles toward effective progress in that direction. The knowledge-management 2 is to be specifically applied by carrying out via web a customized survey throughout the organization at all levels in order to keep in account critical points of view that are frequently overlooked. The proposed analysis is then strengthened by qualitative targeted interviews that support the survey's insights; to this extent the anomalies among the organization wide findings are still important since make it easier to apply targeted interviewing techniques where these are found groups that exhibit extremely different opinions and behaviors.

A focal point of the knowledge-management 2 analysis is given by the Knowledge Chain: a model for benchmarking one organization's current success at leveraging acquired expertise to expedite responsiveness and innovation through the knowledge-management . By the K-Chain these are represented in fact four stages through which knowledge must pass for realizing the cycle of innovation - i.e. Internal Awareness; Internal Responsiveness; External Responsiveness; External Awareness - as the knowledge-management is expected to create permeability between the four cells of the K-chain and accelerate the speed of innovation it is possible to show by this scheme the internal factors which potentially inhibit or foster the knowledge-management . Following from that recommendations on how to proceed with a formal knowledge-management initiative become evident, and the relationships between cultural, structural and procedural factors to technological and infrastructure factors can be clearly assessed. Being able to measure and view the factors which effect knowledge-management separately and collectively on the K-Chain helps the organization comprehend its opportunity in applying knowledge-management . The resulting benchmarks can be used to justify and precisely assess the value of knowledge-management .

Among the several *ad hoc* schemes and approaches commonly applied in the managerial field to structure and conduct the knowledge-audit process one widely used is Datawere's [1998]. More practice-oriented this is articulated through a series of several model-questions regarding either the possible ways of applying the missing knowledge as well as the available knowledge, and also the organizational actors really needing such knowledge; some of the most meaningful questions is following: " .... *which available knowledge can support me to exceed the specific problem of ...? ... what missing knowledge can more effectively support me to exceed such problem ? ... who needs such knowledge? ... how will such knowledge be applied ? ...* ".

The Datawere knowledge-audit process is hence structured by three main steps. 1st step: individuating and classifying both the available and missing knowledge within the organization; 2nd step: locating the missing knowledge at specific repositories or sources where it should be located where available. As both the needed knowledge and the needed structure where contain that will be known by these steps the 3rd step is then designing such structures (to contain the missing knowledge).

An important feature of the Datawere knowledge-audit process is constituted by the particular processes for individuating and elicitation of the tacit knowledge; such processes are specifically proposed to be performed by adopting meta-data or also aggregates of data representing individuals' personal knowledge that are supposed to be not expressed in an explicit manner - e.g. the databases of personal skills, on-line communities of practice, and the repositories of professional profiles. By following the so called "building-block" approach Dataware proposes to make it possible to capitalize on a company's existing resources and systems, to generate immediate return from knowledge resources and to ensure that each phase lays a foundation for the next.

The global Dataware approach is specifically based on seven steps one of which is constituted by the knowledge-audit: (1) to identify the business problem; (2) to prepare for change; (3) to create the knowledge-management team; (4) to perform the knowledge audit and analysis; (5) to define the key features of the solution; (6) to implement the building blocks for knowledge-management ; and (7) to link knowledge to people.

Last but not least, a very important proposal has been made from the European knowledge-management Forum Consortium with respect to the knowledge-assessment process. Named as knowledge-management Assessment Model and Tool this consists of a very well structured set of questionnaires providing a strong guide for conducting a wide and complete assessment of the organization knowledge-management capabilities.

This consists of several main sections respectively focusing on: 1) knowledge-management strategies, 2) Human and Social knowledge-management Issues, knowledge-management Organizational Aspects, knowledge-management Processes, knowledge-management Technologies, and knowledge-management Leadership. Each section is made by the same structure containing a certain number of open questions, closed questions, indicators and rating scales.

However, the model still represents nothing more than an in progress research project (IST 200-26393) involving a small number of great European research centers, and then requires a lot of improvements and refinements to be applied in the business contexts. Anyway, that provides a very interesting and useful tool to be exploited also as main line for developing new and more proficient analysis means.

Here following are illustrated three wide spread methodologies carried-out along some research projects specifically focusing on the knowledge representation and mapping; precisely, these are: (i) the *Moknowledge-audit*, (ii) the *Spede*, and (iii) the *Common-knowledge-auditds* Methodologies. Although these do not represent specific tools for conducting the knowledge-audit these can provide a useful reference-term against the wide ocean of the organizational knowledge analysis approaches and tools.

The *Spede Methodology* was storically developed under the guidance of Rolls-Royce plc involving staff coming from Epistemics; such methodology was developed to test and develop the early versions of a particular engineering-design software, the Pcpack4: with assistance from Epistemics Rolls-Royce ran over 80 Spede projects involving the training of over 150 employees.

What makes the Spede methodology near to the knowledge-audit process is a similarity in the objectives: both aim at detecting and individuating the critical shapes within organizational knowledge. The first in fact represents a combination of principles, techniques, and tools originally created in the knowledge-engineering field and furthers applied to the knowledge management. In particular, that provides several tools for capturing, verifying and transferring that knowledge considered to be vital for creating the suitable conditions where running the business processes.

From a general point of view such methodology has been specifically developed to act as a training course for novice knowledge-engineers or those seconded to a knowledge management activity. Spede-projects typically involve one-week of intensive training followed by two-three months of scoping, knowledge acquisition and delivery phases; indeed, the main deliverable of most Spede-projects is an intranet website. However, previous projects have delivered quality procedures, process improvement information and expert systems. Such projects usually follow a set of procedures coordinated by experienced staff, and all projects are coordinated by a coach who manages the activities of one or more knowledge-engineers on a daily basis. As for the implementation process the Spede-based projects must pass through a series of gates that are constituted by meetings held at various stages throughout the project to act as a “go/stop” into the next phase of the project. Each gate comprises various criteria to ensure the project is on track to meet the objectives and identify any problems, hazards and actions. There are five gates: project launch review, scoping review, technical review, delivery review and post-delivery review.

The "Moknowledge-audit" Methodology. This was developed to support the engineering design by structuring the organizational knowledge analysis, and then supporting the knowledge-management in this field by a specific software system - i.e. the Moknowledge-audit tool. That was made to answer to the complexity of the engineering process in modern industrial companies and of the associated knowledge.

Based on the identified typical life-cycle of the knowledge-based engineering (KBE) the Moknowledge-audit methodology allows to analyze each phase and individuate the related descriptive needs. Moreover, by the Informal and a Formal knowledge model this also allows to structure and formalize the engineering-knowledge, and further provides advanced knowledge structuring capabilities by explicit meta-models and views there-in defined. As introduced the Product Models and Design Process Models as major elements in Moknowledge-audit's knowledge structuring approach that made result the tight interaction of product and process knowledge, which is very typical for engineering applications.

In particular, the Informal Model supports the knowledge collection and the related structuring process. Specifically, by providing a usable communication framework between knowledge engineers and domain experts, where all elements can be linked back to the original raw knowledge, that allows the user to structure knowledge in a way that is especially adapted to engineering knowledge - corresponding paragraphs in text documents of any kind like textbooks, interview protocols, etc.

Given the missing practical means for formal representations under current industrial conditions an approach was found in Moknowledge-audit in terms of trade-off between practicality and formality. That is the Formal Model which is based on a *Product Model* and a *Design Process Model*. The first is used to describe the object level knowledge in the domain like structures, functions, behaviors, geometry, etc. and including various attributes, relations, and constraints. Closely related to the first, the latter provides a description of problem solving activities, control knowledge, and the links to the Product Model. Specifically, the Product Model is structured by different standard meta-classes and views developed in pre-defined views that can be used as a starting point for engineering knowledge modeling: Structure, Function, and Behaviour, as well as the relations between them. Finally, it has to be noticed that the Formal Model is represented by the UML basis in order to obtain a flexible representation familiar to many software experts and easily usable for communication with domain experts.

Some extensions have been defined in the MOknowledge-audit Modelling Language (MML) in order to provide for the necessary additional expressiveness (for instance, for various kinds of constraints). The MO-knowledge-audit Modeling Language MML provides in fact the representation of meta classes and relations between them as MO-knowledge-audit's main formal knowledge structuring facility. Views can be defined in MO-knowledge-audit according to these meta classes: all concepts belonging to a given meta class (like structure, geometry, or function) define such a view as shown below.

The "*Common knowledge-auditDS*" Methodology. Resulting from a European research project (Esprit-II project, P5248, knowledge-auditDS-II) promoted and implemented by an international partnership the Common-knowledge-auditDS methodology is the most widely used at Epistemics for developing the knowledge engineering systems. In particular, this is constituted by a methodological frame specifically supporting the following functions within the knowledge-based system (KBS) development:

- Organizational analysis (including problem/opportunity identification);
- Knowledge acquisition (including initial project scoping);
- Knowledge analysis and modeling;
- Capture of user requirements
- Analysis of system integration issues
- Knowledge system design.
- Project Management;

As shown the first four of the above shown functions lien in the knowledge-audit somehow, and that makes such methodology interesting to this extent. As for the specific KBS development this is described and supported by such methodology from two main perspectives :

1. *Result Perspective*: A set of models, of different aspects of the KBS and its environment, that are continuously improved during a project life-cycle.

2. *Project Management Perspective*: A risk-driven generic spiral life-cycle model that can be configured into a process adapted to the particular project.

4.3 The Liebowitz's Scheme

As already introduced the knowledge-audit (knowledge-audit) process can be thought from a general point of view as an extended analysis of organizational knowledge whose outcomes are obtained by comparing two estimates respectively addressing the status of *lack* and the status of *expectation*. So that the whole process leads to the following key-question: " ... *what gap does arise from the detecting process to be existing between the needed knowledge and the available knowledge ?* ... ". The lack is then represented through that knowledge which is detected to be missing to rightly perform the business processes; while the expectation is represented through that knowledge which is detected to be needed to rightly perform the business processes. Therefore, the knowledge-audit process should be thought somehow to be ruled by the following equation:

Missing Knowledge + Available Knowledge = Needed Knowledge ; *[1]*

where the "audit" is then realized through the comparison between the level indicating the "needed" knowledge and that indicating the "available" knowledge. And for that reasoning the concepts of lack and expectations respectively related to the concepts of "missing" and "needed" constitute the fundamentals of the here proosed knowledge-management system-A detecting process - as be better illustrated in the next Chapter.

That is also addressed by the Liebowitz's knowledge-audit model [2000] through the following main assumption: that a knowledge-audit process must assess the organizational-knowledge specifically individuating :

- the needed knowledge within the business processes;
- the available knowledge within the business processes;
- the missing knowledge within the business processes;
- the persons who need such forms of knowledge;
- the applying ways of such forms of knowledge.

The knowledge-audit process is considered behind the Liebowitz's vision to be a very relevant part of the entire knowledge management strategy for any organization. This follows the strong expectation that a knowledge-audit must provide the knowledge-management designers with an operational information regarding what a knowledge-management system has to do, and precisely which function a knowledge-management system has to perform to effectively support the business processes by creating, memorizing, distributing and applying the needed knowledge which can be resulting to be both missing and available.

Basic target of the knowledge-audit is in fact to individuate not only the missing knowledge as it is considered *tout-court* but also those lacks of awareness about any form or also "availability-condition" of knowledge throughout the organization. Although available in such forms the organizational knowledge can be often perceived to be missing when people ignore it, and that sill represents a situation of lack-of-awareness the knowledge-audit must detect. Moreover, the importance of the knowledge-audit behind a whole KM strategy lies in another specific target: to individuate either the lacks of organizational abilities in updating the needed knowledge and in correctly estimating the already-owned knowledge cause both can produce expensive and dangerous effects like a "... *significant reinventing the wheel* ... ". And finally the knowledge-audit is important since it must individuate the lack of organizational abilities in seeking for the needed expertise to the same organization.

These are the main targets to be achieved by the knowledge-audit. Where achieved these can enable the organizational capabilities in implementing any effective method for storing and disseminating as well as creating and applying knowledge all over the internal and external contexts of organizations.

As it is proposed by Liebowitz' scheme [2000] the knowledge-audit process is very simply structured, and proceeds through the following three main steps :

Step 1 - to *identify the available knowledge* in a specific targeted area of organization:

a. to individuate sources, flows, and constraints within the targeted area involving contextual factors potentially affecting the same area;

b. to distinguish and locate explicit and tacit knowledge within the targeted area;

c. to outline a map containing both a taxonomy of all available knowledge and a scheme of knowledge flows in the area; in such map such a topic, documents, individuals, and connections to external sources will be all related each other so that one can easily and fast access the contained organizational knowledge;

Step 2 - to *identify the missing knowledge* in the targeted area

a. to conduct a gap analysis for identifying the missing knowledge which is needed to achieve the business objectives and goals;

b. to identify where and who to the missing knowledge is needed;

Step 3 - to *formulate recommendations* to the management about both the *status quo* and the achievable improvements within the business process in the area as resulting from the outcomes of the knowledge-audit process.

Following the above said scheme, the Liebowitz's knowledge-audit process is to be applied basing on a questionnaire constituted by two main sections: the first is focused on the Step 1 while the second on the Step 2. Finally the Step 3 is developed by synthesizing the outcomes of the precedent sections. To this extent it should be noticed that a particular distinction is there proposed about the concepts of "information" and "knowledge" since the first one can be globally thought as the answer addressing to the model-questions: " *... who? ... what? ... where? ... when? ....* " while the second one can be globally thought as the answer addressing to the model-questions: " *... how? ... why? ...* ".

4.4 Arising Weaknesses from the Knowledge-Management System Design

Although a wide spectrum of *ad hoc* methodologies is actually available to conduct the organizational analysis a common and intrinsic weakness seems to be arising from the field. Focusing in fact on the basic aim of these methodologies - i.e. to operationally support the knowledge-management system design - a strong weakness can be found in the highly complex relation which is supposed to connect: (a) the outcomes of the knowledge-audit analysis with (b) the available technological and organizational solutions to implement the knowledge-management .

The sophisticated procedures applied to individuate the missing knowledge from the business processes often produce such a not-matching information with the available instruments for implementing the knowledge-management . Given the knowledge-audit-based description of organization's missing/available knowledge flows and bases it can be difficult to establish a "right" correlation between such description and those needed changes really boosting the knowledge-management abilities; in particular it can be difficult to establish such "right" correlation in terms of "right" knowledge-management technologies to be applied and "right" organizational change strategy to be implemented for supporting the adoption of those technologies. In other words, it seems to be missing any form of suitable "right" and "easy" way of establishing a correlation between the *needed-missing knowledge gap* and the *effective gap-covering-way* in terms of precise technological and organizational changes for increasing the knowledge-management abilities of organizations.

The knowledge-audit has been conceived and is commonly conducted to provide such a direction and guidance for designing and implementing (over than controlling) the knowledge-management systems. However, it seems to be not able yet to do so in an operational and effective way as it could be where instead a "right" clearer correlation would be defined between the actually available means for designing and implementing a knowledge-management system (i.e. the knowledge-management technologies and the organizational change strategies) and the possible scenarios a knowledge-audit can outline. By defining such correlation in fact the (organization's) analysis and (knowledge-management system) design/implementing would be rightly connected from such a causal/effect-like correlation.

Defining a pattern of possible correlations between the available knowledge-management technologies and the possible outcomes of a knowledge-audit analysis process could be very difficult for many reasons. First of all it can depend on the heterogeneity often existing between the designers of the knowledge-management technology (SW engineers, HW designers, programmers, analysts, etc.) on one side, and the persons in charge of designing the needed organizational changes to implement any knowledge-management technology, on the other (e.g. IT consultants). Many different professionals are quite always involved at different levels into the organizational contexts (i.e. operational level, management level, and strategic level) for designing and implementing the knowledge-management systems. In particular, the *status quo* is basically analyzed in the big organizations by several professionals who are usually different from who is deciding about the organizational changes to be adopted for implementing the knowledge-management system; and others can be further in charge of deciding about the specific technologies to be bought and applied. In other words, different classes of subjects are usually at different levels of organization involved in single phases or single aspects of the whole design and implementation process of the knowledge-management systems. And in any case they will be different from the basic designers of the technologies that will be then applied by a customization process (that are normally implemented by the IT consulting companies).

That lets then arise a whole weakness from the lien that is supposed to exist between the outcomes of the knowledge-management system-supporting analysis and the knowledge-management system design. Such weakness does constitute the target of this Study whose methodological proposal aims at contributing in the knowledge-audit improvement by making the outcomes more effectively applicable to the knowledge-management system design.

4.5 Necessity of New Metrics for Advancing in the Knowledge-Management

Approaching the problem of estimating the knowledge-management lacks and improvements-expectations can be difficult because of the already discussed reasons in the Study's First Part. Such problem leads in fact to two complex and widely debated issues arising not only from the managerial field: the measurement of the business performances, and the estimate of the intangible assets. As already said no consolidated or widely agreed methodologies nor preferred points of view can be found for any of these issues; instead, several different perspectives have been proposed till now, and although wide spreading within the organizations many of these require more support from empirical evidences and feed-backs in order to confirm their effectiveness or verify their weaknesses.

However, it could be argued to this extent that in any case: *(i)* the knowledge-management results to be a decisive topic for further advancing against both these issues, and *(ii)* to do that more metrics are required.

The business performances are even more widely considered to be deeply related to the enterprise capabilities of handling with their own organizational knowledge throughout the business processes: it must be recalled that the strong technological progress in the fields of information and communications has deeply modified during the last decades the infra-relations within and the inter-relations among the firms as well as it has also contributed in modifying the manufacturing processes by providing new possibilities of control (of the same processes) and moving to new decentralized schemes of industrial production organization (i.e. the network-based schemes). Because of this the characteristic levels (and some times also the concept) of the industrial productivity rose in a significant way; so consequently did the global performance levels of the industrial enterprises: the production systems became even more flexible, powerful, and intelligent and their performances and those will rise much more in the future. The importance of knowledge is then going to even more significantly increase in a world moving towards the so called "Information Era"; that is why someone is believing that knowledge will be even more strongly considered to be one of critical economic factors of the future. In this case it would become also necessary to keep in the right account the importance of handling with such economic factor to create the wealth by the economic activity of the enterprise as it can be given by the power of controlling the knowledge flows inside and outside of organization structure.

This represents the focus of any knowledge-management system and at the same time that makes it necessary however to find out new and more effective ways of quantitatively estimating the knowledge-management system control capabilities, or more generally the knowledge-management system performances. There is no way of improving in fact without a clear measurement of the advancements already achieved or to be achieved. And there is no way of defining a clear knowledge-management system improving strategy or to monitoring the effectiveness of that without a clear metric of the knowledge-management system performances.

As better discussed in the First Part (see Chapter 1) a weakness is arising from the financial and accounting fields regarding the traditional methodologies to estimate the value of the enterprises as well as it is really given in the markets. An already widely recognized idea is even more strengthening: that the economic value of enterprises cannot be exclusively estimated by the traditional economic production factors (i.e. Land, Labor and Capital Goods) addressing to tangible assets but must be based also on the intangible assets constituting part of the global wealth of the same enterprise (i.e. Intellectual Capital). So that from the widely debated IC estimating process and the related proposals, coming either from the scientific research and the managerial field, a global lack is arising of reliable quantitative-based estimators addressing the organizational capabilities of exploiting the IC.

A lack of such estimators then appears to be critical to advance in the IC estimating process because the value of organization's IC is likely to depend on its possible uses as well as for any economic resource, and consequently this is likely depending on the organization's abilities in performing an effective use of this through the business processes. That makes still needed such an estimators addressing the knowledge-management system performances since great effects can be taken by the knowledge-management system on the organizational abilities of handling with the IC. The knowledge-management system is supposed in fact to be acting on every form of knowledge flowing through the business processes, and that virtually makes the knowledge-management system as the heart of organization's business processes; by flowing knowledge everywhere it is needed and in the needed forms the knowledge-management system can move all organization's units and activities. Such role virtually makes the knowledge-management system the decisive organization's part for strengthening all business processes by ruling the access to the needed knowledge (in the right manner and under the right form of access) for accomplishing any task and activity.

The above introduced knowledge-audit-oriented methodologies attempt at outlining such an information regarding the knowledge-management system performances; however, to advance in developing highly-performing knowledge-audit-schemes it seems to be dramatically important to define a quantitative-metric system for linking the organization's knowledge and knowledge-management -capabilities, on one side, to the fundamentals of a knowledge-management system design strategy, on other side. In other words, between the knowledge-audit outcomes and the knowledge-management system design there is an apparent lack of continuity to be intended as a supposed weak causal-effect relation; nevertheless, such lack can be exceeded by defining a quantitative-based estimators respectively addressing the knowledge-management system lacks, on one side, and the knowledge-management system expected improvements from the knowledge-management -technology, on the other side. By comparing such estimates it is possible in fact to quantitatively estimate whether or not the possible knowledge-management improvements can be considered to be successfully facing the lacks. It is then possible to establish a relation between the need of improvement (lack) and the chance of improvement (expectation) given by an individuated means (knowledge-management technology). That still realizes the sought relation. Likewise further parameters are to be defined in order to estimate those knowledge-management system improvements that can be expected from other critical factors potentially affecting the knowledge-management (e.g. the organizational change strategies needed to support the adopting process regarding the knowledge-management technologies within the organization).

4.6 Conclusions

The knowledge-audit is normally intended as an organization analysis process whose expected outcome is an articulated descriptive frame addressing both the organizational-knowledge and the related capabilities of handling with it. Such process can be hence considered to be a very important means for increasing the knowledge-management system performances by effectively supporting its design. Therefore, given the great potentialities of any knowledge-management system to increase the business-process control, through the embedded knowledge, as well as the IC exploiting process the knowledge-audit can then be though to indirectly affect the same organization performances.

Although several *ad hoc* practices and methods are proposed from the management field (in most cases from private information and communication technology consulting companies) empirical evidences show that such practices and methods only weakly correlate the outcomes of the knowledge-audit-process with the operational decisions regarding the knowledge-management system design and implementation phases; indeed, it seems to be difficult to find out a way for proving empirically the "good-matching" between the organizational needs and the technological available answers. To take a strong support to such "good-matching" it must be faced the lack of effective quantitative-estimators addressing :

1. the suitable business performance increases due to the knowledge-management system improvements;
2. the suitable IC-exploiting increases due to the knowledge-management system improvements;
3. the possibly existing correlation between the main potential effects of the knowledge-management systems as in 1. and 2.;
4. the possibility of obtaining the knowledge-management system improvements as in 1. and 2. by modifying the knowledge-management system key-factors.

Chapter 5
A Metric for Assessing the Knowledge-Management Systems

5.1 Introduction

The proposed audit methodology has been developed through an empirical framework which has been specifically set to verify statistically the validity of the metrics conceived for rating the *knowledge-management* capabilities of organizations. Indeed basing on this concept the Study proposes an innovative metric of the organizational capabilities of implementing and using the knowledge-management systems proficiently which strictly lies the knowledge-management performances with the business performances.

The here addressed definition of effectiveness of the knowledge-management system is based in fact on the statistical correlation that can be calculated among the business performances and a certain outcomes of the knowledge-management support; this constitutes the core of a knowledge-management rating system which has been particularly developed and then tested by a specific statistical framework, here fully described. In particular, the knowledge-management rating scheme has been tested by using two sample of subjects presumably considered to be very different from each other against the knowledge-management main features so that very different rates were expected as outcomes of the tests (i.e. null hypothesis): close values in the estimates would have proved the weakness (or fail) of the rating model while very different values *vice versa* would have proved its validity. The positive exit of the test can demonstrate that basing on such outcomes it is possible to define a range of characteristic values of the *knowledge-management levels.*

The development process of the new (here proposed) knowledge-management metric has been conducted focusing on the main fundamentals of the same whole knowledge-management. The basic assumption of such theoretical pathway consists of the existence of a relationship between the effects of the knowledge-management on the organization's intellectual capital and the business performances. That is, a knowledge-management system is here considered to be "efficient" where well supporting the organizational processes to be accomplished at different levels throughout the organization; while it is considered to be "effective" where making the organization able to achieve higher business performances. Therefore, by measuring the statistic correlation occurring between the efficiency of the knowledge-management systems and the performances achieved by the organization it is possible to define an estimate of the contribution of such system to the improvement of the organization: in other words, the effectiveness of the same knowledge-management system.

This Study has been then aimed at developing a metric for assessing the maturity of the knowledge-management systems which can be used to extend the knowledge-audit (analysis) process. In particular, such metric has been defined by a strongly statistic-based approach that allowed to individuate different possible levels of performing knowledge-management systems operating in different real organizations.

This chapter particularly describes the here followed path to define and test the whole knowledge-management metric for extending the knowledge-audit; in particular, starting from the basic assumption of the Study about the knowledge-management these are here specifically illustrated either the statistical model constituting the basis of the assessment process and also the statistical frame that has been used to verify the validity of the same model.

5.2 Basic Assumptions of the Knowledge-Management Metric

As already introduced many of the widely used knowledge-audit based approaches for supporting the knowledge-management S design generally tend to focus on several different kinds of missing knowledge and precisely on that knowledge which is considered to be needed within the organization. Such process is then normally implemented by conducting a wide analysis of organizations, and specifically by focusing on the critical areas of missing knowledge under different forms and kinds - i.e. people's individual knowledge, structured knowledge contained into automatic forms like data-bases or knowledge-bases

One of the most challenging issue behind the knowledge-management S design phase regards the potentially very difficult "good-matching" that must be maintained among the audit process outcomes and the specific needed technological and organizational changes for improving the knowledge-management S; open questions are in this case: " ... *how individuating specific and operational changes in the knowledge-management technology or in the knowledge-management programs in order to effectively meet the audited organizational needs* ? ... "; and also: " ... *how improving the knowledge-management S by quantitatively modifying the knowledge-management S constituting factors ?* ... ". In other words, it seems to be very difficult to use the auditing process outcomes for being-sure that the knowledge-management technologies have been effectively exploited; analogously, it can be very difficult to individuate either the specific knowledge-management technologies and the particular organizational changes to be implemented for satisfying the audited organizational needs.

Therefore to really advance in the knowledge-management system design and implementation processes it seemed to be necessary to give a new structure to the knowledge-audit; and particularly, this had to be defined in order to outcome (output) an operationally usable and highly-focused information about the specific knowledge-management functions to be improved or created where missing. The knowledge-audit outcomes must give in fact a clear indication about those knowledge-management S parts resulting to be weak or missing and consequently to be needing such an improvement. And such improvements have to be expressed in terms of a quantitative estimate so that it would be easier to formulate a related improving strategy.

Moreover, it appeared also to be critical that the knowledge-audit new possible structure must not only keep in account the organizational needs as directly arising from an assessment process but also as expressed in terms of expected improvements from the available knowledge-management instruments. The organizational needs are often intended in fact as a gap to be individuated between the effectively provided knowledge-management S support and an expected support level; the "*what-is-missing*" target of the knowledge-audit process is generally focused through a gap individuated between an actual level and an expected level with respect either to the organizational knowledge and the knowledge-management-capabilities. Then, the knowledge-management system expected-support-level must be considered to be a milestone behind the same knowledge-audit process and thus requires to be fully explored; this can in fact to be very meaningful with respect the knowledge-management maturity level to be estimated within any organization since differently advanced organizations would have likely different idea about the possibilities of improving their own knowledge-management Ss and consequently these would likely have different expectations of improvements.

Then a quantitative-based metrics would be the means to also assess the level of match between the organizations' expectations of improvements and the effectively reached support from the knowledge-management system.

- First Assumption of the Study

This regards the relationship that is supposed to be existing between the knowledge-management performances and the organization performances. Precisely, the assumption is that a well-performing knowledge-management system must somehow produce a positive improvement in the organization performances (as it is basically supposed to do) and consequently a rating of this must be deeply included into the knowledge-management system assessment process. Since the knowledge-management system are basically conceived for supporting the organizations to better perform it seemed to be dramatically relevant, for improving the knowledge-management assessment process, to rate somehow such relationship. And it appeared to be necessary, although not easy, to strongly link the organizations' performances with the knowledge-management system performances through the main here developed knowledge-management -maturity rating scheme.

This links is in fact here developed by the pivotal element of the knowledge-management system / BSC correlations; specifically, those statistical correlations that can be calculated among the knowledge-management S support ratings and the organization's performances as resulting with respect to the Balanced Scorecard (BSC) scheme [Kaplan and Norton, 1992; 1996; 2001]. Therefore, the ratings respectively obtained as a measure of the knowledge-management S lacks and the knowledge-management S-support expected increases are along the knowledge-management S-A model statistically compared each other, by doing so these are measured the related correlations (knowledge-management system/BSC) against four groups of categories addressing the BSC organization's objectives and goals: a) learning and organizational growth, b) business process efficiency, c) customer satisfaction, and d) economic-financial results.

Such statistical correlations represent the core estimates of the whole knowledge-management assessment process proposed from the Study as these constitute the basis of a series of metrics of the organizations' *knowledge-management -Maturity* (knowledge-management system). As better explained further, the knowledge-management maturity directly addresses in fact the organization capability of using either the knowledge-management technologies and the other knowledge-management key-factors (i.e. training activities and incentive strategies) for implementing well-performing knowledge-management Ss as these can be assessed by the organizational global scores achieved: the organizations are considered to be *advanced* in the knowledge-management - maturity development where a high correlation rate is found between the BSC-scheme scores and the knowledge-management system ratings.

As quantitative estimates the other BSC/knowledge-management system-correlation rates can still facilitate a knowledge-management system design-oriented knowledge-audit process by strengthening the above recalled "better-matching" to be maintained between the targeted knowledge-management system support lacks (as resulting from the knowledge-audit outcomes) and the available means for improving and better implementing the knowledge-management - i.e. the knowledge-management specific technologies and the needed factors by whose to be exploited like the knowledge-management training activities and a knowledge-sharing-based incentive system. And finally such correlations make it easier to outline any (related) knowledge-management S improving strategy and actions: any strategy can be more easily formulated as in terms of a better (quantitative) related combination of knowledge-management available technologies, training activities and knowledge-sharing focused system.

- Second Assumption of the Study

The above considerations about the expectations of improvement lead to the second assumption of the Study: the said intrinsically complex and frequently arising weak matching among the knowledge-audit outcomes and the needed knowledge-management system improvements can be strengthened by defining a quantitative-based assessment tool focused not only on the *knowledge-management system lacks* but also on *the knowledge-management system expected improvements* to be implemented by acting on several individuated means. That specifically means to assess either the lacks of the actual provided knowledge-management system support and the expected capabilities of the better-performing knowledge-management S to be implemented.

Such specific knowledge-audit double focus will make it easier in fact to establish a quantitative-based form of balance between a direct expression of needed improvement and such an indirect expression as expected improvement from individuated means. That means to build a knowledge-management S rating system based on the coherence degree existing between the directly assessed knowledge-management needed-increases (in terms of actual lacks) and the indirectly assessed knowledge-management -needed-increases in terms of expected improvements.

This indication will constitute a basis of the further design phase of a new knowledge-management system since this will highlight how much can be different people's detected lacks from people's expectations with respect to the effectiveness of a knowledge-management system. Then, such focus will also make it easier to individuate: (1) the missing or inefficient knowledge-management functions within the knowledge-management system (possibly producing most of the knowledge-management gaps or failures); and (2) the specific technological and organizational changes to be implemented to exceed such lacks. In this way the knowledge-audit can still produce such an operationally usable information for designing and implementing more efficiently and effectively the knowledge-management system.

This Study proposes therefore to structure the Audit process basing on the analysis of two main perspectives:

1 - the lacks of knowledge-management system support;

2 - the increases in knowledge-management system support;

where, in particular, such increases are to be considered as these can be expected from the three main structural parts of each knowledge-management system that are following:

2.1 - the knowledge-management available technologies;

2.2 - the knowledge-management -based training activities;

2.3 - the knowledge-sharing (economic) incentive system;

that constitute the main parameters of the whole knowledge-management S rating system proposed in this Study - in the next paragraph it is better explained why each parameter has been selected.

- Third assumption of the Study -

The knowledge-management system maturity level of one organization can be estimated by calculating the statistical correlation occurring among the knowledge-management system performances and the same organization's performances. To do so, a series of knowledge-management – maturity based metrics can be statistically tested by using two groups of different subjects where these can be presumably considered to be totally different; precisely, the first group must be constituted from *advanced* organizations in the knowledge-management -maturity while the second one from *late* organizations. The basic idea behind this assumption is that by comparing the first group's characteristic value of the knowledge-management system/BSC correlation with the second-group's then a significant difference in value can be found to exist in between. And basing on such difference it can be established the range of possible values of the whole knowledge-management rating scale to use for rating the knowledge-management system of organizations. Once the knowledge-management rating scale is defined any single organization can be then assessed by two main steps: (1) measuring individually its own knowledge-management maturity and (2) comparing such rate with the whole knowledge-management maturity rating scale in order to individuate how far the single organization is from both the *advanced* and from the *late* organizations: its ranking within the scale will constitute the final estimate of the same organization's knowledge-management.

Following the above described main assumptions the knowledge-management assessment process has been then structured basing on these priorities: (a) to focus contemporary on the knowledge-management system and its own presumably related effects on the business performances by analyzing the correlations occurring among the BSC scores and the knowledge-management system support ratings; (b) to analyze the knowledge-management system support not only focusing on how-much it can be perceived to be missing/insufficient within the organizational process but also focusing on how-much it can be expected to be improved by using the knowledge-management available technologies and related strategies; and by doing so (c) to estimate the knowledge-management -M of the organization. From an operational point of view this logical path can be turned in a knowledge-management assessment process which do:

1. rate the knowledge-management system lacks and expected improvements, and also detect the BSC scores;

2. calculate the knowledge-management system /BSC correlation rates and then define the knowledge-management -maturity rate;

3. individuate a ratings-related combination of knowledge-management technologies and other knowledge-management affecting factors which could match the detected expectations as better as possible.

5.3 Categories and Framework of the Knowledge-Management Assessment

The main components of the here proposed audit methodology are described in this paragraph; in particular, the first part of the paragraph illustrates the key components of the rating system - i.e. the knowledge-management system and the BSC parameters - while the second part illustrates the statistical model for calculating the knowledge-management levels and the related knowledge-management system improving strategies.

5.3.1 The knowledge-management System based Parameters

Here are following the main elements constituting the entire knowledge-management assessment schemes; in particular the basic categories proposed for conducting the rating process - i.e. the knowledge-management S lacks and expected improvements, and the BSC perspectives - the knowledge-management system/BSC correlation coefficients, and the related knowledge-management system improving strategies.

- *knowledge-management System Lacks* -

As the gaps and lacks do constitute the main targets of any audit process (see Paragraphs 2.5, 3.2, and 3.3) the first main parameter of the here proposed knowledge-management assessment process is then the "knowledge-management system-Lack". This is in particular considered against one of most important supposed effects of the knowledge-management system: the growth of organization's *Intellectual Capital* (IC). Indeed, as already discussed in the Study's First Part (see Chapter 3) the knowledge-management systems are increasingly considered to be an even more critical instrument of business management and process control. This is because the knowledge-management systems can make organizations able to effectively manage their own intangible assets, among whose there are, first of all, people and the organizational knowledge created by them. And both constitute a consistent part of organization's IC.

Then it seems to be very likely that the knowledge-management systems can be affecting the IC of any organization: it is still likely that the organization's IC will be increased in value by efficiently and effectively dealing with the organizational knowledge, and that is why both the effectiveness and the efficiency of any knowledge-management S have to be assessed against all single IC main components. To this extent the Study considered a basic structure of IC that has been illustrated in the First Part and which is particularly constituted from the following elements: the Individuals, the Organizational Network, and the Inter-firm Networks.

Therefore, the knowledge-management system support level is here intended in terms of support to be provided by the knowledge-management system throughout the organization at different levels, by respectively: 1) helping people in their individual tasks (here addressed as Individual Capital); 2) making the coordination processes and rules better run within the organization (here addressed as Organizational Capital); and 3) sustaining and supporting the coordination of the external relationships among the organization and its own partners like stake-holders, clients, suppliers, and so on (here globally addressed as Networking Capital). That leads to the here used IC basic scheme to structure the same knowledge-management assessment process, and specifically to its related constituting elements that have been derived from a synthesis based on some of the several IC representation models (see the Study's First Part; Chapter 1 and Chapter 3); in particular, these can be briefly described as below:

1. The *Individual Capital*. This is addressing those Intangible Assets based on the Human-based Resources of the organizations. Particularly, an essential part of any organizational structure and of its own IC is constituted by the knowledge-resource that can be considered to be embedded into the organization in terms of individuals and their own knowledge, competencies and skills and also named as "*implicit resources*" (see Chapters 1-3).

2. The *Organizational Capital.* This is addressing those Intangible Assets that are mainly based on the organizational resources, and thus address the different possible ways of applying the above-described knowledge resources to make the organization work coordinately; in particular, these address all schemes, models and praxis ruling the operational, managerial, and strategic decisional processes, and finally the whole organizational structure, to be intended in terms of human relationships structured either formally through the organization's hierarchy and also informally through the communities.

3. The *Networking Capital.* This is addressing those Intangible Assets related to the contextual relationship resources, and specifically the relationships existing between the organizations and the external context where others like stake-holders, suppliers, consumers and competitors can be acting. Resources like these can be individuated by individually analyzing the formal and informal exchanges occurring between the enterprise and the above said actors.

In order to compare the knowledge-management system lacks with the possible related improving means by a uniformly quantitative-based rating scale not only the first group of the knowledge-management assessment rating parameters knowledge-management system-lacks addressing is to be based on the above IC-scheme but also those parameters addressing the knowledge-management system expected improvements - as following the first assumption of the Study.

- knowledge-management system Expected Improvements -

The above recalled knowledge-management system parameters (i.e. the knowledge-management technologies, the knowledge-management training activities and the knowledge-sharing economic incentive system) have been selected as categories addressing the basic components constituting any knowledge-management S as well as the most meaningful. These are in particular: 1. the knowledge-management Technologies; 2. the knowledge-management Training Activities; and 3. the Knowledge-Sharing Incentive System.

As already discussed in the Study's First Part (see Paragraph 2.4) the knowledge-management technologies are even more specifically developed and can be classified by a quickly increasing series of different families so that it can appear to be very difficult to analyze the specific features of each of those. However due to the different particular aim of this Study - to extend and improve the knowledge audit phases as potential support of the knowledge-management system design - it has been here recalled a simple and one of most widely accepted classification of the main knowledge-management technology families. which is based particularly on the possible forms under which the organizational knowledge can be individuated and then classified. The three main classes of knowledge-management technology families addressed by the knowledge-management assessment parameters are indicated below:

1. *knowledge-management Technology Family 1*. This addresses the specific technologies for managing the *explicit knowledge* that can be found *as under structured forms*; these belong to this family: the *Database; the Data Warehouse; the OLAP; and the Knowledge Discovery in Data (Data, Web, Log, Usage, Mining*);

2. *knowledge-management Technology Family 2*. This addresses the specific technologies for managing the *explicit knowledge* that can be found under *unstructured* and/or *semi-structured forms*; these particularly belong to this family: the *Natural Language Processing, the Information Retrieval Systems, the Knowledge Discovery in Text (KDT), the Document and Content Management, and Case-Based Reasoning;*

3. *knowledge-management -Technology Family 3*. This addresses the specific technologies for managing the *tacit knowledge*; these belong to this family: the *Knowledge Acquisition Applications, the Communication Collaboration System, the Group-ware, and the Adaptive Systems and Multimode and Multi-channel Interfaces;*

To strengthen further the mainly targeted attempt of improving such knowledge-management audit process it seemed to be also necessary to select two more constituting components of the knowledge-management systems: the knowledge-management -based training activities and the economic-based incentive systems of the knowledge-sharing. Specifically, these have been added into the whole knowledge-management assessment model in order to exceed one of the not-infrequent limits characterizing many knowledge-management S-design approaches: the technology effectiveness-lack. To this extent it has been realized that the effectiveness of the knowledge-management technologies can be often decreased because of a coherence lack with other knowledge-management critical factors - " *... ICT is important, but not sufficient: organizational aspects (roles, rules, methods) are also critical. Flexibility can be achieved acting on organizational relations ...* " (V. Corvello, P. Migliarese, *Virtual Organizations through a Relational Lens*, 9th World Multiconference on Systemic, Cibernetic and Informatics (WMSCI) Orlando, FL, July 10-13, 2005); and moreover, that " *... ICT alone could not explain differences in organizational performances. In fact, certain changes in information technology that were intended to increase performance, resulted, instead, in performance failures. Knowledge intensive relations occur when the values attributed to the four dimensions of a relation (goals, rules, tools, cultural background) are high ... High performance occurs only when the design of relations and the design of an ICT system are congruent. This means that joint design (including both the technical and the organizational elements) would be required ...* " (D. Laise, P. Migliarese, S. Verteramo, Knowledge Organization design: A Diagnostic Tool, *Human System Management*, n. 24, 2005). That is, in order to fully exploit the knowledge-management technologies one organization must not only apply that correctly but also develop a *mature* environment (from an holistic point of view) that could be really able to use such technology proficiently or, in other words, producing good effects in terms of improvements in the business activities. And also basing on some of the addressed reasons in Migliarese-Verteramo it appeared to be necessary that such a knowledge-management S-oriented audit process be not only merely focusing on the *status* of the knowledge-management technologies but also on the knowledge-management S technology enabling-conditions. And in particular, two main factors among others seems to be critical in this: (1) people's ability and (2) people's willingness or motivation in using the technology as they are expected to do: in no case one can in fact use the technology where be missing the needed specific knowledge in the field, or also where be missing the needed personal motivation to do that. The *not-totally-cooperative* human behavior does constitute in fact a case which can occur when people reject a coherent use of the available technological means because of an unmet expectation of extra-payment or rewards; or also when they do not use it or do it differently with respect to the "designed using conditions" because of the missing specific competency or knowledge - only where people will use technology following the designers expected conditions then technology and organization can produce the expected effects.

Therefore, in order to rate the organization capabilities of using correctly the knowledge-management technologies it has been defined the "knowledge-management -Training-Programs" category by which these are thus intended all activities that are implemented within the organization in order to improve people's knowledge about the knowledge-management technologies - e.g. specific training courses, seminars, knowledge-management e-learning, etc. Instead, in order to rate the organization capabilities of motivate its own people to use the knowledge-management technologies and the knowledge-management systems (i.e. in a pro-active way) it has been focused one of the widely believed critical knowledge-management process: the knowledge-sharing. To this extent it is even more evident that people can be effectively motivated by economic rewards as these are provided against a pro-active use of the knowledge-management system. And that is why the last category of the knowledge-management S-IC rating system is represented by the : "Knowledge-Sharing-Incentive-System".

5.3.2 The BSC-derived Parameters -

To focus on the main organization's objectives and goals these will be represented into the knowledge-management system assessment methodology framework by using the proposed categories into the "Balanced Scorecard" (BSC) scheme (Kaplan and Norton, 1992; 1996; 2001) as indicated in the tab below:

Tab.5.1 The BSC Perspectives (Kaplan and Norton, 19992; 1996; 2001)

1. Learn and Growth
2. Efficiency in the Business Processes
3. Customer
4. Economic and Financial Results

The Balanced Scorecard (BSC) scheme does constitute in fact a multi-dimensional framework for describing, implementing and managing strategies at all levels within the organization; in particular its basic aim is to establish a link among objectives, initiatives and measures and the organization’s strategy in a synthetic overview of the organization’s overall performance. Indeed, the BSC integrates the financial measures with other key performance indicators around the above said four perspectives to facilitate the translation of strategy into action. The BSC hence provides a framework for analyzing the possibly correlated (or causal?) links based on internal performance measurement through a set of goals, drivers and indicators (lag and lead types) grouped into the above said perspectives that respectively address:

1. *Learning and Growth*: those infrastructures that can facilitate the organization's long-term growth and improvement through people, systems and organizational procedures;

2. *Internal Processes*: all organization's internal processes potentially impacting on customer satisfaction and the organization’s financial objective achievement;

3. *Customer*: measures of the successful outcomes of company strategies like customer satisfaction, customer retention, and market and account share in targeted segments;

4. *Economic and Financial Results*: typically relates to profitability – measured by ROI, ROCE and EVA, for instance.

As the BSC scheme provides a wide overview of organization regarding all its own parts affected by the knowledge-management system that can be then considered to be, behind the knowledge-management assessment as a source of referencing terms for assessing the possibly correlated good-effects of the knowledge-management system in terms of organizational performances; that is, in particular, because of the causal-effect relationship existing among the BSC perspectives.

The BSC based overview is structured in fact basing on the suitably correlation existing among the perspectives in terms of an expected results chain: more effective the organization's capability of learning and growing, more efficient in performing the internal processes; and also, higher the organization's capability of satisfying its customers, higher the expected financial results. And that correlation-chain can be considered to be critical against the knowledge-management system support since the knowledge-management system support effects are supposed to be achieved through the same chain. As already said about the Study's first assumption a knowledge-management system is supposed to act on the organization's IC and then directly affect on the capabilities of learning and growing from the organizational point of view: the knowledge-management activities are expected to support people and organization for better handling with their own knowledge, and consequently for learning from its own already performed activities. From that it directly comes the expectation of improvement in the business process: where well supported in learning an organization is likely to increase in the efficiency of its own internal business process, and consequently its capability of satisfying the customers will increase too. Finally such effective knowledge-management S support will produce a whole improvement of the organization that will yield better financial and economics results.

It is then clear that the BSC scheme can be efficiently applied in order prove whether the knowledge-management S is running proficiently as well as it is supposed to do as from the Study's first assumption - i.e. a well performing knowledge-management S must produce positive effects in terms of increases in the business performances.

5.3.3 The knowledge-management BSC Correlation Coefficients

The knowledge-management system / BSC correlation *(*ξ) represent the core of the proposed knowledge-management system-assessment methodology. This is in fact proposed to be the pivotal element for assessing the organizations' readiness/"lateness" in reaching knowledge-management maturity high levels thanks to a proficient use of the knowledge-management technologies and managerial strategies; moreover, this can also allow to consequently define a knowledge-management-ratings based strategy for improving the knowledge-management systems by better exploiting the knowledge-management technologies as well as the other knowledge-management key-factors. Such correlations are here proposed then as basic metric for rating the organizations' knowledge-management maturity levels.

The knowledge-management maturity still constitutes the basic concept by which it is here proposed to estimate the organizational proficiency in using the knowledge-management technologies as well as the knowledge-management plans (i.e. based on training activities and incentive systems to the knowledge-management use) for increasing their own performance levels. In other words, the knowledge-management Maturity is the basis of such an organizational evolutionary *pathway* of the performance-based application of the available knowledge-management means; that is specifically meant as an advancement from an organizational-usefulness-oriented point of view. The knowledge-management -maturity is then to be considered as the metric to estimate the evolution level already reached as well as the next one to be further reached in the future by better using the knowledge-management means. That is why to define this metric the Study has been folding the concepts addressing the business performances and the knowledge-management S performances through the statistical correlation. Given the already discussed difficulties in building an estimate of any possibly existing causal-relationship between the knowledge-management S performances and the business performances (see Chapter 2 and Chapter 3) it has been followed the only "likely-road" provided from the frequencies in the contemporary-occurring-facts.

Consequently, the addressed meaning from the *(*ξ) correlations has been based on the widely accepted assumption that any knowledge-management S is supposed to be potentially affecting the IC of organizations, and to produce (hopefully) good effects on organizational capabilities of achieving the targeted objectives and goals: a positive impact of knowledge-management system in terms of increases in the abilities of achieving goals/objectives will be highly likely in those organizations where the knowledge-management system will be still able to favor people in accomplishing their individual work, and where it will be also able to facilitate the correct internal coordination (given by the organizational schemes and procedures) and finally where it will be able to allow the correct coordination with the external partners and the widening of the networks. That is why the more advanced organizations with respect to the knowledge-management development process are likely to be characterized by a strong correlation between the knowledge-management system-based use of the organization's IC and high-performances: high values in such correlations mean in fact that those organizations must be still able to use proficiently their knowledge-management systems for exploiting the IC and by doing so to achieve the targeted objectives. Where instead a low level of correlation occurs among the IC and the BSC that means that those organizations must be late in the knowledge-management S development process since they must be not able to use the same knowledge-management system for making better and easier the business process so that higher performances are made achievable.

To better clarify the addressed meaning from these correlations it must can be kept in account for instance that a high value correlation (existing between the knowledge-management S support lacks for achieving the BSC and the knowledge-management S support lacks for exploiting the IC) will mean that such an improvement in the knowledge-management system is very likely to affect (and increase) both the achievement of BSC's and the exploiting of IC's components: organizations like these can then be considered at the same time the most sensitive to the knowledge-management S improvements and the most *advanced* in the use and exploitation of the knowledge-management systems. Instead, when low values occur in the IC/BSC correlations it will be not likely to reach better BSC by improving the knowledge-management system since to achieve organization's objectives and goals could depend on different factors (rather than the knowledge-management system).

From the operational point of view, to define the reference-scale of different knowledge-management -maturity classes a range of characteristic values has to be individuated among two extremes: the top, which has been found in correspondence of those subjects that can be considered to be *advanced*; and the bottom, which has been found in correspondence of those subjects that can be considered to be *late*. From the statistical point of view this has been implemented by using the values of the knowledge-management S-IC/BSC correlations as extracted from both the concerned groups of subjects - i.e. the knowledge-intensive organizations and the Italian Public Administrations and the international organizations and further as it is better explained in the following paragraphs.

5.3.4 The knowledge-management System Improving Strategies

The basic idea of the here proposed knowledge-management assessment model is to strongly connect the measurements of the knowledge-management system-support ratings with the needed improving strategy; in this way the so designed analysis instrument would not only allow to assess but also quantitatively indicate how acting on the knowledge-management technologies or also on the knowledge-management other key factors in order to concretely improve the knowledge-management systems. This has been pursued by defining a series of knowledge-management -improving strategies based on the possible values of the knowledge-management-maturity levels as detectable by adopting the knowledge-management assessment methodology.

Since the possible values for such knowledge-management maturity indicators will be behind the whole range a series of specific knowledge-management S improvement strategy can be then defined for each of the above mentioned sub-ranges in terms of coherent increases to be respectively applied on the knowledge-management system. In particular, to apply each increase level means to make a quantitative changes (e.g. related investments) on the knowledge-management technologies (X_1), the knowledge-management training activities (X_2) and the knowledge-sharing incentive systems (X_3). Therefore, any possible combination of such increases will then express how the whole knowledge-management S improving strategy or plan must be singularly focused on each of the said components. Basing on the possible values of the knowledge-management -M indicators the following scheme illustrates how these strategies are to be basically defined in terms of different values of such parameters - the values into the table below are more detailed explained in the following paragraphs :

TAB 5.2 - Possible Combinations of the knowledge-management Key-Factors

KM -M Levels (Φ)	KM-Technologies (X_1)	KM-Training (X_2)	Knowledge-Sharing Incentives (X_3)
KM -Maturity *High Level*	Δ_0 / Δ_L	Δ_4 / Δ_L	Δ_5 / Δ_L
KM -Maturity *Low Level*	$2 (\Delta_0 - \Delta_L)_2 / (\Delta_0 + \Delta_L)$	$2 (\Delta_4 - \Delta_1)_2 / (\Delta_4 + \Delta_L)$	$2(\Delta_5 - \Delta_L)_2 / (\Delta_5 + \Delta_L)$
No KM -Maturity *Low Confusion*	0.33	0.67	---
No KM -Maturity *High Confusion*	0.50	0.50	---

where the correlations of the BSC-based performances against the knowledge-management system expected improvements from the knowledge-management technologies are addressed by the parameters ($\Delta_0 - \Delta_3$); the correlation against the knowledge-management system lacks by the parameter (Δ_L); and finally, the correlations against the knowledge-management training activity and the knowledge sharing incentive system by the parameter (Δ_5). As it will be more clearly described in the next paragraphs two possible conditions of knowledge-management maturity ($\Phi > 0$) are distinguished along such scheme from those addressing the knowledge-management confusion ($\Phi < 0$); and in particular for each of those a different way was followed for defining the related improving strategies.

- *knowledge-management Maturity based Strategies* -

Where a satisfying level has been reached in the knowledge-management maturity then two possible knowledge-management improving strategies are here proposed by the above shown two different formula.

First, as the knowledge-management -maturity high level - Φ [0,5:1] - can be considered to be occurring in correspondence of a balance among the reached development against the main knowledge-management system key-factors; it is meant that the knowledge-management technologies must be well developed as well as people's and organization's capabilities of proficiently exploiting these; so that technologies, people's abilities and people's motivations can be considered to be not very different. Then, the more suitable improving strategy would be to focus on the knowledge-management system key-factors without great differences among each other; that is why each of basic element of the improving strategy has to be focused in a proportioned measure with the ratio occurring among the correlation-based estimate of the knowledge-management system expected-improvements (Δ_0 - Δ_5) and the correlation-based estimate of the knowledge-management system lacks (Δ_L).

Second, in case of a lower knowledge-management -maturity level (behind Φ [0:0,5]) the knowledge-management system improving strategy can be defined by increasing the singular focus on each of its component (x_1; x_2; x_3) in a proportioned measure with the (squared) difference existing among the correlation-based estimate of the knowledge-management system lacks (Δ_L) and the correlation-based estimate of the knowledge-management system expected improvements (Δ_0 - Δ_5). In particular, thanks to the square-based formula this will make it higher the focus of the knowledge-management system improving strategy on that element that will arise to be the weaker or in other words where the lack-expected improvement difference will be higher.

- *No knowledge-management Maturity based Strategies* -

In this case the knowledge-management improving strategies were defined coherently with the differently low levels found in the knowledge-management -maturity by attributing differently constant values to the coefficients (X_1, X_2, X_3) and zero in particular to the knowledge-sharing incentive systems component (X_3). Those strategies are based on the presumably situations of confusions that can produce those values.

Where the knowledge-management -maturity values are behind the lowest sub-range (- 1;- .5) then it is likely that a very great confusion about the knowledge-management is occurring throughout the organization, and in that situation it appears to be likely that no significant impact could be obtained by acting on people's motivation towards the (presumably unknown and/or unstructured knowledge-management system. Such confusion in fact can arise from a poor infrastructure devoted to the knowledge-management activities and/or from a weak managerial-habit to the knowledge-management : in many cases the organizations are not provided with very efficient systems for handling the organizational knowledge as it often occurs in the not-well developed enterprises or small public administrations. A weaker confusion (higher negative sub-range) could be occurring when organizations are provided with a number of knowledge-management-based systems but not have developed yet the managerial structure or capabilities of performing in a coherent way; that situation often happens in those organizations that have merely acquired the knowledge-management infrastructures but do not reached the needed organizational confidence with such instruments for proficiently exploiting their potentialities and then people do not trust (and do not correctly make) the use of the knowledge-management infrastructures. In both situations the organizations can be then considered to be very late in the knowledge-management -maturity development progress, and presumably missing either the needed structure and culture to carry-out the knowledge-management; consequently, such a knowledge-sharing incentive system would be ineffective in both cases.

Finally the coefficients (X_1, X_2) were assigned different values depending on the role that in those cases must have been presumably played by the technologies and the training activities against the (different) progress already achieved in the knowledge-management development:

1. people's awareness about knowledge-management must be weak where a low level of confusion is arising - this is the case of those organizations where the technology infrastructures are not fully exploited; then, people need to be further trained in order to make it possible to better handle with the knowledge-management technology, and a coherent knowledge-management improving strategy must focus more the knowledge-management training activities than the technology;

2. both training and infrastructures must be significantly missing where confusion is arising to be greatest (lowest sub-range) and then the knowledge-management improving strategy must be designed by uniformly balancing the training activities and the technological infrastructure boosting.

5.4 Developing the Knowledge-Management System Assessment

Since the aim of the Study is definitely to propose a new metric for rating the knowledge-management system readiness (i.e. the knowledge-management-maturity of organizations) it was needed to set-up a specific framework for statistically testing the validity of such metrics. As described in this paragraph such framework is constituted from two sub-frames: into the first the subjects were selected and preventively examined to create the specific samples to be tested; and into the second, it has been set the final testing process.

From a general point of view it can be noticed that to have based the here proposed audit process on a statistical structure still represents an important and also innovative feature of this Study. In particular, by using a statistical development framework it has been possible to exceed one of most typical constraints of the case-study based surveys: the intrinsic weak possibility of extending the outcomes. Indeed, the case-studies are mainly focusing on the particular individuated features of only-one subject, and this still reduces the possibility of extending any obtained result to a general variety of different subjects; this depends on the intrinsic necessity of maintaining unvaried the external conditions of the analyzed subjects in order to save the meaning of the same results. Therefore, by basing on a case-study it could be never possible to explore the chance of defining a general metrics as this Study attempted to do. This statistically based approach of the Study is hence due to its own deep aim: defining a general model for the assessing the knowledge-management S through the knowledge-management maturity of organizations, and then defining such a quantitatively related knowledge-management system improving strategy. That is why it has been strongly necessary to search in the statistics for a concrete support arising from the empirical evidences

Tab 5.3. Main Framework of the knowledge-management S-A Model's Statistical Development Path

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Statistical Model's Developing Framework

Sub-frame 1 : Testing the Subjects

Sub-frame 2 : Computing the (Λ) Correlations

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5.4.1 Sub-frame 1: Testing the Subjects

The basic strategy implemented for setting the statistical testing framework was inspired from the most common metrics systems applied on the physical dimensions - i.e. temperature, pressure, and volume. To do that two basic pilot-samples were then created to be considered as two extremes points of the scale - i.e. the bottom and the top extremes of the scales - for defining the range of all intermediate points of the rating scale that are in between.

To better understand the basic idea behind such strategy a good example can in fact be provided by that followed for creating the temperature metrics - i.e. the Celsius degree. The water was exploited for its own specific natural characteristics with respect to the temperature, and in particular two points were kept in account to set the temperature rating scale: the boiling point and the freezing point. These were used in fact to define the top and the bottom of the rating scale and then hundred intermediate points were decided to be in between.

Analogously with this example the Study created a suitable rating scale of the organizations' KM-M level individuating respectively: (1) a KM-M top-level to be considered as the rating scale's top: this was expected to be found in correspondence of the presumably KM-M "advanced" organizations; and (2) a related KM-M bottom-level to be considered as the rating scale's bottom: that was expected to be found in correspondence of the presumably "late" ones . Then the whole rating scale of the KM-M has been defined as the range existing between these two values.

For proving that the samples used behind the experimenting phase have been constituted by selecting different subjects a two steps path were ran: in the first a ranking was made by comparing the means (average levels) of the obtained ratings (step 1.); while in the second a different ranking was made by applying a LMV derived multi-criteria process (in this case the LMV model was applied for producing an estimate of the deeply different level of knowledge-management -Maturity existing among the subjects of the two groups). Particularly, the analysis of the subject has been based on the above proposed knowledge-management system key-elements: (a) the knowledge-management technology availability, (b) the organizational effort produced in the knowledge-management training activities and the wide spread competencies in knowledge-management throughout the organization, and finally (c) the personal motivations to make concrete the knowledge-management program and strategies and specifically the availability of knowledge-sharing incentive systems. To do this then a series of specifically coherent analysis schemes have been applied:

Tab 5.4. Basic Schemes of the Subjects' Preventive Analysis

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- Step 1's Analysis Scheme: comparing the means
- Step 2 's Analysis Scheme: applying the LMV derived model

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54.1.1 Analysis of the Means (Step 1)

As already introduced, the main aim of the process is to analyze the subjects and to rank these with respect to their own rate of advancement in the knowledge-management-maturity development. To do this by the first scheme the obtained data regarding the knowledge-management system compared each other by three sub-schemes: 1. Lacks VS Expected Improvements from knowledge-management Technologies, 2. Lacks VS Expected Improvements from knowledge-management Training Activities, and c. Lacks VS Expected Improvements from knowledge-sharing incentive systems. And then as built three coherent rankings these will be synthesized in the final one based on a the average (i.e. means) of the three rankings. Specifically, each comparison will produce two possible outcomes based on the possible ratios between lacks and expected improvements: A) knowledge-management -M advanced organization where L < EI; and B) knowledge-management-Maturity late organization where L > EI. At the same time the step will also analyze the means extracted from the objectives and goals achieved as resulting from the BSC scheme and will also build some related rankings that will be also considered by an opportune weight system into the final ranking of the subjects. Given the specific rating arrays for gathering the needed information to the process as described in the tab below:

Tab 5,5 Components of the knowledge-management S Rating Arrays

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1. knowledge-management S-Lacks: [L1, L2, L3];

2. knowledge-management S-Expected Improvements: [T1, T2, T3]; [R1, R2, R3]; [S1, S2, S3];

3. BSC: [BSC1, BSC2, BSC3];

===

where [T_1, T_2, T_3] is constituted from the averages from the expected improvements from all three knowledge-management technology families considered - the statistical means were calculated for each of the above indicated arrays addressing both the knowledge-management system support lacks and the expected improvements from all the considered factors (i.e. the three knowledge-management technology families, the knowledge-management training activities and the knowledge-sharing incentive system) in order to obtain a first level of description of the subjects within the sample.

Tab 5.6 Extracted Means of the Ratings Values from the Samples

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- L : knowledge-management S support lack;
- T : knowledge-management S support expected increase from knowledge-management technologies;
- R : knowledge-management S support expected increase from knowledge-management training;
- S : knowledge-management S support expected increase from KS incentive system;

===

where each of the above said means was addressing the N subjects sample by the average level as below:

e.g. $LM_i = 1/N\ [\ \Sigma_k\ (L_i)_k\ ]\ ;$ $k{:}1, \ldots N;$

and then by calculating the average level among three components of each array:

$L = 1/3\ (\ \Sigma i\ (\ LM_i)\ )$ $i{:}1, .. 3;$

in other words the considered means (i.e. L, T, R, and S) were calculated as average of the ratings provided from all subjects of the samples.

By three main schemes and a series of four possible scenarios described below it is possible to plot and synthesize all the results obtainable from the ratings. Specifically, such schemes and scenarios have been defined by comparing the differences among the values regarding each time the knowledge-management S support lacks and those regarding the knowledge-management S support expected increases from the related key-factors (i.e. the knowledge-management technology, the knowledge-management training activities, and the knowledge-sharing incentive system).

Scheme 1: Lack VS Expected Improvements from Technology

In this case the knowledge-management S-lacks addressing ratings are to be compared with those addressing the expected improvements from the knowledge-management technologies; specifically, basing on the possible values of the means two scenarios are to be considered: first, where the lacks exceed and expectations, and second, *vice-versa* where the expected improvement exceed the lacks.

- Scenario 1.1: knowledge-management S Lacks Exceeding the Expected Improvements (L > T) -

Where the knowledge-management S-lack ratings exceed those addressing the expected improvements the organization can be basically considered to be late along the knowledge-management development process. People's higher consideration or trust in the knowledge-management S-lacks (than the possible improvements) demonstrates in fact that they must be not fully conscious or aware about the potentialities of the knowledge-management technologies; they must ignore or underestimate what, in terms of improvements, may be reached by further and better applying such technologies. Such situation can mainly occur when individuals do not know the knowledge-management technologies or also when they do not believe in these; and in both cases the organization they belong to must have not acted effectively since the knowledge-management technology culture must have not been well developed from that organization: that can occur where the organization does not have acted to develop a common sense of awareness of the knowledge-management technology potentialities by boosting both the knowledge-management technology-based infrastructures and the related use. And all that makes think to a *late* organization.

- Scenario 1.2: knowledge-management S Lacks Exceeded from the Expected Improvements (L < T) -

Where the knowledge-management S-lack ratings are exceeded from those addressing the expected improvements then the rated organization can be considered to be advanced behind the knowledge-management development process. This is following from a similar (and opposite in this case) reasoning to that above described. Indeed, people's trust about the knowledge-management technology potentialities must come from people's uses, and that is likely to be connected to the organizational development. It is into the well developed organizations that the even newer technologies tend to be easily applied from the individuals thanks to the organization's global effort for acquiring and wide-spreading throughout the organizational levels the same technology; and of course that can be achieved only by a well-structured knowledge-management development strategy. It is then the whole knowledge-management -environment of organization that can lead people to be even more able to handle with the technology, and by doing so the organization can make that people even more trustful with respect to the chances of improving their own work by further applying the technology.

Scheme 2: Lack VS Expected Improvements from Training Activities

Analogously to the first scheme two main scenarios are here following hypothesized to be suitably occurring: into the first, a certain confusion is attributed to the organization where the knowledge-management S-lack ratings exceed those addressing the expected improvement; into the second *vice-versa* the condition of knowledge-management S lacks exceeded by the knowledge-management S expected improvements is interpreted as indicating a good advancement towards the knowledge-management maturity.

- Scenario 2.1: knowledge-management S Lacks Exceeding the Expected Improvements (L > R) -

As considered into the precedent scheme when the lacks are greater than the improvement expectations people can be considered to be not very trustful in the chances of improvement; in this case the matter is constituted by the knowledge-management training activities. Then, when the expected improvements from the knowledge-management training activities are smaller in value than the knowledge-management S lacks it can be concluded that people must have not been well trained in the knowledge-management. Similarly, the organization must have played an important role in this determining such missing people's trust. Given in fact the potentially significant impact of the specific knowledge in the knowledge-management field, it is unlikely that well trained people could be underestimating the importance of the highly focused training activities focusing on the knowledge-management . Therefore, where it happens the organization must be considered to be *late* with respect to the needed evolution to be accomplished in the knowledge-management organizational path.

- Scenario 2.2: knowledge-management S Lacks Exceeded from the Expected Improvements (L < R) -

In the opposite case - where the expected improvements from the knowledge-management training activities are resulting to exceed the knowledge-management S in the ratings - the organization can be considered to be *advanced* in the knowledge-management with respect to its ability in training its own employees. Even more effectively than the technology infrastructures, the knowledge-management training activities can still make people able to implement the knowledge-management throughout the organization; the technology availability is nothing without human abilities of applying that correctly and proficiently for making the knowledge-management effective. Therefore, such an expression of trust in the chances of improvements, focused on the training activities, is particularly meaningful about the organizational development in the knowledge-management . And consequently, where the related ratings say that people's trust exceed the knowledge-management S lacks it is then likely that the organization must have made significant advancement towards the knowledge-management maturity.

Scheme 3: Lack VS Expected Improvements from Knowledge-sharing Incentive System

Two scenarios are considered also into the last scheme where the knowledge-management S-lacks addressing ratings are to be compared with those addressing the expected improvements from the knowledge-sharing incentive systems. And where a similar reasoning to the first two schemes has been followed to define the possible features of each scenario.

- Scenario 3.1: knowledge-management S Lacks Exceeding the Expected Improvements (L > S) -

For analogous reasons to the precedent schemes some lateness is to be attributed to those organizations where the knowledge-management system exceed the expected improvements from the knowledge-sharing system. That follows from the intrinsic complexity of a knowledge-sharing incentive system. This can in fact be considered as an advanced means for acting on people for stimulating their organizational propensity to the use of the knowledge-management infrastructures; it is a mean, then, particularly adapted to the intrinsically advanced organizations - i.e. those that have already achieved good advancements in terms either of knowledge-management technology availability and people's training. Then, although less significantly than others factors into the precedent schemes, a lack of trust in the knowledge-sharing incentive system can indicate a certain lateness of organization which must have not made people trustful about the potentialities of such advancing means in the knowledge-management development.

- Scenario 3.2: knowledge-management S Lacks Exceeded from the Expected Improvements (L < S) -

Where the knowledge-management system-lacks ratings are exceeded from those addressing the expected improvements from the knowledge-sharing incentive system then a certain advancement character can be attributed to the analyzed organization - of course, that follows what above said about the opposite scenario (L > S). The greater expectations (than the lacks) can be considered in fact as a prove of people's trust in the chances of improvement achievable by better exploiting the knowledge-management infrastructures thanks to a higher knowledge-sharing throughout the organization, and such trust must be based on people's uses to perform the knowledge-management -oriented organizational infrastructures. Then a certain advancement of such organization can be revealed in this cases.

In conclusions, given a number of subjects (N) presumably considered to be different, as resulting from the differences in the three main knowledge-management S key-factors, the above said three comparison-schemes can be used to build three related rankings. By ranking all N subjects it can be obtained a quantitatively estimated difference among the subjects, and that will indicate weather significant differences are occurring (or not) among the subjects of each sample and haw correctly the samples have been defined by grouping homogeneous subjects. Specifically this can make to individuate the α-group and ϖ-group of subjects from whose to extract the top and bottom levels of the targeted knowledge-management -Maturity based ranking.

Moreover, from a general point of view such rating can be also considered as a basic outlook regarding the subjects' knowledge-management maturity levels. In particular, basing on the above described reasons (for the possible scenarios) such outlook will then quantitatively indicate the possible confusion occurring within each subject about the knowledge-management activities and more generally about the already achieved advancements in the knowledge-management system development.

5.4.1.2 Applying the LMV derived Model (Step 2)

By applying the LMV derived multi-criteria derived scheme (Laise D., Migliarese P., Verteramo S., "A Knowledge Organization design: a Diagnostic Tool", *Human Systems Management*, 2005) it is possible to extract a synthetic (and more significant) form of the above said ratings; in particular, such method can make such estimate even more meaningful by contemporary keeping in account all different criteria to be used for assessing the knowledge-management S (i.e. support lacks, and expected improvements from knowledge-management technologies, training activities and knowledge-sharing incentive systems). The LMV multi-criteria is in fact a particular kind of outranking-based methodology [Roy, 1985; Vincke, 1992; Roy and Bouyssou, 1993; Pomerol and Barba-Romero, 2000] where the input (by the Electre I Method) is represented by a multicriteria matrix which and the output a multicriteria balanced ranking - in this case such matrix is to be constituted by the knowledge-management S- and BSC-based ratings while the ranking will be addressing the balanced samples' ranking against the knowledge-management S and the BSC ratings.

Now, let us consider the subjects involved into the experimenting phase of the Study as to be rated by the said parameters a series of possible comparison and also ranking can be defined among such subjects singularly against each parameter. It is easy to define the Concordance matrices based on the two groups of parameters (i.e. knowledge-management system and BSC) and following the "discordance matrices".

Basing on the possibility of rating any organization's knowledge-management system by three main perspectives and its performances by the four BSC ones the LMV method can be effectively applied either for deepening the analysis of the samples, and also for obtaining another more precise ranking of these. Specifically, the criteria to be considered for applying the LMV derived model are the same criteria proposed for conducting the knowledge-management S assessment process (i.e. the knowledge-management system lacks and expected improvements and also the BSC perspectives) so that a multi-criteria evaluation of the samples will be performed.

Tab 5.7 LMV Multi-criteria Basic Elements: Criteria

Criteria Group (A)	Criteria Group (B)
BSC Perspective 1 (Learning and Growth)	KMS- Lacks
BSC Perspective 2 (Internal Process Efficiency)	KMS-Expected Improvements from KM-Tech.
BSC Perspective 3 (Customer)	KMS-Expected Improvements from KM-Training
BSC Perspective 4 (Economic Results)	KMS- Expected Improvements from Tech.

The expected outcome of this analysis process is then represented from two rankings of the samples that can further prove whether a deep difference can be characterizing the subjects within such samples. And as above explained, in case such deep difference is proved then the related [Λ] values of the knowledge-management system / BSC correlations can be considered to be the characteristic values for establishing a meaningful knowledge-management - maturity rating scale.

5.4.2 Statistical Sub-framework 2: Verifying the knowledge-management -M based Metrics

From a general point of view, the here proposed knowledge-management assessment runs through two main steps: a (general-step 1) which asks people within the organizations to rate the knowledge-management S-lacks (or fail) levels and their own improvement expectations from a new combination of the available knowledge-management technologies (or otherwise from some more effective knowledge-management training program, or from an economic-based incentive system of the knowledge-sharing); and a (general-step 2) which compares the obtained ratings with a 'reference-data' and then estimates the same organization's knowledge-management-maturity level (i.e knowledge-management-maturity based ranking). And it finally ends by defining an appropriate (and related) knowledge-management S improving strategy.

As already said, such ranking can be statistically defined by computing the (ξ) values from a series of opportunely selected and verified subjects - as shown into the precedent paragraph. Coherently with the Study's basic aims defining such (ξ) values thus represents the way of making the knowledge-audit process produced information as operationally available to the knowledge-management system design phase; specifically, it makes it possible to obtain many very significant information about the knowledge-management maturity, and even more precisely about the needed knowledge-management system improvements to be implemented through different related combinations of the knowledge-management system key-factors - i.e. technologies, training activities and knowledge-sharing economic incentive system.

Therefore, to clearly illustrate such fundamental of the whole Model it is here-following described the analysis process through which the same Model has been entirely yielded by the above said second sub-frame, and specifically how such (ξ) values have been computed. This is described through the articulation indicated in the Tab below:

Tab5.8. Analysis Scheme of the knowledge-management S-IC/BSC Correlation Computing Process

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Statistical Model's Developing Framework - Sub-frame 2

2.1 First level: analysis of the (Λ) global values

2.2 Second level: analysis of the (Λ) partial values

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The knowledge-management assessment process main statistical scheme can be described as follows. All questions regarding both the knowledge-management system components and the achieved improvements as arising from the BSC scheme are to be requested to single people to be expressed by the same following 1-5 points rating scale indicated in the tab below:

Tab5.9 The knowledge-management system and BSC Rating Scales

- KMS lack or expected improvements w.r.t. Individual Capital	(Allowed Rates: 1-5)
- KMS lack or expected improvements w.r.t. Organizational Capital	(Allowed Rates: 1-5)
- KMS lack or expected improvements w.r.t. Networking Capital	(Allowed Rates: 1-5)
- Improvements in Organization's Learning and Growth	(Allowed Rates: 1-5)
- Improvements in Business Processes Efficiency	(Allowed Rates: 1-5)
- Improvements in Customer Satisfaction	(Allowed Rates: 1-5)
- Improvements in Economic and Financial Results	(Allowed Rates: 1-5)

Therefore, as collected all ratings provided from people operating within the organizations then the correlation computing process can start. So that, given the six arrays containing all people's ratings the correlations can be calculated and then organized by the following matrices.

Tab 5.10. The Main knowledge-management System-IC/BSC Correlation Matrices

1. Matrix [ξ]	- containing the correlations among the IC and BSC based ratings addressing the knowledge-management system support lacks;
2. Matrix [ϑ]	- containing the correlations among the IC and BSC based ratings addressing the knowledge-management System expected improvement from the three said knowledge-management -technology families;
3. Matrix [τ]	- containing the correlations existing among the IC and BSC based ratings addressing the knowledge-management system expected support from the knowledge-management training activities;
4. Matrix [ζ]	- containing the correlations existing among the IC and BSC based ratings addressing the knowledge-management System expected support from the knowledge-sharing incentive systems;

where each single matrix's component will represent the statistical correlation between a particular achieved BSC objective/goal and one of the knowledge-management system lack/expectation component as it is detailed described in the tab below:

Tab 5.11 The Constituting Elements of the Correlation Matrices

ξ ij = Corr [Li ; BSCj];	knowledge-management system lacks;
ϑ ij = Corr [Ti; BSCj];	knowledge-management system expected improvement from knowledge-management -technologies
τ ij = Corr [Ri; BSCj];	knowledge-management system expected improvement from knowledge-management training
ζ ij = Corr [Si; BSCj];	knowledge-management system expected improvement from KS incentive system;

these values will then individuate the statistical correlation existing between each i-*th* component of the organizations' knowledge-management S support and each j-*th* BSC targeted objective/goal. In particular, this will allow not only to better rate the knowledge-management system support lacks but also to understand whether the organization's intellectual capital can strongly or weakly contribute in achieving the objectives/goals through the knowledge-management system effect. And consequently that will represent a critical information about organization's knowledge-management-maturity and the related particular kind of improvement needed (e.g. whether a deeply based on a wider adoption of the more advanced knowledge-management technologies rather than on the strengthening of the knowledge-management training activities).

Given these set of correlations these will be computed the two levels of this analysis sub-frame 2 respectively regarding the global values and the partial values, as shown in the tab 5.8.

- Analysis Scheme 2.1 - Focus on the Global Values -

In order to define a clear and easy way of interpreting the correlation existing between the knowledge-management system and the BSC a global means will be calculated for each matrix as follows:

Tab 5.11 Global Values Extracted from the Correlation Matrices

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$\phi_1 = GM[\xi]$; $\phi_3 = GM[\tau]$

$\phi_2 = GM[\vartheta]$; $\phi_4 = GM[\zeta]$

==

The global values are addressing to the correlation that can be computed basing on the average level of each component of the KMS and BSC arrays; such values then provide a global measure of how-much can be considered to be strong the whole correlation among the knowledge-management system lacks/expected improvements and the achieved results in the organization. This still constitute a very basic estimate of the possibly existing link existing among the organization's knowledge-management system and performances because it must be kept in account that:

a - this is a statistical correlation which does not constitute a causal-effect relationship but only a certain measure of the own frequency in the related contemporary occurrences of both the BSC-related performances and the knowledge-management system rated lacks and expected improvements;

b - no particular links among the singular components of the BSC matrix and those of the knowledge-management system-ratings matrices are considered but only the general sum of both, and then this can be considered only as a global measure of correlation and not particularly specified within the BSC performances and the knowledge-management system ratings.

Anyway, such global sums can be considered as a meaningful estimate of the possible relationship existing between the knowledge-management system performances and the business performances of the organizations to be rated. And this is still important because it gives a first meaningful answer to the basic research-question of this Study - i.e. how to quantitatively estimate the supposed causal-effect relationship between the knowledge-management system and the organizations' business performances.

Since the value of each correlation coefficient can be varying from 1 to -1 this can be also used like range of all the above said means in order to rate all possible results by the same sub-range scale. In particular, since high values of the knowledge-management system / BSC correlation mean high knowledge-management maturity level of organizations the said scale can be constituted by the already recalled four sub-range scale (into the precedent paragraph) with a related way of interpreting the values of the correlations as below:

Tab5.12 Possible sub-ranges of the knowledge-management –Maturity based Ratings

Sub-range 1 (from +1 to + 0.5):	knowledge-management -maturity high level
Sub-range 2 (from 0 to + 0.5) :	knowledge-management -maturity low level - possible underestimate of the knowledge-management /BSC
Sub-range 3 (from - 0.5 to 0) :	knowledge-management -confusion low level (unlikely inverse correlation knowledge-management /BSC)
Sub-range 4 (from - 0.5 to -1):	knowledge-management -confusion high level (unlikely inverse correlation knowledge-management /BSC)

The first two sub-ranges only are characterizing those organizations where the knowledge-management system can be considered to be perceived and presumably used as an effective tool for exploiting the organization's intangible resources. Otherwise, a confusion-state can be individuated since opposite sign variations in BSC seem to be unlikely (either for the lacks of the knowledge-management system or the possible improvements). Negative correlations mean indeed that a lower effect on the BSC objectives/goals can be produced by a knowledge-management system-based increase in the organizations' intellectual capital and *vice versa*; however, that appears to be still unlikely unless the knowledge-management system is not assumed to take also negative effects on the organization and consequently contribute in decreasing its own objective/goal achievement. Where the correlations will present zero values then different factors rather than the knowledge-management system can be supposed to be critical or also decisive.

To define a knowledge-management-maturity based ranking of organizations a first estimate of the knowledge-management-maturity can be extracted by the formula below where two possible means (normal and weighted) of the above said global means are calculated:

$$\phi = 1/4 \, [\, \Sigma_j (\phi_j) \,]; \qquad j{:}1 \ldots 4$$

$$\Psi = \Sigma_j (\, w_j \, \phi_j \,) \,/\, \Sigma_{ij} (w_j); \qquad j{:}1 \ldots 4$$

where the indicated weights are computed by the LMV model which allows to consider at the same time a so-weighted combination of all the knowledge-management S key-components; then in this case also the LMV multi-criteria could be usefully applied to calculate the ϕ as combination of (ξ) (ϑ) (τ) and (ζ) and therefore that will thus represent the knowledge-management maturity level indicator: *knowledge-management–maturity* = Ψ

Basing on the possible values of this parameter as compared with the above said four-levels rating scale (see tab X) it can be defined the first knowledge-management-maturity based ranking proposed behind the knowledge-management assessment Model. And following from this it is also possible to individuate how to apply for each ranked subjects the possible related knowledge-management system improving strategy as already introduced into the precedent paragraph:

Tab 5.13 - Possible Combinations of the knowledge-management Key-Factors

KM -M Levels (Φ)	KM-Tech. (X_1)	KM-Training (X_2)	Knowledge-sharing System (X_3)
KM –Maturity *(High Level)*	Δ_0 / Δ_L	Δ_4 / Δ_L	Δ_5 / Δ_L
KM-Maturity *(Low Level)*	$2\,(\Delta_0 - \Delta_L)_2 / (\Delta_0 + \Delta_L)$	$2\,(\Delta_4 - \Delta_1)_2 / (\Delta_4 + \Delta_L)$	$2(\Delta_5 - \Delta_L)_2 / (\Delta_5 + \Delta_L)$
NO KM -Maturity *(Low Confusion)*	0.33	0.67	---
NO KM -Maturity *(High Confusion)*	0.50	0.50	---

where the values (Δ_L; Δ_0 - Δ_5) are respectively addressing the global means of the correlation matrices as in tab 5.13.

Those values will thus represent a way of making the information produced by the assessment process as operationally available to the knowledge-management S design phase: several possible comparison among the different values of the means and correlations within the sample will provide many very significant information about the knowledge-management maturity and even more precisely about the needed improvements to take to the knowledge-management system by using the knowledge-management technologies, the knowledge-management training activities and the knowledge-sharing economic incentive system by a different combination. Such improvements will address to the sample and will further represent the said "*reference-term*" against which to compare the single case's ratings in order to obtain a weighted means as better estimate of the needed variations to improve single case's knowledge-management system in a coherent manner with the detected lacks.

- Analysis Scheme 2.2 - Focus on the Partial Means

The above shown rating way of the organization's knowledge-management -M does not give however the possibility of analyzing how the knowledge-management S can affect each component of organization's IC, and then whether and how it can increase the organization capabilities of achieving the targeted objectives and goals. Therefore, the second analysis scheme of the [Θ] correlation's has been set in order to define a more detailed *Map of the (missing and expected) knowledge-management system support*.

By individually analyzing such correlation it is possible in fact to estimate how each intangible asset belonging to the IC (i.e. people, organizational roles/schemes, and networking) can be particularly active on giving the organization the capability of being effective through the knowledge-management system support for achieving each of the different kind of objectives and goals (i.e. the BSC related categories). And at the same time, it is also possible to estimate how strictly depending can be each BSC objective/goal-achieving on the knowledge-management system support taken to each of the IC components. In particular, each component of the matrices provides an estimate of the presumably causal-effect relations existing between a single knowledge-management S-IC component and a single BSC-component so that the organization whole auditing process can be supported by a more precise information or estimate regarding either how the IC components are affecting the achievement each BSC component through the knowledge-management system and *vice versa*.

In this case therefore given the above said matrices' components, the global means ($\phi - \Psi$) can be calculated per each component of the matrices as indicated below:

$$\phi_{ij} = 1/4 \, [\, \xi_{ij} + \vartheta_{ij} + \tau_{ij} + \zeta_{ij} \,];$$

$$\psi_{ij} = [\, w_1 \xi_{ij} + w_2 \vartheta_{ij} + w_3 \tau_{ij} + w_4 \zeta_{ij} \,] \,/\, \Sigma_{ij} \, (w_j) \, ;$$

where the same weights of the precedent means are used to calculate the weighted means. By using the above described four sub-ranges scale to rank the twelve components of these two matrices the organization's knowledge-management-maturity levels can be characterized further and more deeply.

A more specific information about the organizations' knowledge-management-maturity level can in fact be expressed by the two other groups of parameters that are, first :

$$\mu_i = \Sigma_j (\phi_{ij}); \; M_i = \Sigma_j (\psi_{ij}); \qquad i{:}1\ldots 3$$

indicating (respectively by the simple and weighted means) how the effect produced by each component of the knowledge-management S-IC is correlated to the BSC objectives/goals achievement, and second:

$$\nu_j = \Sigma_i (\phi_{ij}); \; N_j = \Sigma_i (\psi_{ij}) ; \qquad j{:}1 \ldots 4$$

indicating (respectively by the simple and weighted means) how the achievement of each of the four BSC components can be considered to be correlated to the whole effect produced by the knowledge-management S-IC. In that way a more precise indication is then provided regarding either how the business performances can be affected by each single IC's component through the knowledge-management S-action, and at the same time how the different perspectives of the business performances can be affected by the whole organization's IC through the knowledge-management S action.

Therefore, both can be coherently modified the organizations' knowledge-management -M estimate and the knowledge-management S-improving strategies. In particular, given then the above said two groups of parameters ($\mu - \nu$) that respectively estimate how each component of the knowledge-management system can be affecting the BSC performances, and how each component of the BSC performances can be affected by the knowledge-management system then it can be:

1. built two a double series of ranking of organizations basing on the two groups of parameters;
2. defined a related series of quantitative knowledge-management system improving strategies, based on the knowledge-management S-IC group of parameters;
3. defined a qualitative knowledge-management S improving strategy based on the BSC group of parameters.

Basing on each of the same parameters the subjects' organizations can be rated respectively using the first group (μ) as metric of a knowledge-management system based rating scale, and the second group (ν) as metric of a BSC based rating scale. In particular:

Knowledge-management system Rankings. Basing on the (μ) parameters this group of rankings can classify the organizations by the BSC-correlated effects of knowledge-management system on organization's IC components - i.e. individuals, organization, and external networks. This can then lead to specifically individuate where the knowledge-management system weaknesses are most effective and consequently where the improving actions must be mainly focusing on. By comparing the three μ-based rankings of each sample it is possible in fact to individuate which IC-component can be considered to be less supported by the knowledge-management system (lowest ranking) and the better (highest ranking).

BSC Rankings. Basing on the (ν) parameters this group of rankings can classify the subjects' organizations by the knowledge-management system related support provided/expected to each of the BSC performances; in particular, by comparing the four ν-based rankings of organizations it is possible to individuate where the knowledge-management S-IC effects are presumably most effective; specifically, for which of the four BSC objectives/goals the knowledge-management system support is arising to be most effective (highest ranking) or the less effective (lowest ranking).

As already said, both these groups of rankings are still important in order to extract the needed directions to define a knowledge-management system improving strategy. Specifically, basing on the possible values of the first one it can be extracted a knowledge-management system-improving strategies' plan still similar to that illustrated in the precedent paragraph. While basing on the second group it can be extracted a series of possible qualitative directions about the arising weaknesses of the knowledge-management system and the possible way of improving for better supporting the achievement of the different BSC objectives and goals.

- knowledge-management system Rankings Scheme -

Globally the three μ-based rankings can be outlined basing on the same structure of the precedent four sub-ranges scheme slightly changing the knowledge-management-maturity expression and the knowledge-management system-improving strategies' formula. Precisely, the three (μ_i) components are to be used as knowledge-management-maturity metrics, and the knowledge-management system improving strategies' formula are to be modified adding the parameters indicated below.

Tab. 5.14 Coefficients for Assessing the Knowledge-Management System

$(\delta_1)_i = 1/4 \sum_j (\xi_{ij}) (\text{KMS-IC}_i) (\text{BSC}_j)$ $\quad$ $(\delta_3)_i = 1/4 \sum_j (\tau_{ij}) (\text{knowledge-management S-IC}_i) (\text{BSC}_j)$

$(\delta_2)_i = 1/4 \sum_j (\vartheta_{ij}) (\text{KMS-IC}_i) (\text{BSC}_j)$ $\quad$ $(\delta_4)_i = 1/4 \sum_j (\zeta_{ij}) (\text{knowledge-management S-IC}_i) (\text{BSC}_j)$

where the three knowledge-management S-IC_i and the four BSC_j components are intended as the average values extracted from the samples.

Indeed, the δ-based parameters are defined as a certain weighted means of the (Λ) correlations that allow to contemporary keep in account the average effects of the BSC and the average effect of the knowledge-management system obtained ratings; each of these values provides in fact a more precise estimate of the *global-effect* of each knowledge-management system components on the business performances - than the estimate obtained as from the ($\mu - \nu$) parameters.

This below then represents the main scheme where the knowledge-management system improving strategies are described for all the three possible components of the knowledge-management system; there is intended that focusing the analysis on one of the three main component of the organization's intellectual capital (i.e. people, organizational structure, and external network) it is then possible to outline a related knowledge-management S improving strategy basing on the knowledge-management-maturity level as estimated by the (μ - M) parameters.

Tab 5.15 Possible Combinations of the knowledge-management Key-Factors in the knowledge-management

KM-M Levels ($\mu_i - M_i$)	KM- Tech. (X_1)	KM-Training (X_2)	Knowledge-sharing System (X_3)
KM -Maturity *High Level*	$(\delta_2)_i \,/\, (\delta_1)_i$	$(\delta_3)_i \,/\, (\delta_1)_i$	$(\delta_4)_i \,/\, (\delta_1)_i$
KM -Maturity *Low Level*	$\dfrac{2\,[(\delta_2)_i - (\delta_1)_i]_2}{[(\delta_2)_i + (\delta_1)_i]}$	$\dfrac{2\,[(\delta_3)_i - (\delta_1)_i]_2}{[(\delta_3)_i + (\delta_1)_i]}$	$\dfrac{2\,[(\delta_3)_i - (\delta_1)_i]_2}{[(\delta_3)_i + (\delta_1)_i]}$
NO KM -Maturity *Low Confusion*	0.33	0.67	---
NO KM-Maturity *High Confusion*	0.50	0.50	---

- BSC Rankings Scheme -

The final ranking-scheme is based on the possible values of the (ν) parameters, and provides a series of qualitative indications on how the knowledge-management system could be improved for better facing the lacks or weaknesses estimated with respect to the business performances. In particular, a number of general consideration have been considered to define such indications as indicated below:

- *Weaknesses in Learn and Growth*. A weak link arising between the knowledge-management S-IC effects and the organization's abilities in learning and growing could be mainly produced by the organizational lack of abilities in exploiting the knowledge-management technologies by a right use. This often happens when people is not knowing or not willing to use it correctly; then an improvement based on both the knowledge-management training activities and the knowledge-sharing incentive system should be the most effective in order to strengthen people's knowledge and willingness.

- *Weaknesses in Internal Processes*. In case of weaknesses in the knowledge-management system correlation with the efficiency of the internal processes it appears to be likely that the organizational infrastructures can be inefficient, and it is then likely that an organizational effort should be made in boosting the available knowledge-management technologies. A knowledge-management system improving strategy should then be based mainly on the technology but not only; this should be also containing a related part regarding the training activities since people's ability is still critical for proficiently adopting and using such technology.

- *Weaknesses in Customer Satisfaction.* Given the widely availability of highly specific knowledge-management technologies for supporting this organizational main function (e.g. CRM, business intelligence, etc.) this kind of weakness can be depending on people's ability or willingness of using such technology correctly; then, a related suitable knowledge-management system improving strategy should be focusing on the training activities and the knowledge-sharing incentive systems. The latter can be particularly important since the organizations' external relationships can often depend on the efficiency of the internal exchanges of knowledge: to be effective in providing services outside of the organization it is needed to efficiently exchange all relevant knowledge about the external actors and environment, and this makes the knowledge-sharing so important.

- *Weaknesses in Economic and Financial Results*. This possible weakness in the supposed causal-effect relationship between the knowledge-management system and the business performance still represent a critical issue because of the great complexity that characterizes the chance of making profits and then because of the hug series of suitable reasons (different than the knowledge-management system) that can still be effective in producing profits. Therefore, no particular focus on the here considered main knowledge-management system key-factors are proposed to define a specifically related knowledge-management system improving strategy.

5.5 Conclusions

A knowledge-management system constitutes a techno-organizational means expected to increase the business performances by acting upon the organization's intellectual capital; consequently to be designed in an effective way this requires a (quantitative) operational-based information about organizations' maturity: i.e. the organizational readiness in using the knowledge-management system basic components proficiently. Such information has to be provided by the knowledge-management assessment process in terms of a quantitative-based ratings that allow to define precise and operational-based knowledge-management system improvement strategies. To do this, such information must be specifically based on a series of rates addressing :

- the strength of the relationship between knowledge-management systems' performances and business performances;

- both the knowledge-management system actual lacks and the knowledge-management system expected improvements against the intellectual capital;

to be analyzed within an articulated rating scheme as it is proposed in the knowledge-management assessment Model.

Specifically, in such Model the ratings are based on the [Λ] correlation coefficients to be calculated among: (a) the knowledge-management system lacks/expected supports to the organization's IC, and (b) the business performances as resulting against the BSC scheme. By these ratings it is possible to estimate how-much the business performances of organizations can be considered to be *related* to their own abilities of proficiently use the knowledge-management system, and the *correlated* knowledge-management system modifications that must be implemented in order to increase the business performances.

As defined, the knowledge-management-maturity based metrics within a so performing Model can be verified through a two-steps test to be ran by: 1) grouping several very different subjects by a small number of homogeneous samples (step-1) and 2) calculating the characteristic values of the [Λ] correlation coefficients per each sample (step-2). Where significant differences will be occurring among each sample's characteristic values each other then the metrics can be considered to be a significant reference-term for rating the knowledge-management-maturity level of any other organization.

In conclusions, starting from the whole Study's basic assumptions this Chapter has specifically described the main parts constituting the knowledge-management assessment Model, and the statistical framework that has been set to test the same Model along the Study's experimenting phase. The next Chapter will then describe the entire knowledge-management assessment methodology which has been developed basing on the experimental outcomes and which constitutes the Study's core proposal.

Chapter 6
Characteristics of the Knowledge-Management Assessment Process

6.1 Introduction

As described in Chapter 5 the Study introduces such a new knowledge-management system analyzing particularly focusing on the role the knowledge-management systems can play within an organization through the IC; such role is here specifically addressed through the expected knowledge-management system functions by which the knowledge follows throughout the organization's IC components, and give support to all business processes. That is, the knowledge-management technologies, by one side, and the knowledge-management training activities and the knowledge-sharing incentive systems, by other side, are considered to be the core-parts constituting any knowledge-management system, and consequently the target-elements to be rated behind the assessment process of the knowledge-management system.

Following from that, the here proposed knowledge-management assessment methodology is then based on the pivotal-metric given by an estimate of the correlation occurring between the knowledge-management system performances and the business performances. So that once such correlation-based estimates have been found addressing a series of subjects' homogenous groups, and a reference-ranking has been consequently defined classifying such groups by their knowledge-management-maturity different levels, then any organization's knowledge-management-maturity level can be assessed by comparing its own knowledge-management system and the BSC-addressing rates with the characteristic values of each group into the said reference-ranking. Then the knowledge-management-maturity level of the target-organization can be estimated in terms of difference in the knowledge-management-maturity level with respect to the expected levels indicated into the same reference-ranking.

The knowledge-management assessment process is thus structured through two main steps: first, asking people within the organizations to rate the knowledge-management system lack (or fail) levels and their own improvement expectations from a new combination of the available knowledge-management technologies (or otherwise from some more effective training program focused on the knowledge-management activities, or from an economic-based incentive system of the knowledge-sharing). And second, comparing the organization-obtained final ratings with the 'reference-data' which can be (statistically) obtained as illustrated in Chapter 5.

Therefore, the implementation pathway of the here proposed knowledge-management assessment methodology is based on the main steps illustrated in the tab below:

Tab 6.1 KMS-Assessment Methodology's Main Steps

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Step 1: rating the KMS-IC Lacks and Expected Improvements by gathering information from people operating into the organization focused within the whole analysis;

Step 2: classifying the target-organization business performance by addressing the BSC Scheme;

Step 3: performing the comparison process among the [Λ] Correlation Systems for obtaining the KM-M based ranking for a single target-organization;

Step 4: defining the KMS improving strategies basing on the KM-M values

==

where in particular the last step comes to give the same methodology an operational-oriented approach. That follows the Study's main aim that is not only providing an analysis instrument of the knowledge-management systems (i.e. audit tool) but also outlining an effective method for defining the knowledge-management improvement strategies in a quantitatively related way with the audit-process outcomes.

This Chapter then describes the specific features of the proposed knowledge-management assessment methodology, and also how by running this produces the ratings of the organizations' knowledge-management-maturity and the related knowledge-management improving strategies.

6.2 Rating the KMS-IC Lacks and the Expected Improvements

By adopting the categories' first group the rating process focuses on the KMS efficiency in providing the right support at different levels throughout the organization. Following the recalled IC main structures in Chapter 3 it is here addressed in fact a specific kind of support that can be respectively individuated by three main classes: 1) support given to people in their individual tasks (here addressed as Individual Capital); 2) support given to the organizational structure by making the coordination processes and rules better run (here addressed as Organizational Capital); and 3) support given by sustaining and facilitating the coordination of the external relationships between the organization and its own partners, stake-holders, clients, suppliers, and so on (here globally addressed as Networking Capital).

Therefore, the basic scheme of all KMS-IC rating arrays is structured by the same three main classes of support that will be then addressed by three components in each rating-array; specifically, the elements belonging to the KMS-IC lacks rating-array are all to address the "missing-support", while those belonging to the KMS expected-improvement arrays are all to address the "support-expected-increase". The basic structure of all arrays is shown in the tab below :

Tab 6.2 Possible Ratings for the KMS performances

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- KMS-Efficiency in Supporting :

1. the Organization's Individual Capital (e.g. personal knowledge, skills and abilities)

2. the Organization's Structural Capital(e.g. coordinated working groups)

3. the Organization's Networking Capital (e.g. formal relations with partners, stakeholders, clients, etc.)

==

To effectively compare the lacks-addressing ratings with the expected-improvement-addressing ones it has been necessary to define a framework based on an uniform rating scale; in particular, as already said in Chapter 5 it has been used a 1-5 points rating-scale which is shown in the tab below:

Tab 6.3 KMS Rating Scales

==

- KMS Lack of Support to Individual Capital .... Possible Rates: 1-5
- KMS Lack of Support to Organizational Capital .... Possible Rates: 1-5
- KMS Lack of Support to Networking Capital .... Possible Rates: 1-5

- KMS Expected Improvements in Support to Individual Capital .... Possible Rates: 1-5
- KMS Expected Improvements in Support to Organizational Capital .... Possible Rates: 1-5
- KMS Expected Improvements in Support to Networking Capital .... Possible Rates: 1-5

==

where the values 1-5 are individuated in terms of different levels of efficiency regarding certain KMS functions that are considered to be needed to realize the entire knowledge life-cycle (see Chapter 2). Precisely, any rate is addressing a number of KMS functions perceivable to be efficiently provided by the KMS. Indeed, this kind of rating scale makes no difference among the KMS functions because it is here assumed that a KMS must provide efficiently all these functions in order to be considered to be fully efficient.

The following tab indicates the KMS main functions that are here considered to be realizing the knowledge life-cycle :

Tab 6.4 KMS basic Functions realizing the Knowledge Life-cycle

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- "Create-Knowledge" KMS Functions -

These are referring to those functions supporting any explicit-knowledge creation process: process making available the new knowledge differently generated at individual level (by training, learning by doing, problem solving, etc.) and at social level (by the communities of practice, the project teams, etc.) but not-usable as embedded in human-beings or also in huge amount of structured, semi-structured and unstructured data and information. Specifically such functions perform the "knowledge-capturing" by questionnaires, lessons learning writing, best practices writing, etc. and the "knowledge-discovery" by classification methods, content management, information retrieval, reasoning, etc.;

- *"Memorize-Knowledge" KMS Functions* -

These are functions performing either the knowledge extraction and acquisition from the several different sources throughout the organization as well as the saving in fully and easily accessible databases; in particular, these can be based on complex representation methods like the ontology-based methods, the workflow management functions and also on wrapping, crawling, data warehousing techniques, etc.

- "*Distribute Knowledge" KMS Functions* -.

These are intended as those functions performing the knowledge distribution to the organizational knowledge workers at all levels throughout the organization. Two main approaches are specifically addressed in implementing such functions: the stock-approach, based on the document distribution from/to databases; and the flow-approach, which is based on the knowledge-sharing by synchronic and asynchrony communication system, chat, forum, blog, etc.;

- "*Apply Knowledge" KMS Functions* -

These support the use of the codified knowledge in the business processes everywhere it is required; specifically, these are based on complex systems like the business intelligence, the decision support systems, the customer relationship management systems, etc.

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Of course, while rating the KMS against the above said three main IC components these KMS-functions must be considered to be specifically addressing the same IC-component to be rated; e.g. while rating the KMS-lack of support to individual capital the above KMS-functions must be considered exclusively addressing the individual support those can be providing either in form of knowledge creation, memorization, distribution and application.

That is, each array element contains a single rate respectively addressing the KMS support status in terms of lacks or expected improvements behind the 1-5 range, and that specifically expresses the perceived lack of or expected improvement in the KMS-functions against one of the three main IC component.

6.2.2 The KMS-IC Components

The first of the four [KMS-IC] arrays is the [L] Array, and this particularly rates the possible levels of the lacks perceived in the KMS support as indicated below :

- **[L]**: containing the ratings addressing the "KMS support lack" (i.e. *KMS Gap*) as needed for exploiting and increasing the value of the three main components of the IC - i.e. Individual Capital, Structural Capital and Networking Capital;

Tab 6.5 Rating Specific Question

==

" ... What is the KMS Efficiency in Supporting the Organization (and Exploiting the Intellectual Capital)? ..."

or in other words :

" ... What is the KMS efficiency in providing knowledge to individuals, organization and networks? ..."

==

the specifically related rating-scale is expressed behind the basic 1-5 range where the level 1 indicates that none of the KMS functions is efficiently provided by the KMS while the level 5 indicates that all KMS functions are efficiently provided and then the KMS can be in that case considered to be fully efficiently performing. The Tab below clearly illustrates the addressed meaning by each rate:

Tab 6.6 Rating Scale (Legend)

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1. *Very-Low Efficiency / Very-High Lack* - None of the KMS basic functions is efficiently provided (respectively considered at individual, organizational, or networking level)
2. *Low Efficiency / High Lack* - Only One of the KMS basic functions is efficiently provided (respectively considered at individual, organizational, or networking level)
3. *Medium Efficiency / Medium Lack* - Only Two of the KMS basic Functions are efficiently provided (respectively considered at individual, organizational, or networking level)
4. *High Efficiency / Weak Lack* - Only Three of the KMS basic Functions are efficiently provided (respectively considered at individual, organizational, or networking level)
5. *Very-high Efficiency / NO Lack* – All KMS basic Functions are efficiently provided (respectively considered at individual, organizational, or networking level)

==

The five other rating-arrays addressing the possible levels of expected KMS support increases are structured by the same pattern either in the scheme and in the rating-scale meaning; these are specifically indicated below starting from the KMS-IC expected improvements from the KM technologies through the others:

- **Array [T_1]** : containing the ratings addressing the expected KMS support increase from the KM-Technology Family 1 which is specifically intended as the technology for managing the explicit knowledge under structured forms: i.e. *Database, Data Warehouse and OLAP, Knowledge Discovery in Data (Data, Web, Log, Usage, Mining)*;

- **Array [T_2]** :containing the ratings addressing the expected KMS support increase from the KM-Technology Family 2 which is specifically intended as the technology for managing the explicit knowledge under unstructured and/or semi-structured forms: i.e. *Natural Language Processing, Information Retrieval, Knowledge Discovery in Text (KDT), Document and Content Management, Case Based Reasoning;*

- **Array [T_3]** : containing the ratings addressing he expected KMS support increase from the KM-Technology Family 3 which is specifically intended as the technology for managing the tacit knowledge: i.e. *Knowledge Acquisition Applications, Communication Collaboration System, Group-ware, Adaptive Systems and Multimode and Multichannel Interfaces;*

- **Array [R]**: containing the ratings addressing the expected KMS support increase from the KM training activity;

- **Array [S]** : containing the ratings addressing the KMS expected support increase from the knowledge-sharing economic incentive system;

The scales addressed to rate the above said categories into the Arrays (T-S) are very similar in their structure; in particular, by the *rate 1* (min. in the range) a situation of no expectation is individuated against any of the four main KMS functions, while by the *rate 5* (max. in the range) a situation of very-high expectations is individuated against all of these. And that is for each intermediate rate of each array. So that the possible expectations of KMS improvement vary then, for each array, behind the same 1-5 range matching five intermediate and perfectly analogous levels. The expected improvements either from the technology, from the KM training activities and the knowledge-sharing incentive system can be hence rated behind the same range where the "no-expectation-rate-1" and the "very-high expectations-rate-5" respectively individuate the maximum and the minimum of each key-factors-based rating scale.

In the tab below it is only indicated the rating-scale specifically addressing the KMS expected improvement from the adoption of the KM technology family-1:

Tab. 6.7 Rating Scale (Legend)

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1. NO Improvement Expected - None of the KMS basic functions can be more efficiently provided by adopting the KM-Technology 1 (respectively considered at individual, organizational, and networking level)

2. Low Improvement Expected - Only one of the KMS basic Functions can be more efficiently provided by adopting the KM-Technology 1 (respectively considered at individual, organizational, and networking level)

3. Medium Improvement Expected - Only two of the KMS basic Functions can be more efficiently provided by adopting the KM-Technology 1 (respectively considered at individual, organizational, and networking level)

4. High Improvement Expected - Only three of the KMS basic Functions can be more efficiently provided by adopting the KM-Technology 1 (respectively considered at individual, organizational, and networking level)

5. Very High Improvement Expected - All KMS basic Functions can be more efficiently provided by adopting the KM-Technology 1 (respectively considered at individual, organizational, and networking level)

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Mutatis mutandis the expected improvements from the other key-factors are to be rated by different levels behind the same scheme.

Once all ratings are collected and the related above said arrays are complete the analysis of the ratings can start and then proceed by the above said main steps.

6.3 BSC Scheme for classifying by business performances

As already illustrated in Chapter 5, since the Study attempts at verifying whether a certain correlation exists between the KMS performances and the business performances of those organizations where the KMS is running the KMS-A model is structured to compare the KMS-ratings with the business performances levels. That is, because of the often huge spectrum of different objectives and goals normally targeted the BSC model is set behind the KMS-Assessment to effectively reduce all considerable organizations' objectives and goals to a small number of meaningful classes.

The organizations' objectives and goals are then represented behind the KMS-A through the main categories proposed into the Kaplan's and Norton's scheme of balanced scorecard (1996; 2001) as : 1) the learn and growth (of the organization); 2) the efficiency of the business processes; 3) the customer satisfaction; and the 4) the economic and financial results.

Tab 6.8 BSC based Rating Scales

BSC 1 - Organization's Learning and Growth	Possible Rate: 1-5
BSC 2 - Efficiency in the Business Processes	Possible Rate: 1-5
BSC 3 - Customer Satisfaction	Possible Rate: 1-5
BSC 4 - Economic and Financial Results	Possible Rate: 1-5

As said in Chapter 5 such classification is proposed to lie the same perspectives through an objectives-achievement-chain which proceeds from the first-one towards the others (Kaplan & Norton; 2001): by achieving good results in learning and organizational growth it will be likely to realize efficiencies in performing the business performances; and similarly, that will make likely satisfying the customers, and that will make likely to achieve good economic results. This characteristic of such scheme makes these perspectives however considerable with exclusive regard to the private companies since these only can be considered to pursue the profit while the public agencies are pursuing the social welfare as well as the nonprofit organizations.

Then, partially based on the indicators suggested in Kaplan's and Norton's scheme a number of precise parameters has been hence individuated with specific regard to the said main groups of possibly considerable subjects: (a) the private companies; and (b) the public or nonprofit organizations.

Specifically, the main selected parameters to be used for rating the BSC based performances are indicated in the tab below.

Tab 6.9 BSC based Rating Parameters for Private Companies

- *Learn and Growth Perspective* -	
Parameter 1 : % IT expended on Training / IT expenses	Possible Rate : 1-5
Parameter 2 : Investment in new product support and training	Possible Rate : 1-5
Parameter 3 : % Revenues from new (or innovative) products	Possible Rate : 1-5
Parameter 4 : % Projects measured using the recognized methods	Possible Rate : 1-5
- *Process Efficiency Perspective* -	
Parameter 1 Repair Cost Ratio	Possible Rate : 1-5
Parameter 2 Defect Ratio	Possible Rate : 1-5
Parameter 3 Testing Proficiency ratio	Possible Rate : 1-5
Parameter 4 Application support rate	Possible Rate : 1-5
(Parameter 5: Duration delivery rate)	Possible Rate : 1-5
(Parameter 6: Application maintenance per person)	Possible Rate : 1-5
- *Customer Satisfaction Perspective* -	
Parameter 1 Market Share	Possible Rate : 1-5
Parameter 2 % Service Level Agreements met	Possible Rate : 1-5
Parameter 3 % IT solutions supporting process improvement projects	Possible Rate : 1-5
Parameter 4 Defect Ratio	Possible Rate : 1-5
Parameter 5 Application reliability..	Possible Rate : 1-5
- *Economic and Financial Results Perspective* -	
Parameter 1 % Revenues	Possible Rate : 1-5
Parameter 2 % Revenues from new customers / total revenues...	Possible Rate : 1-5
Parameter 3 % Total Profits	Possible Rate : 1-5
Parameter 4 Total Costs	Possible Rate : 1-5
Parameter 5 Cash-flows	Possible Rate : 1-5
Parameter 6 Sales - ROS Return on Sales	Possible Rate : 1-5
Parameter 4 Total assets (FSAV) / # of employees	Possible Rate : 1-5
Parameter 8 ROI / ROE	Possible Rate : 1-5

while in the next tab these are indicated the BSC ratings possible values and their related meaning in terms of possible decreases, stationary and increases against each of the considered parameters.

Tab 6.10 Possible Scores of the BSC based Rating Parameters for Private Companies

1 - Decreases
2 - Stationary (no Increase higher than 5%)
3 - Low Increases (5-15%)
4 - Medium Increases (15-40%)
5 - High Increases (over 40%)

Here is following the analogous BSC based scheme containing some of the available parameters to rate the BSC performances for a public or nonprofit organization:

Tab 6.11 Possible Scores of the BSC based Rating Parameters for Public and Nonprofit Organizations

Learn and Growth	
Parameter 1 : % IT expended on Training / IT expenses	Possible Rate : 1-5
Parameter 2 : Investment in new product support and training	Possible Rate : 1-5
Parameter 3 : % New Services Created / All Services Provided	Possible Rate : 1-5
Parameter 4 : % Empowerment of Employees	Possible Rate : 1-5
Internal Processes (Efficiency)	
Parameter 1 Repair Cost Ratio	Possible Rate : 1-5
Parameter 2 Defect Ratio	Possible Rate : 1-5
Parameter 3 Testing Proficiency ratio	Possible Rate : 1-5
Parameter 4 Application support rate	Possible Rate : 1-5
Incumbent Costs	
Parameter 1 : Yearly Budget Availability	Possible Rate : 1-5
Parameter 2 : Extra Budget	Possible Rate : 1-5
Parameter 3 : Service Total Value / # Employees	Possible Rate : 1-5
Parameter 4 : Return on Investments / Return on Budget	Possible Rate : 1-5

Given the deep heterogeneity of the parameters within the above said BSC rating schemes, no meaningful information can be extracted from there without a weighted systems for normalizing the BSC performance ratings based on such parameters. Indeed, to significantly compare different organizations basing on their

BSC performances through this parameter schemes an opportune weight systems must be applied to balance the so potentially very different ratings addressing the subjects (as based on different parameters).

6.4 Comparison with [Λ] and rating the KM-M

As already introduced in Chapter 5 the correlation Matrices [Λ] still constitute the core of the KMS-A Model. These make it possible in fact to obtain such an estimate of the supposed *lien* existing between the KMS impact on the organization's IC and the organizational global capability of achieving the targeted objectives and goals (in other words of performing well). And this is then expressed through the possible values of the so called *organizational KM-M level*.

In particular, the [Λ] Matrices are recalled in the tab below:

Tab 6.12 KMS-IC / BSC Correlation Matrices

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Matrix [λ] :	addressing the KMS support lack
Matrix [θ1] :	addressing the KMS support increase as expected from the KM-Technology 1
Matrix [θ2] :	addressing the KMS support increase as expected from the KM-Technology 2
Matrix [θ3] :	addressing the KMS support increase as expected from the KM-Technology 3
Matrix [ρ] :	addressing the KMS support increase as expected from the KM-Training
Matrix [ζ] :	addressing the KMS support increase as expected from the knowledge-sharing incentive system

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where the expected improvements from the three KM-Technology families are individually expressed by three specific matrices, while in the precedent schemes (see Chapter 5) only one synthetic Matrix [ϑ] has been recalled. The synthetic Matrix's components are in fact calculated as arithmetic means of the three singular matrices by this formula:

As extracted from the series of combinations of these values illustrated in Chapter 5 the KM-M levels provide a metric to estimate *how-much* the organization performances can be considered to be depending on the KMS performances or in other words what progress the same organizations can be considered to have made in the KMS development.

Basing on such metric a series of specific *KM-M ranges* can be defined to rate any organization by individuating its position against one of such ranges' values. The KM-M possible levels have been then organized, as in Chapter VI, by four main ranges of KM-M based estimates; so that one organization's KM-Maturity status is individuated by a positive correlation occurring between the KMS-performances and the BSC performances while its global KM confusion-status is individuated by negative values occurring in the same correlation. Even more specifically, two KM-M status - i.e. KM-M high-level and KM-M low level - are then individuated by two coherent sub-ranges by which the more advanced organizations can be distinguished from the less ones.

One organization's KM-M can be then assessed against the so defined KM-M ranking that is specifically shown in the tab below:

Tab6.13 KM-M based Ranking

- KM-M Estimates behind [1:0.5]	KM-M High Level *full exploiting the KMS-IC/BSC correlation*
- KM-M Estimates behind [0:0.5]	KM-M Low Level *possible underestimating the KMS/BSC correlation .*
- KM-M Estimates behind [- 0.5:0]	KM-Confusion Low Level *unlikely inverse KMS-IC/BSC correlation*
- KM-M Estimates behind [- 1: -0.5]	KM-Confusion High Level *unlikely inverse KMS-IC/BSC correlation*

Therefore, following the here proposed KMS-A Model one organization's KM can be assessed by ranking the same organization's KM-M level against the above shown ranking. After that, the possible KM-M gap of such organization can be then estimated specifically against the KM-M advanced level; such gap also constitutes an estimate of the KMS support increase that must be achieved by a KMS improving strategy. In other words, the KM-M high level must be considered as the target of any organization in the KM development. So that once the gap existing between one organization and those more advanced in the KM is known this has to be faced by defining a coherently related KMS improving strategy whose objective is given by the KM-M more advanced level.

From an operational point of view, the [Λ] correlation characteristic values of any KM-M level can be used as a weight system in order to estimate the single case's ratings and also to "weight" the variations in the KM technologies, the KM training activities and knowledge-sharing incentive systems that are to be implemented to bridge the lacks of the KMS in an operational way - to keep later about the KMS improving strategy).

6.5 Defining the KMS Improving Strategy

In conclusions, as the rating phase of the analysis will have detected the level of KMS support lack of a single subject (as indicated in the correlation matrix) this process will provide a KMS improving strategy in terms of KM technology, KM training activity and knowledge-sharing incentive system, all combined basing on the correlation level which is expected to be existing between the Intellectual Capital of the organization and all its own targeted objectives and goals.

The tab 6.14 shows the specific coefficients giving the quota of each suitable KMS improving strategy.

Tab 6.14 Possible Combinations of the knowledge-management Key-Factors in the knowledge-management

KM-M Levels KM M	KM- Tech. (X_1)	KM-Training (X_2)	Knowledge-sharing System (X_3)
KM -Maturity *High Level*	$\frac{(1-\theta)}{[(1-\theta)+(1-P)+(1-Z)]}$	$\frac{(1-P)}{[(1-\theta)+(1-P)+(1-Z)]}$	$\frac{(1-Z)}{[(1-\theta)+(1-P)+(1-Z)]}$
KM -Maturity *Low Level*	$\frac{K1 = \sqrt{(\Lambda-\theta)^2 / 2(\Lambda+\theta)}}{[K1+K2+K3]}$	$\frac{K2 = \sqrt{(\Lambda-P)^2 / 2(\Lambda+\theta)}}{[K1+K2+K3]}$	$\frac{K3 = \sqrt{(\Lambda-Z)^2 / 2(\Lambda+\theta)}}{[K1+K2+K3]}$
NO KM -Maturity *Low Confusion*	0.20	0.40	---
NO KM-Maturity *High Confusion*	0.50	0.50	---

The above indicated coefficients have been defined by each sub-range indicating different levels of the knowledge-management maturity of organizations so that in the case of the lowest levels of maturity the organization must be very far to develop an effective system and then requires a strategy which is based on the technologies and the training at the same weight. That means that the latest organizations should be improved in their own knowledge-management systems by strengthening their own technological infrastructures and then the human capabilities in using such instruments.

In case of the second groups of late organization rated within the sub-range indicating low confusion the KMS improving strategy is suggested by an effort which is slightly higher in the training activities. That is because it can be more easily occur the case of one organization which is still provided with an effective (and highly expensive) technological infrastructure but has not yet developed the needed capabilities for using such instruments in a proficient way. And then most of the KMS strategy of improvement should focus on the training activities.

In the case of low level of maturity in the knowledge-management systems the strategy for improving is defined on a square-based relationship which lies the values addressing the correlation in the efficiency with those addressing the correlation in the expectations. That is in order to make such difference in values less important in distributing the effort of the whole strategy for improving the KMS.

In the case of the highest performing organizations the efforts by which to base the KMS improving strategy are defined in order to make just one of them preeminent on others: where the expectation is lower there is to be focused the most the same effort of the improvement strategy.

6.6 Conclusions

The here proposed knowledge-management assessment process is based on the statistic correlation that can be calculated on a sample of meaningful subjects addressing the ratings of the knowledge-management system, by one side, and the ratings of the business performances of the same organizations, by other side. That gives then an estimate of the relationship which lies the impact on the intellectual capital of one organization produced by the action of the knowledge management system and the improvement of the same organization in terms of better business performances.

In particular, to conduct the said rating of both the business performances of one organization and its own knowledge-management systems it is here proposed a rating scheme which respectively uses a set of parameters based on the balanced-scorecard to rate the business performances, and a combination of parameters based on the intellectual capital of one organization to rate the performances of the knowledge-management system. That is, the correlation between such ratings can give the said estimate of the possible impact of the knowledge-management system on the intellectual capital that yields an improvement of the organization business performances.

The said correlation makes it possible to estimate the maturity of a knowledge-management system against a range of possible values individuating the badly-performing knowledge-management systems where the values of such metric are under zero and the well-performing knowledge-management system where the values of the said metric are above zero.

Once a knowledge-management system has been estimated in its maturity it is possible to use the same metric to define a quantitative improving strategy of the same system which is given by a combination of coefficients addressing the knowledge-management technologies, the training activities and the knowledge-sharing incentive systems by which to implement the same strategy.

Chapter 7
Preventive Analysis of the Subjects

Premise to the Study's Third Part

By this Chapter it opens the Third Part of the Study specifically regarding the experimental phase of the whole research. This is organized by three Chapters: the first, Chapter 8, provides a global description of all subjects involved from both the private and public fields; the second, Chapter 9, illustrates the empirical tests of the KMS-A and the verifying process; and finally the third, Chapter 10, contains a wide discussion about the entire developed research and presents the final results and the possible perspectives for the futures next steps.

The Study's empirical part was developed basing on two main groups of subjects that, coherently with the Study's basic aim of conducting a compared analysis, were selected among private enterprises and public administration bodies. A number of big and small knowledge-intensive organizations were then selected among private enterprises to create the first group, on one hand; while a number of public administrations bodies, public agencies, national research centers and international organizations were collected to create the second group on the other side. It was needed to this extent to conduct a wide selection of different subjects in order to meaningfully represent either the private sector and the public administration as both sectors are populated by a great number of subjects that can be considered to be very different against their presumable KM maturity levels.

As already introduced in the Second Part in fact such two samples of subjects were collected to test the new KM-M based metrics proposed by this Study. In particular, the several different subjects here selected were analyzed to individuate those to be associated to the reference-terms of the same KM-M based metric; the positive exit of the test allowed in fact to consider the characteristic values of such subjects as the top and the bottom extremes of a continuum of intermediate possible measures that defines the same KM-M based metric's scale. Therefore, a number of different organizations in size and scope were then selected from both the private and the public fields, and then a preliminary analysis of these was conducted globally focusing on a number of meaningful factors regarding the KM activities and the KMS key-factors (i.e. the KM technologies, the KM training and the knowledge-sharing incentive systems).

A certain new contribution is here taken in fact to the rankings of the possible knowledge-intensive organizations by modifying the assessment based criteria and also by extending this analysis to a greater number of organizations.

The empirical framework of the Study is then described into the Third Part by the following structure:

- general overview of subjects' groups	(Chapter 7)
- preventive analysis of the subjects	(Chapter 8)
- [Λ] computing based analysis	(Chapter 8)

7.1 Introduction

In this Chapter it is presented a general overview of the subjects focused on a series of main features of their KMSs basing on which several targeted-interviews were conducted to the representatives of each involved organization. Such interviews allowed not only to assist people while fulfilling the rating-grids used into the second part of the analysis but these also allowed to gather all further information used to describe the whole organizational context. Two main objectives were then targeted by interviewing such representatives: first, to analyze the internal context of those organizations gathering descriptive information about the above said issues in order to more easily interpret the ratings obtained from them; and second, to take a direct support to the general analysis of the subjects (see Chapter 5) with respect to the possible main differences existing among the subjects and specifically among those selected from the private sector with those selected from the public sector.

As said a number of different organizations were selected either in the private sector and in the public one and one representative of each was interviewed; then, the main differences among the analyzed subjects as arising from such interviews are here collected and briefly discussed per each group which is listed below:

Tab 7.1 - Organizations Participating in the Experimenting Phase

Group A - Private Subjects

- a. small firms operating as software factories and consulting companies;
- b. big consulting companies mainly operating in the ICT field;

Group B - Public Subjects

- c. Italian public Agencies: i.e. Inps, Agenzia Dogane, ETR;
- d. Italian public administration bodies - i.e. Ministry of Economy, Province PA, Region PA;
- e. International Organizations – i.e. World Bank, Inter-American Development Bank

The analysis of each of the above indicated group is described in the Chapter as it was conducted basing on some critical basic-dimensions of the KM initiatives carried out by the same subjects: 1. the KM goals and objectives; 2. the main types of knowledge to be managed; 3. the main sources and consumers of knowledge; 4. the main KM processes involved; 5. the KM Methodologies employed; and 6. the KM Technologies used. Basing on these issues it was then easier to illustrate how the private subjects arose to be more advanced in the KM development with respect to the public ones, and further it was easier to highlight the particular differences characterizing the sub-groups of subjects within the same groups. By this way in fact it was possible to individuate the critical issues that make the worldwide consulting companies be considered as the most advanced in the KM - e.g. highest coherence between targeted and achieved objectives, strongest effort in making all people fully aware about the importance of bearing the KM throughout the organization. At the same way it was possible to individuate the most late organizations in the KM advancement as resulted to be the local and central bodies of Italian PA where a weak clarity of intents is arising about the KM against a poor technology-based approach which is expected to be enough for improving the document flows.

What the Chapter further does by comparing those organizations is to highlight how the different there applied KM methodologies and technologies can be considered to be coherent with and then revealing of the deeply different consideration and awareness those organization have about the same KM. Using different methodologies and technologies for implementing the KM means in fact to have different expectations of possible benefits from the KM and consequently that leads to produce a less effort to keep the whole organization strongly involved in the KM implementation not only by spreading useful technologies but also making people act in a coherent way for making those technologies proficiently perform to achieve the KM.

After provided a global description about the selection process of the subjects and a very synthetic collection of the first arising evidence from this analysis this Chapter then describes each group of subjects by analyzing the main said critical basic-dimensions of the KM initiative already implemented or just in progress.

7.2 General Overview about the Subjects

This part of the analysis was conducted on the selected subjects to explore: i) the main possible differences among the two sample of these against six particular (above said) dimensions; ii) whether some great difference in KM can be found between the organizations selected in the public sector and those from the private sector; and iii) the possible main methodologies applied in both cases to implement the KM projects. The analysis is then entirely based on the terminology used within each organization as resulted from both the direct interviews conducted and the rating-grids submitted.

Some further item was explored along the interviews because of particular importance against the global development of the KM activities achieved and targeted by the subjects. Here follows the list of such items:

Tab 7.2 - General Elements of the Interviews Conducted along the Experimenting Phase

1. KM Main Activities
2. KMS Status-quo and Planned Improvements
    - 2.1 KMS-IC support lacks
    - 2.2 KMS-IC support expected increases
3. Possible relationships between KMS and organization's performances

Such items allowed to deep the knowledge acquired along the analysis about the whole KM activities carried-out within the subjects and specifically the main differences occurring among these; the following description provided in this Chapter about the main subjects' groups has been in fact outlined basing on the feed-backs obtained addressing such items. A particular importance was further given along the interviews on the possible relationships between the performances of the KMSs and the organizations' business performances as these are perceived from the same interviewed people; as this represents a very critical point of the whole Study it was focused by both the rating-based analysis and the interviews-based.

The subjects were selected attempting at maintaining a wide and balanced representation of both sectors, private and public. As for the private two groups of subjects were basically selected: the first consists of small software factories operating in the Cosenza area (Southern Italy) while the second consists of big consulting companies operating worldwide in the ICT sector. These particular kinds of subjects were selected for two main reasons: first, their high level (organizational) competencies in the closest technologies to the KM (i.e. ICTs) and second, the intangible nature of their outcomes (i.e. consultancy and software). For such reasons it was possible to considered these subjects to be presumably the most advanced in the development of the KMSs. Below is following the list of all subjects that participated in the experimenting phase of the Study.

Tab 7.3 - Private Organizations Participating in the Experimenting Phase

Group A - Small SW Factories	*Group B - Big Consulting Companies in ICTs*
1. ID-Technologies	9. Tim
2. Tematica Ltd.	10. Ericsson Italia
3. Pitagora Inc.	11. Siemens Italia
4. Step Ltd.	12. Microsoft Italia
5. AVR Technologies	13. Accenture
6. VP-Tech	14. Value Partner Spa
7. Infoteam	15. Finsiel Italia
8. CM-Sistemi / Confor AGE	16. Carisiel (Finsiel Group)
	17. Intersiel (Finsiel Group)
	18. BPU Banca Popolare di Bergamo

As for the public administration bodies the selection process was led by the will of covering as possible the wide spectrum of the different classes of PA bodies existing either in Italy and abroad. To this three main groups of PA Institutions were considered at the beginning to be involved: the local and central Italian PAs, the Italian Public Agencies, and the international organizations. Along the Study it was then noticed that the national public research centers could be considered as a particular interesting subjects to this extent because of their basic non-profit intrinsic nature and the average high level of specific competencies held in the ICTs and the most modern technologies. That is the fourth group of subjects was added by selecting a number of public research centers. The list of all public subjects that participated in the empirical phase of the Study is following.

Tab 7.4 - Public Organizations Involved in the Experimenting Phase

Group A	*Group B*
1. Cosenza Province Public Administration	10. University of Calabria (IS)
2. Catanzaro Province Public Administration	11. ICAR / CNR
3. Calabria Region - Office of Tourism	12. CIES / University of Calabria
4. Ministry for Economy - Province Directorate of Special Services, Vibo Valentia	13. CRATI / CNR
Group C	*Group D*
5. Agenzia Dogane	14. World Bank (Development Communications Division in Operations)
6. INPS	15. The Inter-American Development Bank (IT/SDS)
7. ETR Agencies for Taxes	16. European Agency for Environment
8. ASI Garbagnate Healh Care Public Agency	
9. Cosenza Healthcare Public Agency	

For each case a number of rating grids were submitted at various levels of the organization and then an interviewed was taken with a representative of the same organization. Precisely, as for the software factories from the Cosenza area the interviews were conducted directly with their CEOs while one project manager was interviewed for each of the involved big consulting companies. At the Italian local and central PAs as well as at the public research centers and the Italian public Agencies the interviews were conducted with the officers in charge of the internal ISs; and finally the interviews were conducted to the chief officers of each international organization involved. The full text of the interviews just constitutes the basic track followed along each interview which indeed involved further different issues whose main elements have been used to outline the whole description here following.

Such description only presents the main elements regarding the KM and does not pretend to be an exhaustive examination of the KM activities carried out within each organization. Anyway, it can be remarked to this extent that the basic vagueness actually addressing the KM into the literature (Boutillier, Shearer; *ibidem*) makes it also difficult to be fully confident about the extent of any possible review of the KM in any organization (that is indeed fully coherent with the same aim of this Study: to outline some tentatively objective criterion for assessing the KM maturity).

As for the main goals and objectives these greatly vary from one organization to another but they all have in common the idea of increasing knowledge sharing. From a general point of view the most important objective of the private sector organizations seems to be the sharing of both knowledge-creation and knowledge-application while in the PA organizations the main objectives lies in the management of a single part of the national knowledge-heritage consisting of public documents and official Acts. In the international organizations the knowledge sharing still represents the first objective of the KM but seems to be mainly focused on the distribution of official documents.

A basic difference between private and public organizations is created by the same structure of the business processes that is more frequently project-oriented in the private subjects and function-oriented in the public ones. That makes in the first case a high aggregate of knowledge be produced along the whole development of every project by accumulating several different pieces of knowledge generated by different people who then share *de facto* the same aggregate of knowledge - i.e. the project-team members. Very different is instead the case of the local and central PA bodies or the public agencies where every a single officer is in charge of a particular function and then the organizational knowledge is mostly yielded by a creation process that is limited to such officer only; further, the access to the DBMSs is often structured by several differently allowed levels. Such elements limit then the chances of sharing knowledge among the organization members. That is why methodologies or favoring the sharing of tacit knowledge by making people working together or interacting in the workplace - i.e. communities of practices - are more quickly growing in the private subjects.

Here following is shown a synthetic frame of the main goals and objectives as found in the analyzed subjects.

Table 7.5 - Comparison of goals and objectives in the analyzed subjects

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Private Sector

Small Software Factories from Cosenza Area
- To maintain the exact memory of any project development
- To favor the project-knowledge memorization by standard modules
- To favor the knowledge application by reuse of this
- To bear a learning and sharing environment
- To disseminate knowledge

Consulting Companies (many operating Worldwide)
- To maintain a whole internal map of the experts
- To improve knowledge sharing across units
- To facilitate the knowledge sharing through informal networking
- To establish common language and management frameworks for KM
- To connect individuals within the company to avoid re-inventing the wheel
- To share business intelligence with employees
- To create a central repository for what they know about competitors, markets, their industry
- To accelerate the accumulation and dissemination of knowledge in the company (active in 80 countries)
- To facilitate the growth in the value of knowledge existing within the company

Public Sector

Italian Local and Central PA Bodies
- To support by the DBMS a centralized management of all official Acts and main documents produced within the same PA local and central bodies;

Italian Public Agencies
- To acquire, memorize and use the Agency's core-duty addressing knowledge in order to fulfill the same mission
- To use that knowledge for producing analysis on the field to be used as evidence-based reference terms for the decision making

Public Research Centers
- To create and maintain the research project knowledge bases
- To increase the ability of sharing the produced knowledge with other research centers and entities

International Organizations
- To bear a global strategy to share knowledge
- To increase the ease of accessibility to organizational knowledge, both internally and externally
- To facilitate access to best global thinking and expertise on development programs
- To facilitate the creation and sharing of knowledge for better decision making

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As for the main KM processes the knowledge-sharing appeared to be the most focused process in all subjects although several differences was found either in the specific objectives targeted and the modalities followed to implement such processes. In the synthetic table below there are indicated some few arising features addressing the main four here considered KM processes - i.e. knowledge-creation, knowledge-memorization, knowledge-distribution, and knowledge-application - that were first, generally analyzed through the interviews to the subjects' representatives; and second, used in the KMS rating grids analysis (see Chapter 9).

Table 7.6 - Main implemented KM processes in the subjects

Knowledge-creation: strongly supported in the private companies to the whole project-knowledge; while mainly limited in the PA subjects to the public Acts and the national information records
Knowledge-memorization: widely supported in all subjects although fully accessible in the private organizations and frequently limitedly accessible in the public organizations per different hierarchical levels
Knowledge-application: rigidly structured in the private organizations by shared standards while largely unstructured in the public organizations
Knowledge-distribution : strongly supported in the private subjects as well as in the international organizations; while less supported in the Italian public subjects

As for the main contents and topics addressed by the core-knowledge managed within the Subjects in most cases their KM activities were found to be addressing specific types of knowledge: health knowledge (at the ASI Healthcare public company, CS healthcare company), development knowledge (at the World Bank and Inter-American Development Bank), environment knowledge (at the European Environment Agency), problem-solving knowledge and managerial critical issues (at Accenture, or Value Team), technological knowledge (at the software factories from Cosenza area), students (University ISs), personal data and work-retirement data (INPS), economic and financial personal data (Carisiel, BPU), etc. From a certain point of view that confirms the hypothesis proposed by some authors (Bouthillier and Shearer) about the decreasing importance of the cultural and organizational knowledge against the wide consideration in 1980s (Choo, 1998a). However, from another point of view that can support the hypothesis that being so highly focused on the core-business related knowledge the KMSs could demonstrate some weaknesses against the target of strengthening the common spirit of cooperation among people throughout the organization. As shown in the case of the worldwide consulting companies it is dramatically important to make people feel as part of an only-one subject for implementing proficiently the KM; that is because such feeling can make every people acts to contribute effectively in the whole needed organizational effort for implementing the KM. Therefore, a highly performing KMS can be thought to be also effective in supporting the organization in handling with any other form of organizational knowledge that can be usefully applied to build and strengthen the common spirit of identity throughout the organization.

The particular methodologies used in each organization are overwhelmingly designed to provide or facilitate the sharing of explicit knowledge while attempts to codify tacit knowledge are globally few. Communities of practice, question and answer forums, and expert databases, all of which facilitate tacit knowledge sharing are very limitedly spread across the subjects. These are widely used in fact in the private companies, either in the big consulting companies and in the small private sw companies, while these are used less in the research centers and the international organizations although these are well known. Such tools seem instead very poorly used (where used) in the local and central Italian PA. About the arising diversity of the applied methodologies it could be argued that this reveals different consciousness levels of the organizational relevance of the KM and differently clear KM programs. Various strategies are used in fact to implement the KM by very sophisticated strategies involving all employees as different knowledge agents playing active roles in KM (i.e. private consulting companies) while some methodologies are based on simple data-exchange through the DBMSs (i.e. Italian local and central PA bodies).

Many of the KM methodology indicated in the tab below are applied from the subjects to the explicit-knowledge sharing; however, just few subjects were found to be really able in applying proficiently several of such methodologies. Indeed, most of them only applied the *knowledge-database*. This is the case of the local and central bodies of the Italian PA as well as the Italian public agencies; the research centers were found instead to be applying also the communities of practice and the collaborative technologies; while the international organizations were found deeply applying the question/answer forums over than the DBMSs and the communication technologies; finally the private subjects were found to be applying most of the here reported methodologies.

Tab 7.7 - Methodologies mainly applied in the Subjects

Private Sector	Public Sector
1. Knowledge database	1. Knowledge database
2. Best-practice repository	2. Communities of practice
3. Expert database	3. Collaborative technologies
4. Communities of practice	4. Question and answer forums
5. Question and answer forum	5. New information alerts
6 New information alerts	
7. Learning center	
8. Network news for customers	

By addressing the Bouthillier's and Shearer's typology (ibidem) which synthesizes the principal KM methodologies in height main classes (see the table below) it can be easily emphasized how some evident differences arise among the subjects in the KM development basing on their applied more/less sophisticated methodologies. A certain progressive ranking of the KM methodologies can be assumed into such typology starting from the storage-based and increasing towards the action-based methodologies. That is, the public subjects can be considered to be late in the KM since their methodologies are limited to the storage-based ones while the private subjects can be considered as advanced since these are applying the other (more sophisticated) methodologies like the communication-based and the action-based (that resulted to be applied by the worldwide consulting companies only).

Tab 7.8 - Bouthillier's and Shearer's Typology of the Main KM Methodologies (ibidem)

- Storage and retrieval based Methodologies (adopted by All Subjects although in different ways) -

1. *Knowledge Databases*- these store every form of explicit knowledge in databases similar to standard document databases making it possible to memorize and retrieve knowledge by different access forms (e.g. DBMS query modalities)

2. *Knowledge Mapping* - based on a knowledge discover analysis this maps every knowledge-resources (also in tacit form) providing its location to facilitate not only the retrieval but also the sharing

3. *Expert Databases*- this maps experts by identifying knowledge of each expert and providing a guide map to help employees find those experts

- Communication based Methodologies (mainly adopted by the private subjects) -

1. *Communities of Practice* - favoring the knowledge-sharing among people from different parts of the organization this bears the informal networking natural development (specially involving tacit knowledge exchanges)
2. *Question and Answer Forums* - based on e-mail or chat rooms these make people often geographically dispersed support each other for solving similar faced problems (shared tacit knowledge is stored through these in specific archives)

- Selected Dissemination oriented Methodologies (mainly adopted by the private subjects)

1. *News Information Alerts* - these support the automatic distribution of selected information and explicit knowledge throughout the organization
2. *Organizational Learning* - these represent the training activities making people directly acquire new knowledge

- Action based Methodologies (adopted by private subjects only)

1. *Virtual collaboration* – enable people from various areas to work together

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To implement the here considered four main KM functions - i.e. knowledge-creation, knowledge-memorization, knowledge-application, and knowledge-distribution - the subjects resulted to use, although in several different ways, several commonly wide spread KM technologies. To this a deep difference was found to distinguish the private subjects from the public ones. Indeed, despite the fact that knowledge culture is widely accepted to be a significant factor in KM the public subjects appeared to heavily rely on the technological infrastructures to improve their own capabilities of performing well and did not show a coherent consideration about the average level of peoples' abilities in handling with such technologies. The private subjects instead appeared to be fully aware about the central role people's acting plays in the KM implementation, and it arose their coherent strong effort to make all employees even still able to use proficiently these KM technologies to implement the KM. Here follows a table illustrating some of the widest spread KM technologies.

Tab 7.9 - Main KM technologies applied by the Subjects

Private Sector	**Public Sector**
- Web-based intranet	- Web-based intranet
- Lotus-Notes database	- Lotus-Notes database and email
- Microsoft mail for email news alerts	- Portals
- Compuserve bulletin boards	- Teleconferencing
- Portals	- Satellite Broadcasting and Cable TV

As already introduced in the Study's First Part and then more widely discussed in the next Chapter the KM technologies do constitute a very important part of the whole KMS-A; that is why a particular focus on the technologies applied by the subjects was conducted along the empirical analysis by the rating grid that involved the following three main families of highly specific KM technologies:

Tab 8.10 - Main KM technologies Focused in the Study's Analysis

KM-Technology family 1 : Management of Explicit Knowledge under Structured Forms <e.g. Database, Data Warehouse, OLAP, Knowledge Discovery in Data (Data, Web, Log, Usage, Mining) >

KM-Technology family 2 : Managing Explicit Knowledge under unstructured and/or semi-structured forms <e.g. Natural Language Processing, Information Retrieval, Knowledge Discovery in Text (KDT), Document and Content Management, Case Based Reasoning >

KM-Technology family 3 : Managing Tacit Knowledge Forms < e.g. Knowledge Acquisition Applications, Communication Collaboration System, Group-ware, Adaptive Systems and Multimode and Multichannel Interfaces >

7.3 Private Organizations

A general description of the organizations involved into the experimenting analysis of this Study is here provided basing on the main issues of the interviews - i.e. KM objectives and goals, the main types of knowledge, sources and consumers of knowledge, the KM processes, methodologies, and technologies.

7.3.1 The Software Factories in Cosenza Province

The subjects constituting the first group are software factories located within the Cosenza area (Calabria Region, Southern Italy) normally small in length but characterized from a very high specialization level of the products and services made. In particular, one of them, AVR Technologies, operates in the very highly specialized market of the "virtual reality" producing several ad-hoc software-products for the movie and the cartoon industries as well as for the most advanced form of surgery and psycho medical assistance. Another, Pitagora, belongs to a national bank-group whose represents the main information-based service provider: Pitagora in fact provides to the Cerved Group all products and development/management based services related to a complex system of DBs.

The remaining subjects are operating in the ICT field providing various kind of high-level support to national and international level with several different kinds of focus like information security systems.

As for the actual evolution achieved in KM these organizations can be considered to be fully conscious about the potential impact the KM can have on the business performances. These are then deep involved in an organizational effort for boosting the KM as these still know about the KM, the KM technologies and the related ways of applying.

Therefore, the belief is strong throughout these organizations that handling in a proficient way with knowledge means being able to codify, memorize and reuse the project-knowledge in new projects or also in technical maintenance interventions. Since their project-teams are small (i.e. less than twenty members) and quite always operating in the same place (i.e. central bureau in the same town) many knowledge processes are performed in informal way; knowledge is transferred throughout the organization under tacit forms. That happens for two main reasons: first, there is no need of coordinating different organizational units located in different places like it happens in big network organizations; and second, their specialists and professionals are usually young and very highly skilled people: such features still creates a good cooperative organizational environment where no formal ways of communicating are needed.

Their approach to KM is then mainly focused on the DB technologies; that means that a strong and deep development and application of the DB technologies was made to boost their KM programs. That follows one main evidence: that the "project-implementation" does constitute the core-process of these organizations so that every internal knowledge-process is structured basing on the same project implementation path. Specifically, the project-knowledge individuates that knowledge flowing throughout the organization's business process that must be managed by the KMS. To this many "knowledge modules" are produced while implementing the projects and stored in a huge factory repository that is fully accessible for new applications and further developments: such modules then constitute a developing basis for implementing new project-shapes through new applications or solutions for new clients.

A brief description is provided below about the specific items of the interviews conducted with the professionals of every organization involved in this Study.

1. Stated goals and objectives

A wide consciousness was here found about the importance of the KM. Indeed, although most of the here considered organizations are small in lenght (between 30-

90 employees) many people in these believe the organizational knowledge does constitute a critical factor which must be handled very cafrefully for increasing the business performances. These organizations are then making a big effort for strengthening the formalization processes of all organizational knowledge shapes flowing through every project's implementation.

2. Types of knowledge to be managed

Mostly the core-knowledge is there directly addressing the project - i.e. all implementation phases. This then regards the already implemented projects, and is managed under the structured forms of the project-related documents that is normally stored into the firms' knowledge-DBs constituted of the *ad-hoc* repositories fully accessible to all employees. All projects have to be fully reported and accessible through the DBs so that any next maintenance or improving intervention can be easily taken. It is very frequent in fact that evolutionary modification are requested from these organizations' clients because of changes in their own business processes or their products or also clients.

3. Sources and the consumers of knowledge

Consumers of knowledge are the project teams as they can be continually engaged into the project development, and consequently they can need a certain continuous access to the knowledge-bases for acquiring the needed knowledge to be reused - i.e. already adopted technical solutions or also pieces of software-code. That is why many modules of source-code are commonly there store for facilitating the development of new systems that are partially based on already applied solutions, or that can be built starting from a common base of past projects. Reusing seems to be the most important form of knowledge-application that the KMSs have to perform to support these kinds of organizations.

At the same time the project and the project-team members represent the main sources of knowledge since they can be thought as the main contributors of such knowledge-DBs: as created along the project development by the team-members for developing the same project knowledge is stored by the same team-members into such DBs.

4. Knowledge processes: Creation, Memorization, Distribution, and Application

Globally, a slight interest is given from these organizations to the *knowledge-creation* which is basically supported by the standards commonly adopted for handling with those pieces of individual knowledge (e.g. reports, documents, etc.) that anyone is required to produce and store in the common knowledge-repository along his own work.

The *knowledge-memorization* instead represents the main process that must be performed in order to keep it available everything has been produced within all implemented projects in terms of software-codes, reports, various documents etc. Therefore, the KMSs in these organizations are strongly required to be effective in supporting people in everything is needed for maintaining the knowledge-DB always highly-performing.

No particular need was found of supporting the *knowledge-distribution* in organizations like these since all people are basically expected to access directly the firms' knowledge-DBs for acquiring every piece of knowledge where needed. More than a system-versus-people model of knowledge-distribution it was there found a people-versus-system model: people is then required to be informed on the ongoing activities as well as to be pro-active in retrieving the needed knowledge at the firm's repository and not *vice versa*. That situation seems to be also motivated from the small dimension of the personnel; the project-teams are usually constituted from less than ten people so that many knowledge-exchanges happen in informal way by direct conversations.

Finally, it was noticed how the specifically *knowledge-reuse* represents the most important KM function since all form and shapes of knowledge saved into the firms' DBs are there because these can be applied in new projects (to more quickly develop the whole project) or for making it easier the maintenance interventions: the knowledge scheme of one already implemented project makes it easier to intervene either for maintaining the efficiency of that system or also for developing a possible needed evolution of that. Therefore, the repositories still represent the memory of these organizations specifically regarding the already implemented projects that can require new interventions, or next implementation of similar releases.

5. Methodologies employed

As said the focus of these organizations' ongoing KMSs is centered on the project-knowledge production and storing into the knowledge-bases. Therefore, specific KM methodologies are required for supporting three main core-activities: *i)* project-knowledge creation; *ii)* knowledge-DB access/contribution; and *iii)* maintenance of the knowledge-DB. As for the creation process of the project-knowledge a particular support is generally provided from the related ISO 9001 Quality standards in terms of formats and patterns that must be followed for producing and storing all project-files. Usually, such process is strictly related to the methodologies adopted for implementing the same projects (e.g. Gantt Plans, etc.) since specific records are required to be produced along each phase of the project-implementation. Specific softwares are used for controlling the entire development process of any project (i.e. cases of Pitagora, ID-Tech, Step, AVR) that in particular support people providing them with a structured path for developing all sub-phases of the whole project implementation. Those can also provide a support regarding how outlining all project-documents as well as these can rule how accessing and contributing to the knowledge-DB by strict standards for codifying and memorizing files and records. And finally, precise modalities are often defined for effectively beraring the maintenance of the worth knowledge-DB: these often regard all technical checks on the efficiency of the systems.

The discussion forums are some time used to make people commonly discuss about a specific possible critical issues to be faced within the project development. Anyway, because of the small dimensions of those organizations the direct informal exchange of knowledge is the most commonly used way for sharing knowledge since people know them each other very weal and there is no interpersonal competition among them (no heavily structured hierarchies and differences in roles, tasks, and responsibly). Therefore, just in few cases the forum seem to be adopted for further favoring such kinds of knowledge-exchange on a strictly focused issue; these happen in those organizations belonging to distributed enterprises' groups (e.g. Pitagora, ID-Tech, VP-Tech, Confor) where some time the same project-team can be constituted from people acting in different places around Italy.

6. Technology used

As partially introduced above the DB technologies are the most used in organizations like these, and that happens because of the discussed reasons. Moreover it must be noticed that in these organizations act professionals who are very young and well trained in this field so that the main functions that one DBMS have to commonly perform are there highly developed and proficiently applied for the KM.

There is instead a poor application of those KM technologies conceived for managing the forms of tacit knowledge (i.e. communication-collaboration systems, group-ware) because basically in organizations like these there is not a great need of supporting the communication among people. The organizational environment is quite always characterized from a high level of natural cooperation among the employees that is possible because of social factors (many people are young and come from common study programs or common Universities) and a general "lean" organizational structure that does not impose high competition.

Finally, it can be also noticed how those technologies conceived for managing forms of explicit knowledge under unstructured and/or semi-structured forms (e.g. natural language processing, information retrieval) are there applied within the production processes but not for the internal KM. That basically depends on the above said approach of these organizations to the KM: the project-knowledge is considered to be the core-one, and that is normally believed to be made fully available by the standard modalities ruling the knowledge-storing and retrieving processes so that such organizations have no need of applying other technologies for automatically acquiring any possible further knowledge from people.

Although this approach is followed in all cases here analyzed no evidence shows a particular return on the KM programs and activities of such organizations. And it could be argued to this extent that such organizations do not realize the potential importance of applying further methods for boosting the automatic knowledge-eliciting process because these have not to face the lost of knowledge occurring when people leave: this depends on the small dimensions of the local labour market where the high-specialized work offer is high, and makes it possible for such organizations to have a very low turn-over.

7.3.2. The Worldwide Technology Consulting Companies

The second group is constituted of several big, national and international, enterprises and consulting companies mostly operating in the sector of the ICT (consultancy).

Basing on the evidences provided from the direct interviews conducted to many of their representatives these organizations can be considered to be the most deeply involved in a continuous organizational effort to improve and boost the internal KM. In particular, three key-factors appeared to be critical to this: 1.the big dimensions; 2.the wide network-based organization (with many offices operating in several different places and countries); 3. the high-level turn-over in the personnel. Such factors in fact tend to determine a great necessity for these organizations of memorizing, sharing and distributing every piece of data, information and knowledge that is formally generated along their activities. That follows their great necessity of making different people to be really able to reuse several kind of different knowledge in different projects implemented in different contexts and moments.

The KM still represents therefore the main means to make these organizations proficiently work since all knowledge flowing throughout their wide network organizations can be effectively coordinated by the KM. Their organizational capability of formalizing the knowledge is considered to be crucial for performing well all business process. Organizations like these have then developed (and commonly apply) several strictly formalized methods for accomplishing every KM functions and specifically to create, save, acquire, and exchange every piece of knowledge with all other units across the network. That is mainly achieved by effectively managing the firm's DBs where all knowledge flows are continuously collected and coordinated to bear the well performing status of the firm's KMS.

The evolution level reached from such organizations can be then considered to be the highest in the KM as this lies not only in their methods for sharing or distributing knowledge but also in the common strong organizational willingness these have created of applying such methods in indifferent way across all of their units although located in very different places. That makes these organizations' KMSs performing well thanks to people great ability in acting in the right way for making the KMS perform effectively all KM processes.

1. KM Goal and Objectives

As partially introduced organizations like these are strongly aware about the great importance of the KM. In particular, both the concepts of IC and KM are widely considered to be critical for achieving great benefits in terms of higher efficiency in the business process. That is, usually their KM programs are clearly defined and well known throughout all business units of such organizations. A continuous effort is always on in these organizations for strengthening the common willingness of practicing the KM everywhere across all different organizational levels so that the KM be performed by all people acting within the same organization. Such effort is mostly based on everyone's belief that by performing the KM processes a concrete benefit can be achieved either at individual level and at organizational level. Therefore, everyone within these organizations is pushed by such belief to follow the specific KM patterns ruling the access to the stored knowledge as well as the search for new insights from combining existing knowledge, and the contributions to the communication among employees. To some extent the strength of the KM programs can be seen as depending on people's belief in the KM cause it is such belief that motivates people in acting proficiently to implement the KM.

2. Types of Knowledge to be managed

The main types of knowledge managed by such organizations' KMSs can be mainly individuated around four items: i) the industries; ii) the clients; iii) the projects; and iv) the internal experts.

The *industries* address the main sectors of interest of such organizations; in the case of the analyzed subjects, for example, the TLCs or also the IT based services or the bank services do constitute some of these. Basing on the interviews taken along this Study such knowledge-area is particularly important for starting new initiatives and bearing the related risks as well as for individuating the key-necessities of new potential clients or also the market trends and the competitors' strategies. Therefore, the KMS of such organizations provide any consultant or professional with the most possible needed information or knowledge addressing such interest-area.

The *clients* also represent a very important area of knowledge aggregation for the big consulting companies. Every past or potential new client must be known as better as possible in order to be able in any moment to develop the best possible matching solution that he is looking for. To satisfy the client it is needed to aggregate the client-based knowledge: everything could be useful to any professional or consultant of such companies to individuate, implement and provide the most close technical solution to that his client needs basing on client's necessities. That then makes it necessary to know the client's business processes, the client's organizational structure, the client's ITs, the clients' business improvement perspectives. All that is contained into the knowledge-base of these organizations, and is proficiently handled by their KMSs.

The *project-knowledge* still constitutes another very important knowledge-aggregate managed by these organizations' KMSs; that is following their basic project-oriented organizational structure. Similarly to the small ICT factories the project does constitutes the logical unit of the production process, and at the meantime the same outcome: to know about the project then means to be aware about its own production. In such organizations every single phase of the project implementation process is therefore carefully reported and saved by the KMS so that every piece of knowledge related to every project is fully available either to maintain that project's outcome or to reuse the adopted solutions or methods (or whatever) from that project in another one. As already observed for the first group of subjects the most important KMS function is also in this case that addressing the "knowledge-application" (i.e. the reuse of knowledge).

The *internal experts* finally represents the last main aggregate of knowledge to be managed by the KMSs of organizations like these. That depends on the central role the tacit knowledge plays in the business processes of such organizations. In other words, although very highly performing the KMS is not completely able to acquire all knowledge taken by professionals and experts. It is then important to such organizations to be aware about whether those professionals and experts are available or not and where they are within the organization: basing on one needed expertise it is important to know : " *... who knows about what ...*"; by doing so the needed informal communication channels can be activated to acquire that needed knowledge.

3. Sources and Consumers of Knowledge

Analogously to the first group's subjects people is to be considered at the same time knowledge source and consumer in such organizations because of the high intensity of knowledge application. Performing the business processes people use knowledge that others have created along past projects and at the same time contribute in creating new knowledge that other will re-use in the future. People is then either creator, user, and holder of knowledge. That is why everybody is strictly requested to give his own knowledge to the firm's knowledge-base that will make that knowledge fully accessible to others.

4. KM Processes to be implemented (i.e. the key-KM-functions)

All the basic said KM processes - i.e. knowledge creation, memorization, distribution, and application - are commonly and efficiently performed by these subjects' KMSs. Due in fact to the critical importance of the knowledge-sharing in all business performances a very great effort is continuously produced from these organizations to apply strictly formalized KM methodologies.

In particular, the *knowledge-creation* is performed by everyone in such subjects by formalizing the knowledge he produced along his own work. To do this he receives a strong support from the KMS not only on the technological side but also on the methodological side thanks to the rigid project-development methodologies to which everyone is instructed since he begins working at one organization like these. Moreover, the training in the KM is conducted in a particularly effective way on all organization's members by continuously pushing them to work in a cooperation-oriented way: that means to be continuously pushed 1. to create knowledge; 2. to share that with others through the organization.

The *knowledge-memorization* is commonly performed in organizations like these by adopting strict rules for saving opportune records in the firm's knowledge-base. This KM function is particular important in order to make knowledge available for possible future reuses in next applications. To this it must be noticed that not only the particular saving or recording -patterns can be effective to make such KM function effectively work but more than this people's willingness can be crucial. That is effectively pursued in such organizations by the above recalled training activities as people is well trained to the knowledge-sharing and then pushed to explicit any form of tacit knowledge by contributing his own records in the knowledge-base of the whole organization. That is there done particularly well since everyone is clearly trained to the concrete benefits the KM can give everybody and the whole organization in terms of higher performances.

As for the *knowledge-distribution* this is performed either by the KMS automatic functions and by people's cooperation who directly guide others to the needed knowledge through the knowledge-base. Therefore, people automatically receive information from the KMS in forms of several bulletins and other periodical news on one side, and contribute in providing others with direct guidance about the needed knowledge and experts. It is not infrequent that such firms' professionals and consultants are directed from their own colleagues to the key-knowledge which is fully available through the firm's knowledge-base. The availability of both people's direct guidance and full formalization of knowledge (in the knowledge-base) makes then it possible to perform the knowledge-distribution in a very effective way - while in the small enterprises such KM performance is often not performed it in the same way because of a lower level of knowledge-formalization which produces a lower availability of knowledge in the firm's knowledge-base. Indeed, that is possible thanks to the KMS which keeps effectively connected all professionals, consultants and experts working in an only one network.

The right way of combining both the technology and people's behaviors through a strong training makes such organizations' KMS also perform at high level the *knowledge-application*. Also in this case in fact the KMS automatically keeps people continuously informed about the firm's activities and every kind of knowledge can have been created in the past or ongoing projects. And also in this case people can decide to ask others through the KMS about the needed knowledge. And also in this case therefore the networking capabilities of such organizations' KMSs are crucial to favor the knowledge-exchange and distribution across the several organizational nodes of such big companies often operating in different places of the world.

5. KM Methodologies implemented

The KM is then implemented in such organizations by stressing all the three main elements of a KMS: the technology, the training activities and the KM incentive systems. So that a very rigid methodology is to be applied to implement any project and to make fully available through the KMS the whole project-knowledge created; moreover, people is kept under a continuous training action to the KM methodologies, and then pushed by economic incentive systems to being proactive contributor of the knowledge-base and of the whole KM process involving the entire organization in a common effort in increasing the same KM activities.

That is why many of the most common KM methodologies are there strongly applied; the communities of practice for example are commonly managed by periodical meetings among different project-teams; while the knowledge mapping is implemented by sophisticated DBMSs that often contain expert mapping. Last but not least, the training activities are often managed internally by these organizations in order to produce the most strong possible effect on people in terms of transfer of ideas and behaviors.

6. KM Technologies used

The DB and data-warehouses represent the core-part of the technologies used by these organizations to implement their own KMSs. The firms' knowledge-bases are in fact implemented by adopting sophisticated DBMSs that allow to make these organization really work like an only one highly-connected network where knowledge can be still shared worldwide. The communication common tools (i.e. e-mailing, chat, forums, group-ware and so on) are used too.

However it is important to recall to thie extent that technology means nothing without the right way of use it. In other words to use the technology to make concrete the knowledge management can be ineffective without people's behavior so that people's training must be considered as embedded into the same KM technology as the case of such organizations still proves.

7.4 Public Organizations

Due to the wide spectrum of different public administration bodies exscinding either in Italy and abroad the second group of subjects for running the Study's empirical part was created by selecting four main kinds of public organizations.

The first sub-group of those is focused on the central and local bodies of the Italian PA, and specifically involves: 1) the Administration bodies of two Calabria's Provinces (Southern Italy), Cosenza and Catanzaro; 2) the Calabria Region (Office of Tourism); and 3) the Ministry of Economy (Vibo Valentia Province Directorate).

The second sub-group was constituted by selecting a number of public Agencies and specifically: 1) the Agenzia Dogane; 2) the ETR Agency of Revenues; 3) the INPS National Institute for Social Previdence; and 4) two health-care public Agencies.

The third sub-group was constituted by selecting a series of national research centers; these particularly are: 1) the ICAR Institute for ... (National Council of Research); 2) the CRATI Consortium (National Council of Research); 3) the CIES Center for Social and Economic Engineering (University of Calabria).

Finally, the fourth and last sub-group was created by selecting a number of international organizations like the World Bank (Development Communications Division) , the Inter-American Development Bank (Sustainable Development S ...) and the European Environment Agency.

7.4.1 Central and Local Bodies of the Italian Public Administration

The group representing the local and central bodies of the Italian Public Administration consists of a number of subjects that were selected to represent the three main levels of the PA: the Province Administration (i.e. Cosenza and

Catanzaro Province PAs), the Region Administration (i.e. Calabria Region PA) and finally the central government (i.e. Ministry of Economy).

From a general point of view, these subjects appeared to be similar each other in their advancement in the KM because of two main common features: first, a strong technology-based approach; and second, a globally weak organizational capability of adopting the KM oriented standards ruling the organizational behaviors. Indeed, a certain digitalization process of the organization knowledge-heritage is actually in progress although a great number of processes and functions appeared to be even not supported by the ICTs as well as the management of all documents and Acts arose to be mostly supported by paper only. The total electronically control of official Acts' and documents' flows then represents an apparent clear objective that such organizations planned to reach in the few next years. However, a basic weaknesses was generally found in such organizations in people's ability in dealing proficiently with the KM technologies as well as in people's willingness of acting in a coherent way as expected to bear the needed organizational change to implement the KM. Therefore, a very poor awareness arose from such organizations about the deeper meaning of the KM with respect to such technology adoption merely limited to the production and memorization of electronically release of official Acts and documents.

1. KM Goal and Objectives

Although a big effort involved the whole Italian PA along the last few years (ref. Bassanini Law) to promote the PA digitalization in most of the analyzed cases the KM has been found to represent a very slightly known problem so that the consciousness about this problem cannot be considered to be strong within the PA organizations. With specifically respect to the analyed cases just few concrete advancements have been found like the "Catahospital Project" implemented by the Catanzaro Province's PA to provide all citizens around the Catanzaro Province area to access via Internet to the health-care public agencies operating in the same area.

The specific IS Offices are generally missing from these organizations, and that still tends to produce an intrinsic weaknesses against the aim (and the possibility) of concretely implementing any KM program; although the apparent great importance given to the ICTs it is arising a very poor capability of exploiting the KM potentialities. Many people in charge of the IS functions as interviewed said that the KM is not considered to be a critical issue within the PA today because of three main reasons: 1. a very low people's willingness in changing their way of working as needed from the KM; 2. a very widely low people's knowledge about the KM technologies; 3. the actual combination of other incumbent (more important) priorities and small available budget to KM. So that a precise idea about the KM was exclusively found in some few people but not within the whole organizations, and most important not at the high levels of the organizational hierarchies. Therefore, given such basic and strong legacies it appears to be very difficult to imagine that a quick progress can be achieved in few years.

2. Types of Knowledge to be managed

Some part of the official acts and documents produced by the PA body in general represents the main type of knowledge there managed. No importance seems to be given to that knowledge contained in all informal acts and documents flowing throughout the organizations among the several offices and people working there.

The official Acts produced by the Catanzaro Province (e.g. Delibera, Determina, etc.) are stored for instance by a whole DBMS which makes them fully available to the internal Officers and does support not only the store and retrieval but also the creation of those documents. The same situation has been found at the Cosenza Province while the only one organizational knowledge managed at the Office of Tourism of the Region Administration by a DBMS regards the yearly flows of tourist who are registered at any Hotel operating in the Region area. Finally, the core-knowledge of the analyzed Directorate of the Ministry of Economy instead is represented by the personnel salary-record that such body handles with by a sophisticated DBMS connecting all the Italian Provinces' Directorates each others and all to the Ministry central body.

Therefore, the here analyzed organizations presented a very limited number of managed knowledge-classes strictly regarding the official acts while any different form of knowledge that is normally created and exchanged among the employees throughout the organization are left out from any possible KM activities or progam.

3. Sources and Consumers of Knowledge

The knowledge consumers and sources can be individuated in such organizations following the above described main types of knowledge here produced and managed; it is the case in fact of the same officers and employees producing and using the said official Acts and documents along their tasks and roles. Indeed, since all official Acts and documents must be available at different levels of the PA to run any procedure (to perform any business process) then all offices can be considered to be the main *knowledge-consumers* of such Acts and documents. It must be noticed in this case that in no case has not been found a KM function allowing externals (i.e. citizens) to access the same documents: any Official Act must be physically required at the front-desk of the related Information Offices of any PA body. That witnesses many PA bodies can be considered to be actually late against the progress in the ICT application to improve the citizen-PA or enterprise-PA communication and knowledge exchanges.

Similarly to produce such knowledge it is needed to access the same documents then the official Act DBs is going to become the main *knowledge-source* of such organizations. Due to their usual recent implementation however the DB contain only a small part of all official Acts and documents produced while the greatest part of the official documental heritage of such Institutions is actually contained into the traditional paper-based archives so that their digitalization process is far from being complete. And consequently the true main source of knowledge for these organizations is represented by that paper-based archives.

4. KM Processes to be implemented (i.e. the key-KM-functions)

The main KM processes to be there implemented address the knowledge creation and storing. The last Laws tried to push such organizations to make a more intensive use of the DB technologies imposing the digitalization of the (new) knowledge-flows involving either the knowledge memorization and distribution and also the knowledge creation and application. However this process is still in progress and much work remains to do.

No particular importance seems in fact to be actually given to the *knowledge-distribution* and *knowledge-application* functions; that is maybe because there is no particular need of making knowledge automatically transferred to who is expected to need it. While any knowledge is basically thought to be accessed where needed from someone - i.e. any official act's retrieval from the DBs is basically thought to be occurring only in correspondence of one officer's need and is never sent automatically to anyone. All knowledge-exchanges seem in fact to be ruled within the PA by a very wide spread belief: that the trigger of any knowledge-exchange is the people's need; in other words, that who needs knowledge has to search for it and has not to be waiting for.

At the same time the knowledge-application appears to be very limited. Given the rigid structure of the managed knowledge (e.g. the Official Acts at the Province Administrations, the tourism flows at the Region Administration, and the employee-salary records at the Directorate of the Ministry of Economy) a poor application can be made to reuse it for creating new knowledge (i.e. new Acts).

5. KM Methodologies implemented

The main methodologies applied in such organization to the KM are strictly related to the two basic functions for memorizing/retrieving the PA's official Act and documents to/from the said knowledge-DBs. So that any officer is requested to create release of all Acts and official documents he is in charge of and then to save it into the DBMS. To this just few attention was given while implementing their DBMSs to create different access levels to different kind of documents and Acts; to this every organizational area and every officer was provided with a limited access to the whole PA's knowledge-base in order to prevent anyone to access not-allowed areas or not allowed Acts and documents and maybe altering any of those.

No other particular methodology arises to be effectively applied in the analyzed bodies of the Italian PA to bear the KM while a strong human resistence (some kind of a human legacy) can be easily detected in any body of the local and central PA. People seem there to be not willing to turn to a systematic and continuous way of formalizing his own knowledge and sharing that with others for increasing the common knowledge of the whole organization they belong to. That is why any method to push people to approach the KM is commonly considered to be strongly rejected from people.

6. KM Technologies used

Following the above said description of the KM activities found within the analyzed PA bodies the BD represent the most important applied technologies for KM. At the meantime the intranet and Internet are even more widely adopted for exchanging information by e-mail although it is not easy to find a formalized "protocol" for ruling such document and information exchanges.

7.4.2 Italian Public Agencies

The Public Agencies represent a very specialized part of the whole national PA as these are in charge of very specific duties and competencies. With respect to the central and local bodies that specifically means a smaller number of more focused tasks to be accomplished directly operating in the field. Such higher activity specialization partially produced a higher effort in attempting to implementing the KM because of the clearer core-knowledge to be managed and a consequent higher expectations from the KM.

However the KM initiatives conducted till now were ineffective because of the great lack of specific internal competencies and the weak willingness to apply the KM needed changes in people's behavior. Further, in some case being designed at highest levels of organizations with external consultants' support the KM initiatives were far from the field, and that produced a strong rejection from people who had to face very different situations than assumed in the design phase. Then no specific strategies or programs was developed for favoring the knowledge-sharing. So that a great potential of KM advancement can be given to such organizations but this still misses a clear strategy focusing on people working on the field.

1. KM Goal and Objectives

Along the conducted analysis of the subjects one basic difference was found to arise with respect to the KM oriented goals and objectives between those subjects belonging to the PA local/central bodies and those belonging to the public Agencies. In particular, the focus on the KM as well as a wider involvement in the KM was found to be higher in the latter ones: this means that a higher number of business processes actively involved in the KM was found to be higher in the public Agencies. That probably depends on their basic higher focus on a very specific mission which had favored to some extent a wider and deeper adoption process of the ICTs and then a quicker adaptation of the old generations of workers to the new instruments. All that contributed in facilitating the KM implementation.

That is, a higher consciousness about the KM importance and a consequent increasing effort has been found in the public Agencies against the PA although a true advancement towards the KM is far to be complete.

2. Types of Knowledge to be managed

Following the higher level of specialization of the public Agencies' activities - i.e. fiscal and economic revenues control, healthcare services, and retirement - the knowledge to be managed by their systems mainly regards the same activities. In case of the Agenzia delle Dogane that knowledge directly addresses both the national and the private properties that are under control of such Agency.

However similarly with the case of the central and local bodies of the PA other forms of knowledge created from the emploees while performing any process are not considered to be an issue. Therefore, much important knowledge created throughout the organization is exclusively held by people in tacit forms and then is lost where they leave.

3. Sources and Consumers of Knowledge

Given the great importance of the specific knowledge that is applied and generated along all processes here performed - e.g. fiscal control at Agenzia per Entrate or ETR - the main *sources of knowledge* are: 1. the whole DBs containing the main classes of knowledge stored and managed and 2. the performed processes that are producing new knowledge to be stored in the same DBs.

While *knowledge-consumers* are mainly the officers in charge of the several processes who have to access the DBs for 1. gathering all needed information to accomplish the operations in the process and 2. updating the DB with the new data or information produced by the just completed process.

Therefore, what is arising to be different against the central and local PA is here the importance given to the process in the creation and consumption of knowledge that still follows the above said higher focus of the Public Agencies on their own specific Mission. It is in fact the higher continuity and intensity of more focused activities that extends the production and consumption of knowledge to the business-process.

A particular system named as "Anagrafica Tributaria" (Tributary Ana graphic) must be here briefly recalled since it makes it possible a whole integration of all DBMSs belonging to the several national Agencies - e.g. Agenzia Dogane, Agenzia Demanio, Agenzia Entrate, Agenzia Territorio, the Province Directorates - and the Ministry of Economy central body. That systems then represents the most important part of the sophisticated network connecting all Agencies and then represents the most important great source of knowledge for all Agencies.

4. KM Processes to be implemented (i.e. the key-KM-functions)

Since all Agencies have to handle with a very important and delicate knowledge-heritage directly belonging to the Italian National State then the *knowledge-*

memorization and *knowledge-creation* are considered to be the most critical process requiring a strong support by the KM.

Analogously with the case of the central and local PA there is few need to *distribute knowledge* throughout the organization by any peer-to-peer like modality since anyone is expected to be able to retrieve all knowledge where needed (and where allowed to him/her) by individually accessing the specific DBMSs.

Moreover the *knowledge-application* appeared to be limited to the DBMSs' update where a just performed process makes it necessary to modify the knowledge contained in an existing record of the DBMS or to create a new record to contain that new knowledge just created.

5. KM Methodologies implemented

The implemented methodologies to carryout the KM appeared to be strictly limited in such public Agencies to the management of their DBMS and in most cases that is made by external subjects providing all needed DBM based services - e.g. all Agencies are supported by the So.ge.i. (a highly qualified public company in the IT sector). In this case the Agencies only participate in designing the methodologies for managing their own knowledge and in some case that is poorly effective in terms of availability and adaptability of the KMSs to the real situations of the field.

To this the training activity is basically considered by such organizations (like others) to be critical to make people able to use the DBMSs proficiently; however, an insufficient level of abilities was frequently found there in maintaining a highly performing level of the DBMSs because of a people's large lack of personal abilities - that was explicitly said by the same representatives interviewed along this Study. Moreover, what was also found to be dangerously missing in such organizations was the explicitly admitted lack of people's willingness to the knowledge-sharing which makes potentially slow such organizations in advancing towards an highly evolved state of the KM, towards the KM maturity.

6. KM Technologies used

As said many public Agencies are fully supported by external subjects from the tecnological point of view so that there is a jointly participation in the technology design and implementation processes of the DBMSs and the related servicess.

It has to be noticed that not only the storing and retrieving functions are implemented but also many processing (and reasoning) functions were developed basing on the same DBMSs; such more advanced KM functions are important to specifically support the Agencies in the activity of control and monitoring on the field these are in caharge of.

Finally, both internatl and external communications are supported by the most widely Internet based tools (e.g. Lotus Notes, MS e-mail sw, chat, forums, etc.).

7.4.3 Public Research Centers

Along the last few years a strong effort has been made by the here analyzed research centers to implement the KM due to their great expectations of improvement; given in fact the importance of the memory in the scientific work - i.e. outcomes of the past projects, results and tracks of the research programs - all such centers have deeply invested in new technologies for sustaining the KM programs. However, a very hard constraint has been found in a widely spread low people's willingness to follow the rules imposed by the basic KM methodologies; that specifically addresses the needed rules for formalizing any shared knowledge in such a way that the KMS could save it. Then, although people is extremely well trained in these centers to the use of KM technologies it is frequently found to be easier to exchange knowledge in informal way by talk or by any personnel way often inaccessible to the KMS (e.g. personal files produced in a not sharable format).

That is why the interpersonal relationships there constitute the main way of making *de facto* the KM work although often in an mostly unstructured and informal manner, and consequently in a not-always effective manner. To improve in the KM such centers then require a people-based strategies to boost their awareness about the KM potentialities in bringing a concrete and common improvement to the whole organization.

1. KM Goal and Objectives

In many cases the KM initiatives have been launched in such organizations with a precise idea and expectation of favoring the knowledge life-cycle throughout the organization. Then a clear consciousness can be attributed to such subjects about the objectives and the KM priorities.

However a certain lack of balance was found in their KM programs with respect to the technological and the human components; precisely, the technological component appeared to be higher in many KM programs implemented by these organizations (i.e. higher investments in ICT infrastructures against poor investments in KM specific training programs). It could be argued to this extent that such lack of balance in the KM initiatives was probably due to a basic overestimate of people's abilities in handling with the KM given the high people's abilities in handling with the ICTs. Probably, a too strong technology-oriented approach has been applied in such organizations to implement the KM underestimating the importance of people and specifically of people's motivations in acting in a conform way with the KMS designers (see Chapter 1).

2. Types of Knowledge to be managed

The core-knowledge to be managed in these organizations is constituted by all documents and files that are produced by all researchers along the research projects and activities there developed - e.g. reports, deliverables, drafts, etc. Then the research-project and the scientific (interest) area represent the two main logic areas of knowledge aggregation and consequently the two main types of knowledge to be managed.

Since the researchers tend often to use very personal methods for codifying and storing their own files it can be still difficult to apply any standard form or pattern to structure such knowledge, and then to rule such knowledge's flows in a rigid way. That seems to be depending on two main factors: first, the intrinsic very poor reusability of most part of the project-knowledge; and second, the high impact of the personal way of self-organizing his/her own work. Most of the (new) knowledge produced by each researcher along any project development is in fact contained into his/her own personal files that often stay out of the KMS; these are not included into any project document or report and instead these can still contain a very reach knowledge for developing new applications or further possible advancements of the same research. However most of that knowledge tend to be lost after the end of the research project, otherwise that stays exclusively belonging to the single author of that knowledge. Further, the projects development are generally hard to be developed by formalized and standard methodologies so that it becomes consequently hard to produce a coherent project-development documentation containing all pieces and shapes of the related knowledge produced. Therefore, although a high cooperation levels is commonly wide spread throughout these centers a potential very low share of knowledge can intrinsically affect their KM programs.

3. Sources and Consumers of Knowledge

Following what above described people must be considered in this case to be at the same time either the main sources and the consumers of knowledge. Indeed, the usual informal exchanges of knowledge occurring among the researchers make it evident how it can be difficult to individuate one particular source and one particular consumer. Every researcher participating into the same project is at the same time and at a similar level both consumer and producer of a common knowledge-aggregate so that the whole research-project community can be considered as a network where all researchers represent a node and their relationship represent an arc. Then knowledge can be thought to be contemporary produced and consumed in any node of such networks.

In the analyzed subjects many repositories - i.e. DBs and s.c. knowledge-portals - have been found to be existing for memorizing the project-knowledge and making those knowledge flows be facilitated either moving inside the same organizations and outside towards external connected organizations. Such repositories can be then considered to be other forms of *knowledge-sources* but still lower than people since there is contained just a small part of the whole knowledge produced along a research project development.

4. KM Processes to be implemented (i.e. the key-KM-functions)

The necessity of supporting the basic KM processes - i.e. knowledge-creation, knowledge-memorization, knowledge-distribution, and knowledge-application - in these organizations is weakly perceived; that probably happens because of the basic said unstructured path of the research project development and the researchers' natural predisposition to exchange knowledge informally: all processes are basically expected to be individually performed by each researcher following his/her own needs.

Anyway, the *knowledge-memorization* and the *knowledge-distribution* arose to be considered the core-functions within their KM programs; these were in fact basically designed to support people in transferring all documents produced into a centralized "main-repository of Center's knowledge" containing a whole collection of all reports and documents about the projects developed.

5. KM Methodologies implemented

The here applied KM methodologies are then based on the main principle that every people belonging to the research community existing around the research center is expected to freely contribute in the above recalled knowledge-repositories his/her own files. It is following the basic expectation that every file regarding the projects there carried out are to be contained into such repository and then fully available to anybody is allowed to access that repository. In particular, such last consequent expectation lies in the basic confidence on the widely agreed non-profit nature of the scientific research so that every research result and outcome is basically expected to be fully available to the world-wide scientific community (and even more so is expected to be inside of the same research unit by which it has been produced).

However, that confidence does constitute one of the weakest elements in the KM programs developed by these research centers since the so "natural" expected attitude of researchers to share their research results is not always so high. It is well known that frequently the community of researchers can be not willing to share their researches' results with others; the competition among researchers based on their proposals' innovations push them to not share their results. Combining that motivation with those above recalled about the intrinsic difficulty in formally structuring the research project development path it is easy to realize why often those knowledge repositories are wrongly expected to be plain of provided knowledge.

To this extent the lack of formal schemes for giving the research-projects a rigid development path can represent a critical missing element in such centers' KM programs as well as the above said lack of training focus on people's awareness about the potential benefits that can be achieved by the knowledge sharing.

6. KM Technologies used

Many advanced technologies are used in the analyzed centers for managing the organizational knowledge either for the *knowledge-storing/retrieving* and the internal/external *knowledge-exchanging*; in particular, the KM-oriented ERP systems and the web-based DBMSs represent the more sophisticated that are there used to manage contemporary the said KM functions. Further, all common web based KM technologies (e.g. e-mailing, chats, forums, group-wares, etc.) are fully used to bear the intensive knowledge-exchanges involving all of them since these belong to wider research networks whose several units are located in many different places either around Italy and abroad.

7.4.4 International Organizations

A group of subjects was selected from the International Organizations - i.e. a World Bank's Division, an Inter-American Development Bank's Division, and the European Environment Agency - in order to enrich the whole analysis with some very interesting organizational case that appeared to be at the same time so different and so similar to other already described subjects against some basic problematic directly related to the KM.

For all these subjects the KM still represents a very critical resource and a means to boost the organizational capabilities of being effective on the world-wide scale. The knowledge heritage of such organizations aggregates in fact millions of shapes produced all around the world and containing very different points of views. That cultural difference still represents one of the critical issues against the basic KM related necessity of ruling in a common way the whole knowledge-heritage of such organizations.

One of the most important challenges for such organizations is then to guarantee a very high level in the knowledge-sharing all around the world; in few words, to make it possible that everything is produced (and made) in each part of the globe from such international organizations' agencies can be effectively available in any other part. And although on a greater scale this seems to perfectly match the same challenges that the other above analyzed organizations have to face on a smaller scale - e.g. people's willingness to share knowledge; people's abilities in performing well with the KM more advanced technologies; common standards to agree for formalizing any KM process regarding the knowledge production, distribution, memorization, and application.

As considered for the other subjects several great effort have been made from such international organizations along the last few years to boost their own organizational abilities in performing coherently with the KM oriented guidelines. However, many open issues remain and have to be faced in an effective way under both the human and technological point of view.

1. KM Goal and Objectives

A deep consciousness is deep emphasized by such subjects about the potential good impact of the KM and the related expected benefits on their own performances; these seem to be fully aware about the importance of boosting the KM throughout their organizational structures. However, a certain lack of synchronism is perceived across their several Divisions and bodies. Probably because of the very huge extent of such subjects it is not possible to find out an only-one central network controlling any knowledge-flows passing throughout the entire organizations. Although expected such an entity like this appears to be not existing yet. A number of partially independent networks are in fact operational on several different shapes of the whole organization so that one particular Division's knowledge is exclusively managed by its own a specific KMS, so it is for anyone Vice-Presidency or the geographical areas. That is, in some case a number of common knowledge areas was duplicated for managing similar kind of knowledge flowing through different organizational units.

To this extent the total world-wide integration of all operational DBMSs does represent a critical issue to be faced in the next few years. And of course to make it really effective a strong effort must be made on people's behavior in order to make everybody feel to be a part of an only-one world-wide organization, and act in a coherent way keeping all resources and knowledge of his/her own fully available to the same only-one organization.

2. Types of Knowledge to be managed

As for the main kinds of knowledge managed these subjects can be considered to be very similar to the world-wide private companies. Then, the core knowledge-aggregates are around: i) the project; ii) the activity-sector; iii) the geographical area; and iv) the same-organizations.

The *project-knowledge* addresses every single action and initiative implemented from these organizations; so that everything is expected to be reported into opportune files and records that are then made fully available through the related area-repository of the Division's KMS. Such way of reporting in a centralized way about the project implemented is particularly important to these organizations; first of all, this is important to guarantee a well coordinated implementation worldwide since several organizations are always involved in such projects jointly with these organizations' local and central agencies - i.e. national governments, private institutions, non-government organizations. And since all of those are operating on a worldwide scale it is still important to apply effective methodological means for making all people, coming from all around the world, to effectively cooperate for implementing the same initiative (i.e. the project). Secondly, such project-knowledge is critical to share the achieved results either inside and outside of the same organizations; that seems to be actually considered from these organizations to be more important on the external side than the internal side. It seems in other words that such organizations use the knowledge-project to bear a strong diffusion worldwide of their initiatives' impact on the developing countries, and instead these seem some time to be not fully aware about the great potential of reusing such knowledge for starting and developing new initiatives and projects - that specially arises from the evidence of a global fragmentation of their own knowledge-heritage across several different (and not always well interconnected) KMSs.

The *sector-knowledge* addresses the knowledge regarding all sectors around which the interest and then the initiatives of such organizations are focused for boosting the social and economic development of the poorest countries in the world - e.g. social rights, natural resources, technologies, finances, etc. That knowledge does contribute in increasing the global capabilities of these organizations to conceive and implement potentially very effective action against the poverty and the social conflicts. Indeed, a deep consciousness of all specific target-sectors is critical to individuate the suitable players to involve, the objectives to achieve, the plans to implement for implementing really effective actions. As arising from the witnesses-interviews collected along this Study with some representative of such organizations this knowledge-area is still important when a new project is to be launched as well as along the whole development process of the same project.

Around the *geographical-area* it is aggregated all knowledge regarding the target-areas of these organizations' actions so that it is considered to be particularly critical for boosting their intervention programs' impact on the local conditions of the targeted countries and geographical areas. To know deeply about those countries can be dramatically necessary in order to choose the "right way" for implementing any possible intervention. To this extent, it is well known that the cultural differences existing between the developing countries and those participating in these international organizations can make ineffective any support interventions coming from the latter. This mainly tends to occur when strategies and methodologies for implementing such interventions are outlined not keeping in the right account the specific local conditions of those countries. And that makes then critical to accumulate not only that knowledge about the social and economic conditions of those countries but also that knowledge regarding any past intervention carried out on such countries and the impact really achieved. All that knowledge has then to be contained into the knowledge-bases of these organizations to provide them with the memory about others (who are expecting concrete and valuable interventions) and them-selves (who are expected to be able to take such interventions).

The *internal-organization* knowledge regards the organizational structure and then the activities conducted and the role played by each part of such international subjects. Given in fact the worldwide extent of these organizations and the very wide spectrum of activities and programs conducted that part of knowledge is specifically needed to make all their "agents" working all around the world conscious about the same only-one network they belong to. In that knowledge is then held the same identity of these organizations and that is why that knowledge has to be shared among all people who are expected to act in a coherent way with the main aims addressing that identity.

3. Sources and Consumers of Knowledge

Within these organizations the main *knowledge-consumers* can be individuated in their own agents - i.e. the officers operating at both the central Agencies and at the Agencies located in the developing countries. They use in fact the knowledge contained into their Divisions' DBMSs either along the project development and after the project is finished to diffuse all over the achieved results. In particular, as already observed the officers can coordinate the whole implementation process of every project by handling with a common set of related records; it is in fact the continuous access to the same set of records and files that allows them to be aware in any moment about the project development and specifically about the steps to take, the objectives to achieve, the resources to employ, the strategies to implement, the goals to reach, etc. By doing so they continuously consume that knowledge produced by other officers and also by external contributors like partners, beneficiaries, shareholders, etc.

Because of the very wide extent of the Agencies network operating all around the world the main *knowledge-sources* can instead be mainly individuated by the DBMSs. It is very difficult in fact that one individual's personal knowledge can cover so many interest areas, sectors and intervention programs belonging to such subjects. What instead represents the memory of such organizations are the same KMSs wide spread across the worldwide network. The knowledge generated in every past or ongoing project can be found in those KMSs and there is fully accessible to every officer would be aware about a specific program, geographical area, or single project.

4. KM Processes to be implemented (i.e. the key-KM-functions)

Coherently with the above described main KM features of these organizations the *knowledge-creation* and *knowledge-memorization* do constitute the best supported KM processes. Specifically, these are normally implemented by using the DBMSs that maintain fully available every kind of different files and records. So that every officer can freely generate and memorize (and access) any kind of new knowledge into his own Division's DBMS being assisted by the common DBMS support functions.

Given the huge networking structure of such subjects the *knowledge-distribution* is considered to be particularly important, as above observed, to bear a strong sense of identity of the same organizations across the several agencies operating all around the world. That is why that KM function is well supported by a very efficient internal communication system connecting every officer operating around the world;

by such system everybody is kept widely informed on the main ongoing activities as well as those more close to the projects he(r) can be in charge of .

A weak support seems instead to be given to the *knowledge-application* process since (similarly to the Italian PA case) everybody is expected to be able (and autonomously willing) to access the main KMSs to retrieve any needed knowledge. So that the knowledge application is not rigidly structured by standard schemes or rules and is instead left to the individual initiative: everybody is basically free to access the DBMSs and use the here available knowledge in the managed activities in the best way he(r) can trust. In this case a more rigidly structured way of applying that knowledge (e.g. a formal project implementation methodology) could be effectively increase the organizational support to the same knowledge-application process one can handle with.

5. KM Methodologies implemented

From the formal point of view the basic methodologies applied to sustain the KM in these organizations mostly lie in the individual knowledge that everybody is expected to contribute by personal files and records memorized into the several Divisions' KMSs. Therefore, such common knowledge-based repositories managed by the said DBMSs are continuously accessed by the officers who transfer there their own documents regarding every activity they are in charge of; then the DBMS makes that knowledge available to others who will access the system to get any needed knowledge.

From the informal point of view instead the KM is mainly implemented by the continuous sensibilization action such subject conduct upon all their officers to diffuse and strengthen the common awareness about the importance of wide spreading the achieved results (i.e. the social and economic improvements taken in the developing countries) by their activities. Therefore, people and their organizational behaviors still constitute also in this case the real means for making the KM be pursued.

6. KM Technologies used

The technologies used to implement the KM mainly address the common DB based technologies and the intranet and Internet based ones. Specifically, the first ones are used to support the creation and memorization of knowledge while the latter are used to favor the knowledge-exchange and distribution. These can be both considered to be very important to bear the efficient coordination status of the several projects ongoing worldwide. Given then the great number of organizational units operating all around the world it seems to be particularly easy to realize how the efficiency in communications and knowledge-exchanges can be critical to make the whole organizational structure be well performing. That is why sophisticated DBMSs connect the central with local Agencies of such organizations and manage their own entire worth knowledge-heritage.

7.5 Conclusions

Starting this study several differences were expected to be found between public sector and private sector institutions with respect to the KM. By comparing the subjects from the private sector to those from the public sector the objectives of KM initiatives generally arose a global greater awareness of the private subjects, specially the consulting companies worldwide, about the potentialities of the KM. And apparently coherent with this, it also arose these subjects' stronger lead towards the KM based on the common worldwide people's participation in sharing not only knowledge about the activities but even more the organizational-consciousness about the KM-oriented behavior in work. The public subjects' KM initiatives appeared instead to be far from that organizational consciousness and involvement; the KM programs seemed to be conducted mostly for facilitating the memorization process of a very specific office-related knowledge - e.g. Italian local and central PA and public agencies - and the internal circulation of that knowledge within their own PA network which often is very limited to citizens' and other private subjects' access not only because of technical reasons. Just in the case of the international agencies a wider and stronger awareness about the importance and the potentialities of the KM has been found. However, that seemed to be far from the highest level of coherence in people's behavior that belongs to the private subjects and specifically to the worldwide consulting companies.

With respect to the specific here considered KM processes each subject arose to manage more than one of these but none of their KM initiatives attempted to manage all six KM processes except for the worldwide consulting companies. In particular, the *knowledge-creation* process arose to be well supported in a formalized way exclusively within the private companies while none of the public administrations, either Italian or international, resulted to have developed any effective structured way for managing such KM process; that proved a certain grade of lateness in such subjects against their KM programs' objectives. Opposite, the *knowledge-memorization* seemed to be considered as the most important KM process within both the private and the public organizations; the KMSs of both subjects arose in fact to be highly focused on supporting this KM function because of the basic need, found in many subjects, to save their own organizational knowledge-heritage - that is specially true in case of the Italian PAs and the public Agencies whose organizational knowledge-heritage consists of a very important documents and official Acts that cannot be altered or lost.

Moreover, it is to be noticed that from the interviews to the subjects' representatives a low consciousness arose about the apparent commonly addressed difference between tacit and explicit knowledge (Nonaka and Takeuchi, 1995); no difference was explicitly given from many of them in fact to such concepts while they attributed a common only-one basic aim of the KMSs: to make organizations able to manage in a proficient way any form of data, information and related knowledge where transferable on a permanent memory support. A basic underlined indifference between the knowledge management systems and the (traditional) information systems was found in interviewed belief since they did not explicitly define "internal" and "external" knowledge while explicitly declared a basic lack of focus in their KMSs on the personal knowledge produced by the employees. That was especially evident in the case of the Italian PAs and the Italian public Agencies where frequently the technological progress achieved in the ISs does not match a proportioned progress achieved in people's abilities of exploiting such infrastructures for implementing the KM. Where instead the lack of human competencies in handling with the ISs is lower (i.e. International Organizations, Italian national research centers) KM and information management (IM) seem anyway to be strongly interrelated as some authors suggest be frequently occurring (Kakadbase et al., 2001) [Kakabadse N.K., Kouzmin, A. and Kakabadse A. (2001) "From tacit knowledge to knowledge: leveraging invisible assets." *Knowledge and Process Management*, **8**(3), 137]; that proves a poor consciousness of the KM great potentialities.

In conclusions, in the subjects selected from the PA sector it was found a globally weak consciousness about the KM as well as a low clarity in the KM objectives and goals; these organizations appeared to be mainly focused on the accumulation and management of a very specific knowledge-heritage. In the international organizations instead a higher awareness about the KM arose as well a bigger capability of using the KM technologies for increasing the whole knowledge-sharing across the several organizational units operating worldwide. A high awareness arose in the small software factories from the Cosenza area about the KM whose programs appeared to be mainly aiming at bearing the knowledge reuse. And finally in the worldwide consulting companies it was found the highest level of awareness about the difference between KM and IM as well as the strongest organizational effort produced to widely and deeply implement the KM through people's behaviors. Several very rigid standards are there applied in fact for conducting the KM in the business processes; and more than this a strong spirit of an only-one-mission-only-one-network worldwide is promoted by those organizations pushing all their single employees to efficiently act for: a) transferring their personal knowledge to the only-one organization's KMS in a highly standardized manner; b) reusing the common knowledge accessible worldwide through the KMS; and 3) further supporting these processes by being "strictly tuned" with all nodes of this only-one-network operating all around the world. That is the way to effectively implement the KM as proposed by the most performing organizations.

Chapter 8
Empirical Applications of the Knowledge-Management Metric

8.1 Introduction

This chapter describes the outcomes obtained conducting the second step of the whole empirical application of the knowledge-management assessment model that has been here developed for extending the knowledge-audit. After the first step that has been made interviewing directly a number of representatives of such organizations (see Chapter 7) the second step has been carried-out by analyzing the ratings addressing the knowledge-management systems and the business performances of the subjects, and then the related correlation indexes.

Specifically, the ratings are here preventively analyzed focusing first on the single values that have been found against the performances of the knowledge-management systems, from one hand, and against the business performances of the involved organizations, on other hand. Then, such analysis is followed by the focus on the methodological process by which the here proposed model has been applied for assessing the knowledge-management capabilities of all subjects in both samples, and then the correlation values have computed and have been compared for each subgroup; it is then described the series of different levels of knowledge-management organizational capabilities that have been individuated per different levels of correlation occurring between the performances of the knowledge-management systems and the business performances of such subjects.

Finally, the results obtained in terms of needed improving strategies for the knowledge-management systems of the subjects are collected by a series of suitable suggestions and then organized into a special guidelines that are here proposed to take concrete advantages to some of the special subjects that have been analyzed. The concrete contribution achieved in the knowledge-management system design is consisting in fact in the final frames leading to different suitable strategies to be implemented by applying the such a technological and organizational changes in the knowledge-management systems of the here analyzed samples in order to increase their own business performances.

Finally, a particular focus is given into this chapter to the specific possible contribution of the knowledge-management technologies into the definition of a knowledge-management improving strategies: here are shown in fact the correlation levels found to be occurring between the here considered different main families of knowledge-management technologies and the business performances of the subjects.

8.2 Preventive Analysis of the Subjects

The *preventive analysis of the subjects* is based on the ratings collected through the same subjects with respect to both the knowledge-management system efficiency and the expected improvement in the knowledge-management system from the key-factors focused within the here proposed analysis model: i) the knowledge-management technologies; ii) the knowledge-management training activities; and iii) the knowledge-sharing incentives system. In particular, such ratings are here analyzed to distinguish the more advanced organizations in the knowledge-management development from the less ones, and this is specifically made through two steps: first, by comparing the average values of the data addressing the private subjects with those addressing the public subjects.

8.2.1 Analysis of the Knowledge-Management Systems

As reported into the tab 8.1 a significant difference was found among the subjects with respect to the knowledge-management system efficiency; in particular, two main differences can be individuated: the first occurring between the values addressing the private subjects against those addressing the private ones; and the second occurring among the subjects within the subgroups of the public organizations. Indeed, the knowledge-management system efficiency average value is 3.975 for the private subject group while 2.975 for the public ones; therefore, a difference of 20% is occurring between them. Although little this can represent a first empirical evidence of the basic hypothesis that a more advanced state of knowledge-management progress can be found in the private companies focused on high-tech services (i.e. so called *knowledge-intensive organizations*) while a lateness state can be found in the public organizations.

It seems to be remarkable that the difference occurring between the private and the public groups is lower than the difference found between the values addressing the private subjects and those addressing the group made by the public agencies and the public administration local/central bodies (20% *VS* 27.5%). That comes from the difference found among the four subgroups of public subjects: a 15% difference is occurring in fact between the group constituted by the public agencies and the local and central public administration bodies, and that constituted by the public research centers and the international organizations. This means that two possible different classes of knowledge-management performing organizations can be distinguished within the same public subject group: the more late and the less late. Such evidence strengthens the above said consideration about the expected difference between (private) knowledge-intensive organizations and public administration since in this case the difference to be considered is 27.5%. Anyway, such evidence is further analyzed along the next paragraphs.

Some more meaningful difference can be found among the subjects where the average levels are considered within each sample. Specifically, a small difference (11%) was found occurring between the private subgroups since the average level of the knowledge-management system efficiency rating in the sw factories is about 3.70 while reaches 4.25 as rated in the big consulting companies. A greater difference was found instead within the public group (20%) since the values found are respectively 2.8 for the local and central bodies of Italian public administration, 2.4 for the Italian public Agencies, 3.4 for the public research centers, and 3.3 for the international organizations. That makes it evident how the more heterogeneous sample of public subjects is constituted by more differently knowledge-management system supported organizations, and further proves that both the local and central bodies of the public administration and the public agencies will arise from the whole analysis as the latest subjects.

Basing on the interviews conducted along the Study the difference found between the two private subgroups (i.e. 3.7 in the software factories and 4.25 in the big consulting companies) can be considered to be lying in a general stronger organizational effort produced for the knowledge-management within the latter subjects. Such effort mainly address the organizational behavior of employees who are more rigidly instructed to act under the knowledge-management policies at the big consulting companies rather than at the software factories, and that mainly depends on two basic factors that are both higher in the first case: the organization dimension and the turn-over.

Most of the here analyzed consulting companies are constituted by hundreds of organizational units and offices operating all around the world, and involving thousands of people in charge of a very great number of projects to be coordinated by sharing a knowledge generated, stored, applied, and distributed on a worldwide scale. Further, many employees stay working in the same position just for short time before being moved to another different project or before leaving the same company. Both facts produce a great need of applying rigidly standardized knowledge-management processes throughout all organizational unites and offices in order to reduce the chances of loosing any knowledge when people leave or when people is working in different places. That is why such organizations can be considered to be fully focused in a global effort for making that knowledge as easier as possible to be accessed, used, distributed and shared through a formalized patterns / format. The software factories instead are characterized by a smaller and more stable organizational structure (i.e. smaller in dimension, and with a lower people turnover) and consequently the need of applying formal scheme for the knowledge-sharing is weaker: people can directly talk each other to share knowledge (informally). That reduces the organizations' capabilities of eliciting knowledge and consequently reduces the chances of supporting people by the knowledge-management system. In conclusions, the knowledge-management system higher efficiency in the big consulting companies is mostly motivated by the higher effort generally produced at organizational level through a wider and more systematic application of knowledge-management standards than in the software factories.

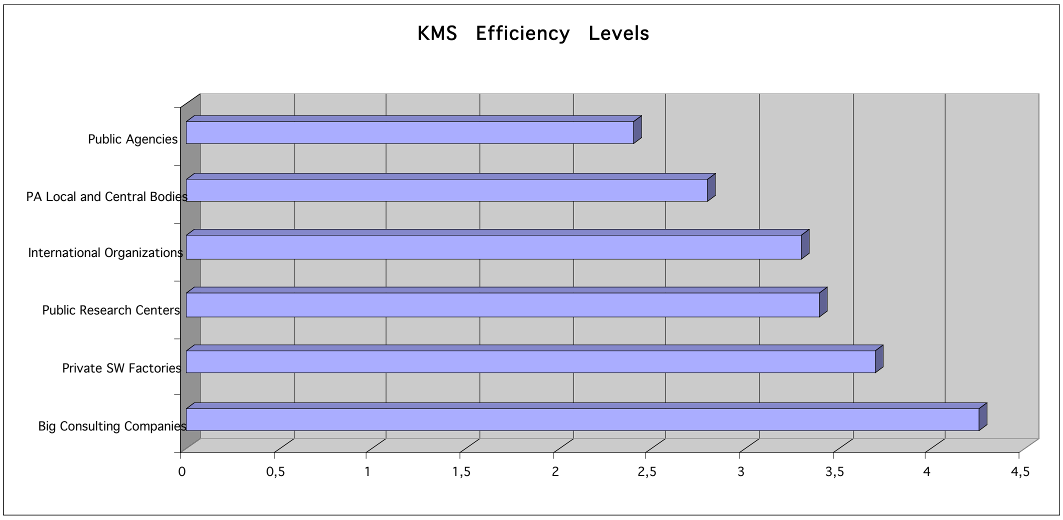
As already observed basing on the knowledge-management system efficiency levels rated the here analyzed public subjects can be classified by distinguishing the lower ones (i.e. the Italian public administration local and central bodies and the public Agencies) from the higher ones (i.e. the national research centers and the international organizations).

To characterize the first two it can be noticed that the highest difference detected as a whole is occurring among the private big consulting companies and the Italian Public Agencies (37%). Mainly, as for what directly reported from the interviewed representatives of these organizations such difference can be due to the basic inadequacy of the technological and organizational structures of the public agencies against the missions these have to accomplish. The role of the Agencies is still critical within the complex Italian public administration network; these are in charge in fact of very specific and important public services (e.g. the INPS handles with the social retirements, the ETR with the collection of fiscal revenues, the Agenzia Dogane with other kind of fiscal control actions) that even more increasingly need to be supported by the knowledge-management systems because of the complex instances/requests of the even faster and wider society. However, in most cases the Agencies present a very old organizational structure (references) whose ability in handling with the information and communication technologies does not match the complexity of the recalled instances/requests of the society. Although a very sophisticated technological systems have been introduced to manage the Agencies' huge data-bases their wide organizational and technological change seems to be not complete yet: the technological infrastructures are exclusively managed by few specialists (Information System Offices) while the whole number of employees able to handle proficiently with these remains small. And that still contributes in making the Agencies weakly able to perform their own business processes as requested from the timing of the outside society. Therefore, it can be argued that it is mainly because of the said incomplete modernization process (i.e. a technological and organizational change process) that a low level of the knowledge-management S efficiency arises from the here analyzed Italian public Agencies: the collected ratings "say" in fact how people working at the Public

Agencies is not efficiently supported by the knowledge-management system and a change is then needed in the knowledge-management system addressing technology and organization.

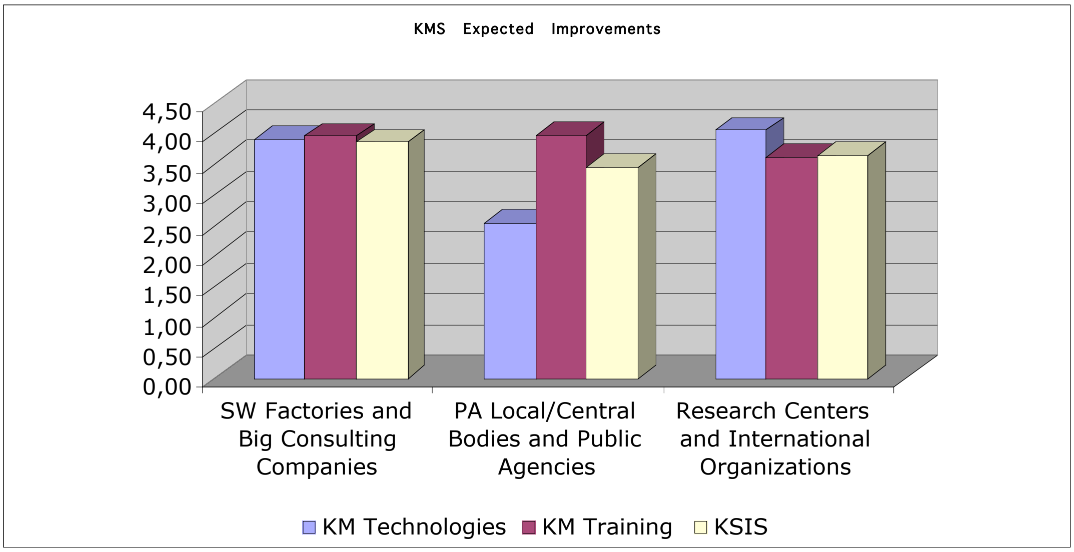
Similar reasons can also motivate the low level found in the knowledge-management system efficiency of the public administration local and central bodies where the need of support from the knowledge-management system seems to be slightly higher than the level found in the public agencies (2.8 *VS* 2.4). Such difference can maybe occur because of the wider specificity characterizing the organizational knowledge managed within the first subjects than in the latter which follows the main difference in scope between the missions of such subjects. As described in Chapter 8 both local and central bodies of the public administration mainly generate, store, distribute and apply knowledge contained in their own official Acts and documents mostly addressing the political and administrative decisions taken by the same body; indeed, following the wide spectrum of the competencies of the same public administration body (e.g. education, health, transports, buildings, etc.) a wide spectrum of different political Acts and administrative documents is managed by the knowledge-management system. The Agencies instead mainly manage such a more complex knowledge constituting the same base of the specific services provided directly and continuously to the society (e.g. fiscal controls, social retirements, etc.); mostly, such knowledge consists of records containing core information regarding people, firms, personal property, fiscal states, and everything is needed to perform the basic service the Agency is in charge of. Therefore, given a presumably similar level of lateness in the knowledge-management development characterizing both these subjects the said difference in the managed knowledge then yields a different need of support from the knowledge-management system as it is perceived slightly higher in the public Agencies than in the public administration local and central bodies, and consequently the knowledge-management system efficiency is perceived to be lower in the first ones than in the latter.

Both the Italian research centers and the international organizations present higher values in the knowledge-management system efficiency than the values found in the public administration bodies and the public Agencies; that tentatively supports the idea that a higher level of knowledge-management development can be found in the first organizations. In particular, what mainly arise such difference is the ability in handling with the information and communication technologies which is higher throughout the researchers (at the research centers) as well as throughout the officers at the international organizations than the employees of the Italian public administration local and central bodies and those working at the Italian public Agencies - as for ability here is specifically intended the personal competence of individuals in handling with the technological infrastructures making the knowledge-management system run in each considered organization. The researchers for example resulted to be generally very well trained in the information and communication technologies so that they have no difficulty in handling with all knowledge-management technologies implementing the knowledge-management processes - e.g. we-based portals, knowledge-bases management systems, communities of practices, forums, group-wares, etc. So they are the officers at the international organizations. Thanks to the individual correct use of the technological infrastructures the knowledge-management system can then run proficiently at organizational level and consequently produce a higher performances in terms of support given either at individual, organizational, and network level as it is arising from the collected ratings.



The ratings addressing the knowledge-management system possible improvements globally arise a uniform expectations from the here analyzed subjects. The specific average values are respectively 3.9 and 3.28 for the private and public subjects with respect to the knowledge-management technologies; while these are 3.94 and 3.77 regarding the knowledge-management training and finally 3.84 and 3.53 regarding the knowledge-sharing incentive system (KSIS). Then, comparing the public and private groups of subjects no significant difference can be found (i.e. these are all lower than 15%) and a strong expectation of improvements is wide spread across all these subjects (i.e. 3.89 total average level for the private subjects and 3.53 for the public ones).

Organizing the data by three groups - 1. private subjects, 2. public administration local/central bodies and public Agencies, and 3. research centers and international organizations - some slight difference arises as it can be seen in the table below. In particular, what is to be noticed is the balance among the three main components of knowledge-management system expectations as it is arising from the private subjects (i.e. 3.90, 3.94 and 3.84) while it seems to be lower or missing across the other two subgroups. The knowledge-management system improvements expected from the knowledge-management training exceed in fact the other expectations in the subgroup of public administration and public agencies (3.95 VS 2.53 from the knowledge-management technologies and 3.43 from the KSIS) as well as the expectations from the knowledge-management technologies exceed the others as rated from the research centers and the international organizations (i.e. 4.03 VS 3.59 from the knowledge-management technologies and 3.64 from the KSIS). To some extent that can support the hypothesis that a stronger awareness about the knowledge-management can be found in the private subjects where a very similar importance is given to all knowledge-management key-factors while a weak awareness is present within the public subjects where a particular greater importance is given to one of the knowledge-management system key-factors. That is because the balance in the expectation can mean to have already reached a balanced development state against all the three knowledge-management system key-factors while *vice versa* a lack of balance can mean that the knowledge-management system progress is late against one particular key-factor. This is the case of the knowledge-management training within the public agencies and the public administration local/central bodies from one side and the knowledge-management technologies in the research centers and the international organizations from others. Basing on the interviews in fact the need of conducting specific knowledge-management focused training actions is strong throughout the public agencies and the local and central bodies of Italian public administration since the knowledge about knowledge-management technologies, methodologies and practices is poor in many employees so that the implementation of the knowledge-management appears to be still limited at organizational level by such lack of knowledge. Within the research centers and the international organizations instead the "employees" do know more about the knowledge-management technologies and are then more confident that a technological improvement can contribute positively to increase the organizational capability of implementing the knowledge-management : that can be why their expectation is higher from the knowledge-management technologies rather than from other knowledge-management system key-factors.



Within the private subjects a balanced situation was found in the expectations of both the software factories from the Cosenza area and the big consulting companies. Specifically, the average values found among the first ones were very close each other: 3.63 for the expected improvement level from the knowledge-management technologies, 3.58 from the knowledge-management training activities, and 3.6 from the KSIS; while a slightly higher variance occurred among the values of the latter: 4.17 for the expectations from the knowledge-management technologies, 4.30 form the knowledge-management training activities, and 4.08 from the KSIS.

It can be observed in particular that the training seems to represent to the big consulting companies as the most important knowledge-management system key-factor. This is arising from the outcomes of the conducted interviews due to the greatest importance that organizations like these give to the personal contribution to the knowledge-management in terms of organizational behavior. Through the analysis of the involved subjects in fact the knowledge-management arose to be considered mostly as a way of behaving within the organization in order to favor others in the free and independent access to knowledge. That means knowledge is mostly intended as the support holding the "memory" about others' actions. Indeed, many representatives from the consulting companies described the strong effort which is continuously made across their organizations to make everybody act in order to favor others' chances of accessing what everybody does within his/her tasks - i.e. the outcomes, the development, the description of the tasks they accomplished. Many initiatives are implemented to train people in such way of acting individually like Summer Schools, seminars, high-intensive training periods: initiatives like these aim at strengthening in their consultants, managers and professionals the idea about the identity and the mission of their own companies and then the following (related) need of sharing each others everything in terms of knowledge. That is done to make people feel as one part belonging to the great body of the only one enterprise so that people can be pushed to act in a naturally cooperative way by helping and asking help to his/her own colleagues all over the world. Then, the knowledge-management is carried out bearing a worldwide network connecting people; that is specifically pursued acting on people willingness through a strong continuous and highly-focused training action. This can by why the value of the expectations from the knowledge-management training actions exceed those from both the knowledge-management technologies and the KSIS: technology without willingness is nothing, and training is the best way of motivating individuals' willingness over than using an economic incentive system for the knowledge-sharing (KSIS).

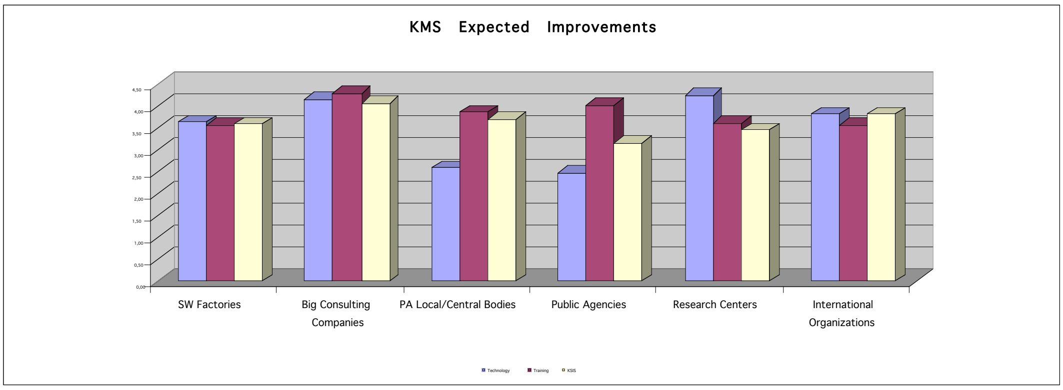
As for the public subjects the public administration local and central bodies and the Public Agencies present very similar values in terms of expectations of knowledge-management system improvement either from the knowledge-management technologies, the knowledge-management training activities, and the KSIS; in particular, 2.59 and 2.48 are the values respectively obtained for the knowledge-management technologies, 3.87 and 4.03 for the knowledge-management training, and 3.60 and 3.17 are for the KSIS.

What seems to be remarkable is the low level of expectations from the technologies against the high level of expectations from the training. This can be motivated by the information and communication technology wide spread throughout the public administration along the last few years. Many very complex and sophisticated systems (e.g. expert systems, data warehouses, DBMSs, web portals, group-wares, etc.) have been introduced in several local and public administration bodies as well as in all public Agencies in order to modernize and improve the services provided by the public administration both internally and externally to citizens and enterprises. However, there was not produced a parallel and balanced effort to improve people personal ability in handling with such information and communication technology based systems: the information and communication technology based infrastructures are commonly strong and sophisticated throughout the public administration but those exceed in some case people specific knowledge and abilities. In many of the here analyzed cases the information and communication technology infrastructures are centrally managed by a small Information System office where few experts and specialists are in charge of providing the entire organizational structure with the needed information and communication technology based services, and of guaranteeing the effective operational state of the same information and communication technology infrastructures. Moreover, in some case the information and communication technology based services are provided to the public administration by outsourcing;

then, the only one information and communication technology competence owned by the public administration only regards the handling with the outsourcing external providers. That is why globally a basic need of training is widely and deeply felt (to be even unsatisfied) throughout either the public Agencies and the public administration local and central bodies involved into the Study's empirical analysis. And that is why consequently the greater expectation for improving the knowledge-management focuses on the training actions versus the technologies cause the latter is available while the first is not too much.

Where the knowledge-management technologies produce the highest expectations is in the public Research Centers; there can considered to be an effect somehow of the highest training level of the employees (i.e. the researchers) in the technologies. The here analyzed research centers in fact are constituted by very young researchers all well trained in the use of the information and communication technology based applications. Moreover, the chances of implementing any possible economic incentive systems are there very poor. And last but not least the researchers working there seem to be not willing to adopt any practice of rule for sharing knowledge under standard formalized patterns cause the sharing is mostly done informally by talking and cooperating on the same project or research activity. Therefore, such researchers believe to be not needing much more training (cause the are already well trained on the information and communication technologies and no training is needed on the knowledge-management practices) neither they believe in the possibility of receiving any extra payment because of their personal knowledge-management action. Probably because of this they trust the knowledge-management system improvement is to be pursued mainly by focusing on the knowledge-management technologies rather than on the knowledge-management training and the KSIS.

What was found across the international organizations is a lower expectation from the training (3.55) against the same expectations from both the knowledge-management technologies and the KSIS (3.81). That could be due to a relatively weak awareness about the role of individuals' willingness in implementing the knowledge-management through their own way of performing the knowledge-management processes. Although well trained in the use of information and communication technology based solutions the officers of the international organizations are commonly not trained in the knowledge-management oriented behavior (as the professionals from the worldwide consulting companies) and then they do not know how much powerful people's behavior can be in sharing knowledge at organizational level for example. Their idea about training is mostly lying in the basic knowledge that is needed for handling with the knowledge-management systems and the information and communication technology based systems, in general. That is because the training programs there implemented generally misses the role of the knowledge-management system and individuals' expected contribution in the whole knowledge-management implementation. And consequently their expectations of improvements tend to focus mainly on the technology and the KSIS.



In conclusions, by analyzing the knowledge-management system efficiency ratings it was found a consistent difference occurring between the private and the public subjects; in particular, this occurs between the private subjects and those belonging to the public administration local and central bodies and the public agencies. Further, focusing on the single groups it was found just a tight difference between the private subjects of the small software factories from Cosenza area and the big consulting companies, from one side, and a deeper difference between two differently performing subgroups among the public subjects, from the other: the knowledge-management systems belonging to the public agencies and the public administration local/central bodies seem to perform at a lower level than those belonging to the research centers and the international organizations. From a global point of view the highest values were found in the big consulting companies while the lowest ones were found in the public agencies.

The analysis of the rating addressing the knowledge-management system expected improvements instead highlighted how the private subjects can be characterizes by a globally balanced expectation from all knowledge-management system key-factors while the public subjects shown some differential: a higher need of training as found in the public administration local/central bodies and public agencies, or a higher need of technology as found in the research centers, and finally a weak expectation from the training as found in the international organizations.

Basically, these first empirical evidences support the idea that some deep difference characterizes the knowledge-management development of the subjects and particularly that the private ones can be considered to be more advanced than the public ones. That is because of the different level of knowledge-management system performance as in the knowledge-management system efficiency rating: the basic 20% difference found between the private and public groups reaches the 37% where considered exclusively between the big consulting companies and the public administration local and central bodies. Moreover, the balanced expectations found in both the private software factories and the big consulting companies witnesses to some extent the higher awareness of these subjects about the knowledge-management system possible improvement against the higher (and partially limited) focalization of the public subjects on only one knowledge-management system key-factor.

8.3 Compared Analysis: Focus on the Knowledge-Management Metric

Here are described the outcomes obtained by applying the correlation based computing that lead to test the effectiveness of the knowledge-management metric which is here proposed as pivotal element of the knowledge-audit extension; as applied on the subjects the correlation-based metric produced very different estimates in values distinguishing the private one by high levels and the public ones with very low levels.

To build the correlation matrices: the analysis of the ratings started comparing the data obtained from each group respectively rating the knowledge-management system (efficiency and expected improvements) from one side and the balanced scorecard performances from other. The balanced scorecard rating was specifically conducted by applying the schemes reported in the tables below. It has to be noticed that two specific schemes addressing the balanced scorecard model (Kaplan and Norton, 1996; 2001) were differently applied to the groups of subjects: private and public ones. Following the same nature of the balanced scorecard scheme as proposed by Kaplan and Norton that was made because of the main basic difference distinguishing such two groups from the point of view of the achieved performances: while profit motivates the first ones the social interest motivates the latter ones. Because of this it was needed to define two specific sets of indicators addressing two main groups of goals that are specifically indicated in the tables 8.4 and 8.5.

Tab. 8.4 - balanced scorecardMain Indicator of Performances for Rating the Private Subjects

1. Learn and Growth	3. Customer Satisfaction
1.1 IT expended on Training / IT expenses (%)	3.1 Market Share
1.2 Investment in new product support and training	3.2 % Service Level Agreements met
1.3 % projects measured using the recognized methods improvement projects	3.3 % IT solutions supporting process
1.4 Project Delivery Rate	3.4 Defect Ratio
1.5 Duration Delivery Rate)	3.4 Defect Ratio
2. Process Efficiency	4. Economic and Financial Results
2.1 Repair Cost Ratio	4.1 % Profits / FSAV
2.2 Defect Ratio	4.2 % Revenues / FSAV
2.3 Testing Proficiency ratio	4.3 % Revenues from new customers / total revenues
2.4 Application support rate	4.4 Total assets (FSAV) / # of employees
(2.5 Duration delivery rate)	
(2.6 Application maintenance per person)	

- *FSAV Functional Size Asset Value*

The schemes applied to rate the performances were defined by selecting a number of indicators addressing the four main dimensions proposed by Kaplan and Norton - i.e. learning and growth; internal processes; incumbent costs; and social value created. However, given the higher global differences characterizing the subjects within the public group (against those of the private one) and the intrinsic vagueness of the addressed concept, a very wide set of indicators was defined to address the fourth perspective of the scheme: the social value created. Indeed, only four of these were applied in each case as selected as the most adapted to the single subject. Just a part of all selected indicators in fact is reported into the table 8.5.

Tab. 8.5 - balanced scorecardMain Indicator of Performances for Rating the Public Subjects

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1. Learn and Growth	*3. Incumbent Costs*
1.1 IT expended on Training / IT expenses (%)	3.1 Budget (Yearly)
1.2 Investment in new product support and training	3.2 Extra Budget (Possible Rearrangements)
1.3 % projects measured using the recognized methods	3.3 Average Returns on Expected Costs
1.4 # New Services / # Provided Services	3.4 Total Cost of the Service / # Employees
1.5 Empowerment of Employees	3.4 Returns on Investments / Returns on Budget
2. Process Efficiency	*4. Social Value Created*
2.1 Repair Cost Ratio	4.1 # Registered Applications/Records
2.2 Defect Ratio	4.2 # Analyzed Applications/Records
2.3 Testing Proficiency ratio	4.3 # Completed Applications/Records
2.4 Application support rate	4.4 # Extra Services Directly Provided to the Citizens
(2.5 Duration delivery rate)	4.5 # Web Services to citizens
(2.6 Application maintenance per person)	4.6 # Web Services to Enterprises
	4.7 Public Revenues Increases
	4.8 Fighting Frauds
	4.9 Defenses of Copyrights and Trademarks
	4.10 Creation of Partnerships with External Entities
	4.11 (...)

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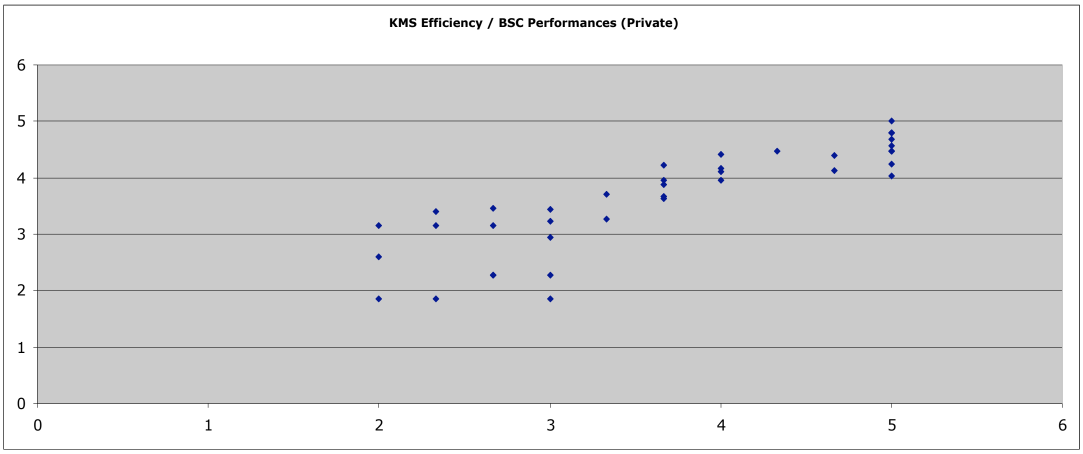
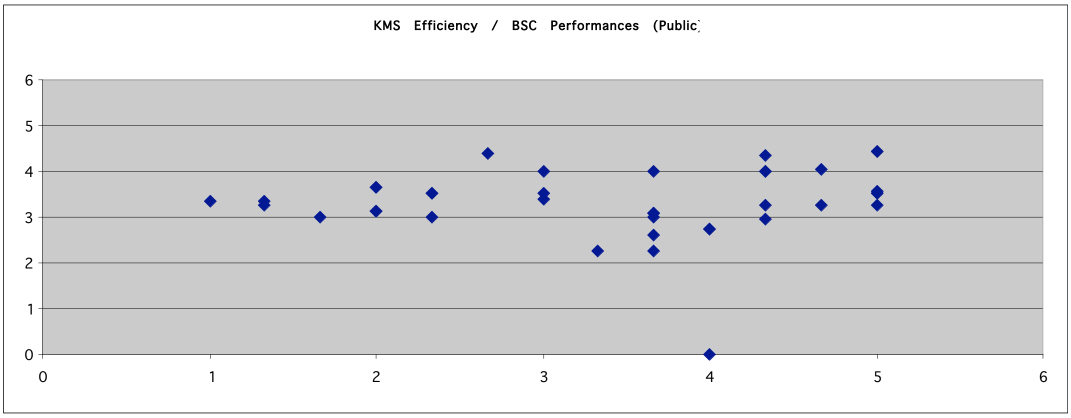
The rating obtained for the performances by the balanced scorecard schemes were then compared with the ratings addressing the knowledge-management system efficiency and that allowed to get a graphic prove of the higher dispersion of the values addressing the public subjects against the high concentration of those addressing the private subjects. The tables below show in fact how the values found tend to distribute for the private subjects around the major diagonal of the knowledge-management system/balanced scorecard diagram (tab. 8.6) while those found for the public subjects tend to spread randomly (tab. 8.7) - there are reported the data found for the average level of the knowledge-management system efficiency and the balanced scorecard performances.



The data here plotted show how the private subjects are characterized by a stronger correspondence between the data addressing the business performances and those addressing the knowledge-management system performances rather than the public subjects. That means that a stronger correspondence could be existing between the use of the knowledge-management system as made by such organizations and the obtained results in terms of improvements in the business processes; while just a weak correspondence can be found between the same values addressing the public subjects.

This first evidence still represent a key-issue behind the empirical analysis of the Study cause this is the same basis of the empirical support to the here proposed main idea of using the knowledge-management system-ic/balanced scorecard correlation as quantitative based estimate of the relation passing among the knowledge-management system support to the business processes and the organizational capability of traducing this in terms of business performance increases.

By analyzing then the covariance values it can be found that a 78.8% covariance is occurring between the balanced scorecard performances and the knowledge-management system performances of the private subjects while a 13.1% covariance is occurring between the same parameters where calculated for the public subjects. Therefore, it is expected that a great (more than significant) difference will be occurring between the related value of correlation for the private subjects, from one side, and for the public subjects, from the other.



Basing on the same above said knowledge-management system and balanced scorecard rating average levels it was possible to calculate the correlation values shown in the table 9.8 that demonstrate how a great difference is occurring between the private and the public subjects: while a very high levels of correlation were found for the private subjects a very low levels were found for the public ones. In particular, the values found for the private subjects reached the 86% level in the case of knowledge-management system efficiency and the expected improvements from the training, the 85% in case of expectations from the technologies, and the 74% for the expectations from the knowledge-sharing incentive system. In the case of the public subjects instead the correlations found are still lower; this is 20% and 33% for the knowledge-management system efficiency and the expected improvements from the technologies while it stands around zero for the expectations from the training activities and the knowledge-sharing incentive system.

These data strongly support the basic idea of the Study that a deep difference can be found between the knowledge intensive organizations and the public organizations in the use of the knowledge-management system for improving the business performances, and then that a highly correlated relationship can be estimated between the performances addressing the knowledge-management systems and those addressing the business performances in the first case only. Basing on these data in fact either the variations in the knowledge-management system efficiency of the private subjects and in their knowledge-management system expected improvements are close related to those occurring in their business performances. Instead, the variations in the knowledge-management system efficiency and expected improvements from technologies are occurring in the public subjects only weakly following the same variations in the performances. And, more than this the variations in the knowledge-management system expected improvements from the training and the KSIS are there occurring with a zero correspondence with the variations occurring in the performances.

Tab. 8.8 - Knowledge-management System / Business Performances Correlation Values

	Private	Public
Knowledge-management Efficiency / Business Performances	86 %	20 %
Expected Improvements from Technologies / Business Performances	85 %	33 %
Expected Improvements from Training / Business Performances	86 %	3 %
Expected Improvements from KSIS / Business Performances	74 %	- 3 %

Given the wider and more articulated whole analysis scheme here developed (see Chapters 4-7) a greater number of correlation values are calculated between the knowledge-management system-ic performances and the business performances of both the private and the public subjects. In particular, these are the single components of the correlation matrices whose rows are represented from one side by the three knowledge-management system components (respectively addressing: 1. the individual capital, 2. the organizational capital, and 3. the networking capital) and from other by the four main groups of balanced scorecard indicators (respectively addressing: 1. the learning & growth of organization; 2. the efficiency of internal processes; 3. the customer satisfaction/cost incumbent; and 4. the economic and financial results/social value created). There are then twelve components measuring how the business performances of one organization can be related to the effects produced by the knowledge-management system on its own.

In the table below such twelve correlation values are all clearly indicated for each of the here considered classes of data: a) the knowledge-management system efficiency, b) the knowledge-management system expected improvements from the knowledge-management technologies, c) the knowledge-management system expected improvements from the knowledge-management training, and c) the knowledge-management system expected improvements from the KSIS. These are here below organized by the related four main matrices addressing respectively the private and the public subjects.

Tab. 8.9 - knowledge-management system-ic / balanced scorecard Correlation Values - Private VS Public Subjects

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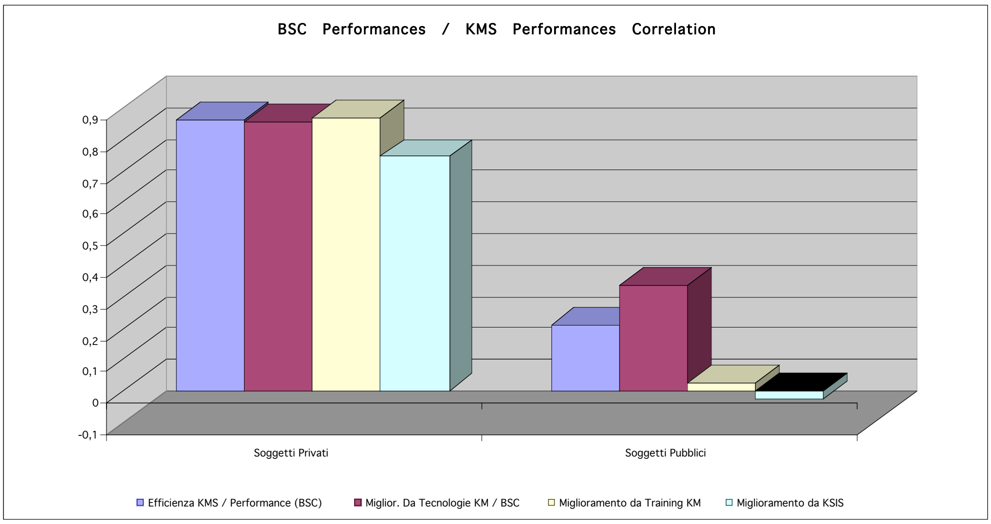
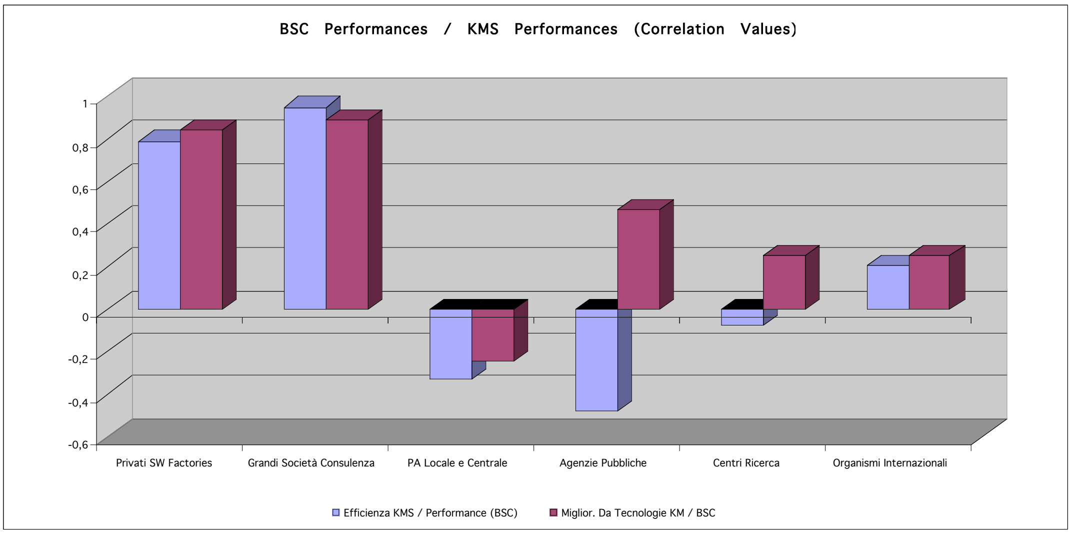
In the tab below it is clearly shown that very highly different values are produced in the estimates produced by applying the here proposed metric in the two groups of subjects. In particular, while the estimates addressing the private subjects are very high in values with respect to the correlation that have been found either between the knowledge-management system efficiency and the business performances and between the expected improvements and the business performances. The estimates of the correspondent values produced applying the metric on the public subjects are very low.

Such differences strongly support the idea that the private organizations use proficiently their own knowledge-management systems since the levels of efficiency of their own systems are strictly related to the business performances as well as their expectations of improvements (i.e. higher than 75%). In the public subjects instead the correspondent values are still lower supporting the idea that such organizations are not similarly able in using the knowledge-management system for achieving high performances neither have a clear vision about the way of improving as their expectations seem to be not strictly related to the business performances - just in case of the technology their expectations seem to be stronger related to the business performances (38%).



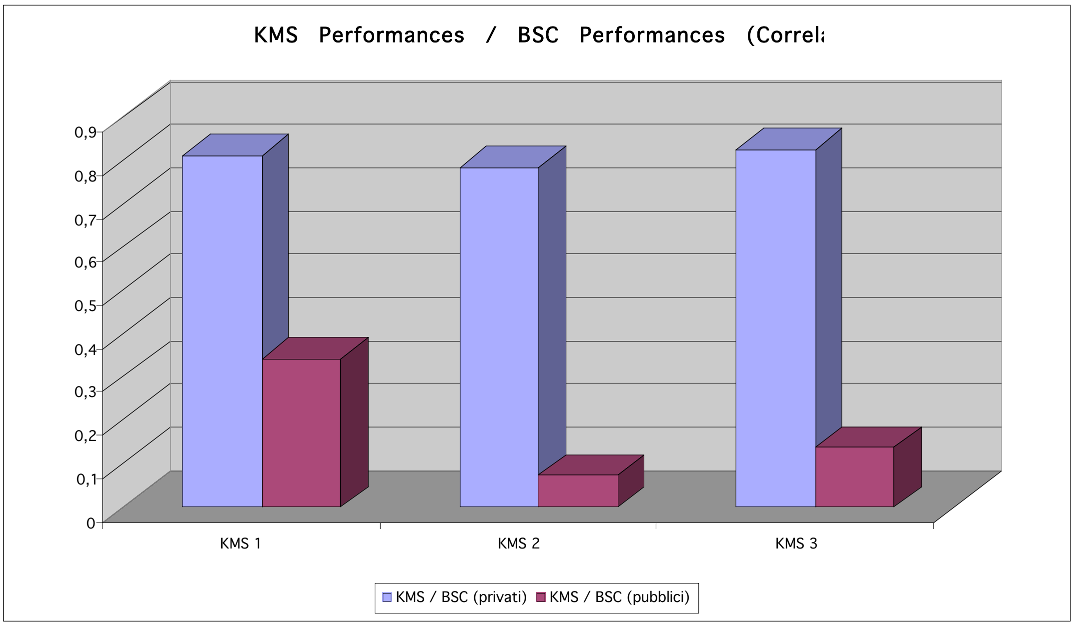
In the graphic below the single values of the estimates produced by the correlation-based metric for each subgroups belonging to the two samples; this particularly shows that very high values have been produced in correspondence of both the subgroups of the software factories and the worldwide technological consulting companies while very low estimates have been found in correspondence of all subgroups constituting the private organizations' sample. The Italian public agencies and the local and central bodies of the Italian public administration present the lowest values of the estimates (-25%; -40%) and that strongly supports the main hypothesis formulated into the precedent chapter basing on the evidences arising from the interviews to the representatives of the analyzed organizations.



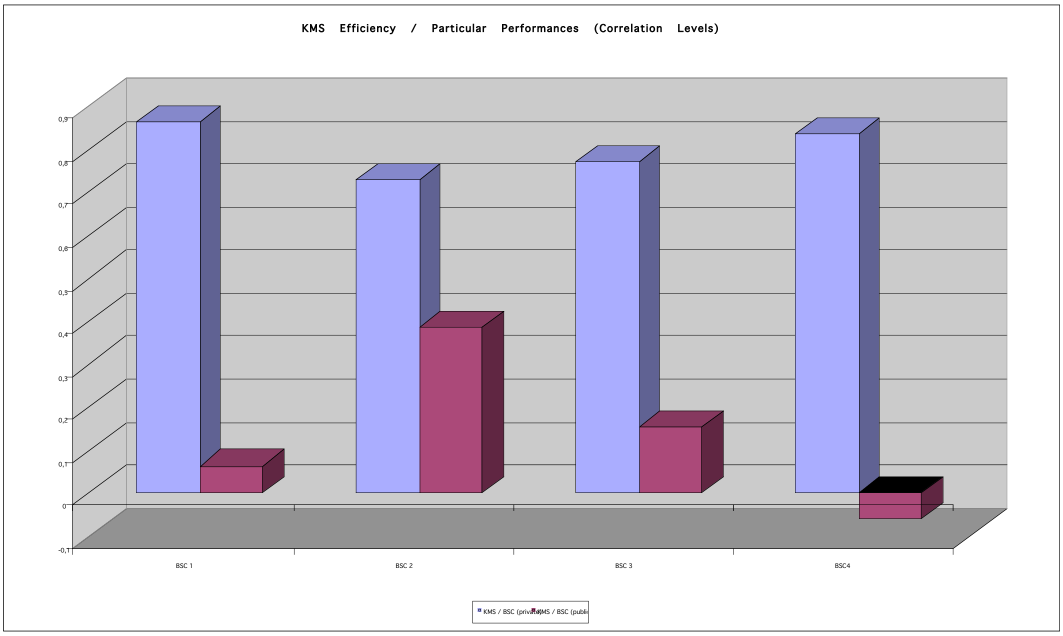
Indeed, the metric can be also applied in a more focalized way on each of the single components of the intellectual capital of organizations (i.e. individual capital, organizational capital, and networking capital) as well as single components of the balanced-scorecard oriented business performances.

In the first case in fact such a way of applying the metric can produce an estimate addressing the relationship between the support given by the knowledge-management system to each single component of the intellectual capital of the organization, from one side, and the business performances, from others. That means that as applied in such particularly focused way the metric can indicate how-much the increases in the business performances of one organization can be associated to the support given by the knowledge-management system to one single component of the intellectual capital; that can still constitute a direct clear indication to be applied into the design process of the same knowledge-management system by highlighting the most critical element of the intellectual capital on which to focus the knowledge-management design process.

The values produced by the empirical tests conducted on the samples are shown in the graphics below where it is plotted that the private subjects produced high values for all three components of the intellectual capital while low estimates have been found in correspondence of the public subjects. Also in case the exit of the metric test is positive as such values prove that the private subjects are still able to proficiently use their own knowledge-management system to support all components of the intellectual capital achieving good results in terms of business performances; while the public subjects are not able at the same level - just in case of the support provided to the individual capital (i.e. people and personal knowledge) a medium level has been achieved from the public subjects (30%).



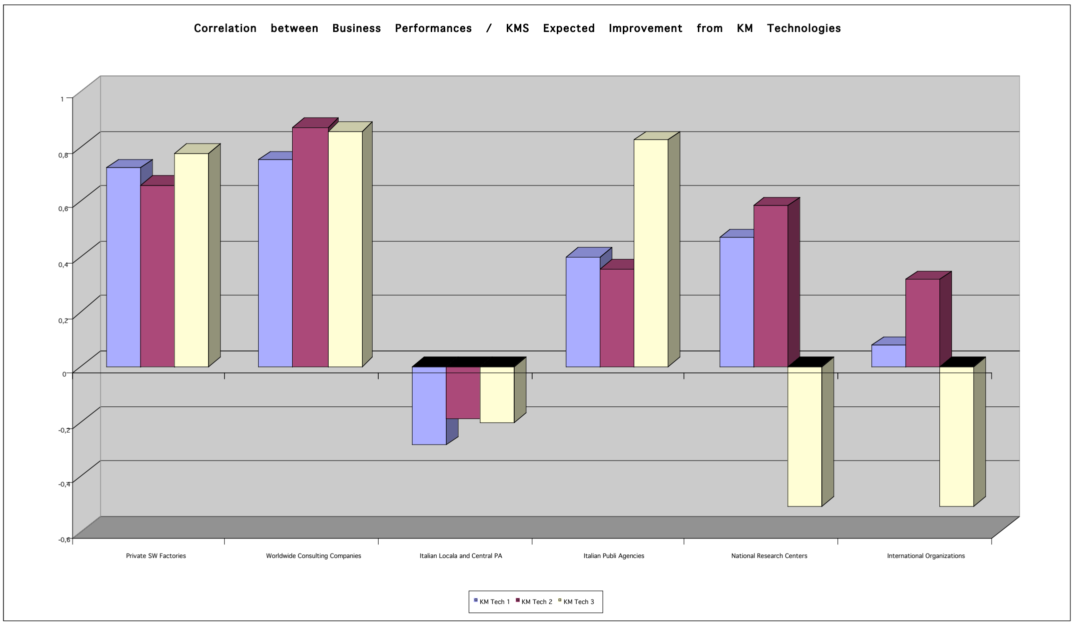
Into the graphic below instead are presented the estimates obtained by singularly applying the correlation based metric on each of the four balanced-scorecard derived perspectives on both the public and private subjects. In this case the addressed meaning of such estimates regards the correlation occurring between the support globally given by the knowledge-management system to the intellectual capital of all organizations and each single component of the said scheme used for rating their business performances. In this case therefore the estimates also provide a critical indication that can be effectively used within the design phase of the knowledge-management systems by individuating the possibly needed improvements that should to taken in order to increase those business performances that are revealed to be insufficient. The graphic below also shows such a data supporting the full meaningfulness of the (here proposed) correlation-based metric as the estimates obtained from the private subjects are very high in values while those obtained from the public ones are very low; that proves that the knowledge-management systems operating inside of the private organizations are positively and significantly contributing the achievement of all business performances while in the case of the public organizations the knowledge-management systems are weakly supporting the achievement of the business performances except of the case of the efficiency of the internal processes where the estimate exceeds the 30% in value - that confirms the evidence arising from the basic analysis of the subjects (see Chapter 7) about a possible technology-based approach which tends to characterize many of the here analyzed public organizations.



8.3.1 Focus on the Knowledge-Management Technologies

Given the scientific and technological lien with the same origins of the interest in the knowledge-management (see Chapters 1 and 2) a particular importance should be given to the role of the technology against the analysis of the empirically obtained results. It is in fact particular important to explore the relationship between the technology that has been specifically used to implement the knowledge-management systems and the impact produced on the real organizations in terms of increases in the business performances. Although a great expectation is basically characterizing the development of the knowledge-management technology the here obtained data demonstrate that such technology-good business performances relationship cannot be assumed to be occurring in all cases.

As shown into the diagram below the contributions expected from the knowledge-management technologies to the achievement of good business performances can deeply vary between the public and private subjects. In particular, while the here analyzed private organizations can be characterized by uniform expectations throughout the here considered three main families of technologies for knowledge-management (i.e. for explicit knowledge under structured forms; for explicit knowledge under semi-structured form; and for tacit knowledge) the public organizations are instead characterized by significantly different profiles of expectations. In particular, the local and central bodies of Italian public administration are characterized by very low level of correlation; that means that such organizations could be not trusting a possible increase in the business performances from any of the available technology - to some extent, that seems to be coherent with the global vision of such organizations as the most late in the development of the knowledge-management systems. The public agencies instead are characterized by a consistent expectation from that technology which focuses on the exchanges and acquisition of tacit knowledge; that means that such subjects believe in the possible contribution of the technology for strengthening the organizational internal and external networks through which knowledge can be flowing. Similar profiles finally characterize the expectations of the national research centers and the international organizations although by different values: the correlation is high in correspondence of expectations of the first ones from the traditional technologies while is lower in the latter while this is near to the same level for the third class of technology; that should mean a strong competence in the traditional technologies that produce high expectation while not a deep trust in the newer technologies.



8.4 Guidelines for Boosting the Knowledge-Management Systems

The here obtained results in terms of suitable knowledge-management system-improving strategies are here collected and then organized with specific regard to the public subjects as these were proved to be late in the development of the knowledge-management systems.

As proposed in Chapter 6 the correlation based metric can be used not only for assessing the knowledge-management capabilities of one organization but also for defining a quantitatively-related strategy for designing (or improving the already existing) knowledge-management system; in particular such strategy is consisting in a combination of values addressing the quota by which structure the said strategy basing on three main components: the technologies, the training activities focusing the knowledge-management, and the knowledge-sharing economic incentive system.

That is, here are following the strategies that should be applied to improve the knowledge-management systems in all subgroups of the here analyzed samples. In particular, the graphics below show the single components of the respectively related improving strategies per each subgroup.

In the case of the technological consulting private companies (both the software factories operating in Southern Italy and those operating worldwide) the improvement strategies are quite similar with a basically uniform distribution of the effort on the three main components - i.e. technology, training, and knowledge-sharing. That is because a uniform high awareness has been found in these subjects about the importance of the three main types of available technologies to be applied as well as the other key-factors on which to structure the design of the knowledge-management systems. The high level of already reached by such organizations in the development of the knowledge-management system structuring means in fact that a full and deep awareness must characterize them and consequently a global effort towards the knowledge-management has been made by those subjects either from the technological and from the organizational points of view. So that all key-factors are uniformly important to further improve their system as well as their capabilities in even more better perform the knowledge-management activities and then achieving higher business performances.

The most important factors to base the improving strategies in the local and central bodies of the Italian public administration and the international organizations is constituted instead by the training activities. That is follows from the basic wide lack of competencies that has been detected to be existing still today in such organizations where the diffusion of the technologies has not been accompanied by a coherent process of training.

In the case of the Italian public agencies the main lack to be faced is represented by the technologies that arose to be not fully available to the subjects involved into the empirical phase of the Study. That is why the related component is prevailing in the here-proposed improving strategy against those addressing the training activities and the knowledge-sharing incentive system. Because of the high competence levels diffused in the national research centers about the knowledge-management activities and technologies the improving strategy of the knowledge-management systems is uniformly distributed on all the said key-components.

8.5 Conclusions

A globally positive exit has been produced by the empirical test of the here proposed metric for assessing the organizational knowledge-management capabilities of organizations. In particular, very high values has been found in the case of the private organizations while very low values were have been found in the case of the public ones. That proves that the deep difference existing between the subjects of the two groups in the development of their own knowledge-management systems has been coherently revealed by the here proposed metric as very different estimates have been produced in value: high values of correlation can be associated mean in fact to a presumable strongly (although not necessarily) related capability of the private organizations in using proficiently their own knowledge-management systems for achieving good performances while a weaker capability can be associated to the public organization although some difference can be individuated among the different organizations belonging to the subgroups of the public subjects' sample.

Furthermore, by applying the here proposed analysis framework a number of specific improving strategies have been defined to design (or simply to individuate the improvements needed from) the knowledge-management systems of these organizations - of course, such strategies have been defined coherently with the differences characterizing the subjects of the two samples. The strategies to be applied in the private subjects are structured by a globally uniform effort to be done on technologies, competencies and incentives while the strategies to be implemented in the public organizations are structured differently per each of the subgroup belonging to this sample: where most of the effort has to be focused on training activities in the central and local bodies of the Italian public administrations and into the international organizations, the technologies represent the most critical factor on which to base the improving or design strategy of the knowledge-management system.

Chapter 9
Conclusions

9.1. Premise

In 1995 Nonaka and Takeuchi proposed to the international scientific community and to the widest universe of enterprises a vision about something very easy to believe but still difficult to formalize: as the value creation processes increasingly tend to depend on the value of knowledge the competitive advantage of every organization will consequently depend even more on the ability of organizations in learning which means to create, use and accumulate knowledge while accomplishing all business processes. Although a very intrinsic difficulty in formalizing or providing a concrete prove of this such vision produced a very deep impact on the organization and technology field turning the traditional approaches to the information and decisional support systems towards a new horizon represented by the knowledge-management systems. To some extent it could be argued that a cultural change occurred into the concept of information processing system, and a jump has been made towards the higher knowledge-management step.

However, such evolution is actually in progress starting from the same concept of knowledge that should be addressed to achieve the coherent objectives with the improvement of enterprises: while it seems to be clear the aim which is to structure the organization and the information systems for favoring and strengthening the knowledge-creation and -transmission processes, it does not seem to be clear the way for doing so.

9.2. The Survey's Final Contribution

The Study's final contribution mainly lies in the extension of the structure of knowledge-audit models [Laybowitz, 2001; Dataware, 1998; Wiig, 1993] which is here added with a specifically focused process on the knowledge-management systems. In other words, as the knowledge-audit process can be considered to be mostly an inventorying process of organizational knowledge [Laybowitz, 2001] this is here widened in the analysis spectrum by introducing a specific assessment process regarding the organizational capabilities in managing the same organizational knowledge.

Such extension is here proposed to increase the effectiveness of the knowledge-audit process since the *status-quo* merely regarding the organizational knowledge (i.e. target of knowledge-audit processes) cannot be considered to be sufficient to base the final advise that organizations can use for improving its own knowledge-management activities. To make stronger such advise, and to increase the effectiveness of knowledge-management systems design and implementation phases it is also needed in fact to be aware about the *status-quo* regarding the organization capabilities of handling with knowledge. Then, the true contribution of the Study lies in the attempt at bridging the supposed existing divide (i.e. a weak matching) between the organizational knowledge as represented by knowledge-audit analysis reports and the knowledge-management key-factors to be used for building-up a knowledge-management system (e.g. knowledge-management technologies, training, etc.). No suitable strategy for selecting the available specific technologies or other possible support-system constituting factors seems to be well structured for conducting proficiently the design and implementation plans of the knowledge-management systems.

The here proposed knowledge-management assessment strategy then tries to answer to the following question: " ... *how can the knowledge-audit process be improved in order to produce a clearer operational outcomes to design a* knowledge-management system*?* ... " where the proposed answer is: " ... *such* *improvement can be taken by extending its analysis spectrum to the organizational knowledge-management capabilities, and then by estimating the coherent changes that must be part of the knowledge-management system design strategy ...* ".

The Study then develops the idea presented in Iazzolino, Pietrantonio, Ruffolo, Verteramo [2004] and then recalled in Iazzolino, Pietrantonio [2005a; 2005b] regarding the extensions of the knowledge-audit models to the assessment of the knowledge-management organizational capabilities by a grid where the intellectual capital structure is crossed with the balanced scorecard [Kaplan, Norton, 1996; 2001]. In particular, such concepts are here further developed and organized within one rating scheme of knowledge-management systems; such framework is specifically based on a metric which is here developed by combining different values of the correlation occurring between the business-performances addressed ratings with the knowledge-management efficiency addressed ratings. Specifically, where the first ratings are calculated by a group of balanced-scorecard extracted parameters the latter are calculated by three main design factors: the available technologies, the training activities, and the economic incentives.

The here developed metric allows to establish a quantitative relationship among: (a) the knowledge-management system provided support to intellectual capital's intangible assets; (b) the constituting factors of the system (i.e. technology, personal motivation and personal competencies); and (c) the increases in the business-performances. That makes it possible not only to estimate the effectiveness of the knowledge-management system (which is here intended against the performance increases) but also to individuate the needed interventions to be accomplished in terms of technological and organizational changes.

9.3. Further Developments

In conclusions, the Study achieved two main results: first, this has outlined a metric establishing a relationship between the performances of a knowledge-management system, against the intellectual capital of the same organization, and the organization's business performances; and second, as successfully tested such metric on real organizations this has proved that such metric can be used to define the needed interventions for improving a knowledge-management system, and consequently for extending the knowledge-audit and strengthening the design phase of the knowledge-management systems.

However, although both the basic research questions of the Study have been positively answered these can be just considered as prior results that need to be further analyzed and tested on other different real subjects as well as the same theoretical framework should be further strengthened in its fundamentals. Then, two main directions at least should be followed for further developing the Study's research: the first is given by the extension of the correlation based metric; and second, is given by the design oriented model of the knowledge-management systems.

The fundamentals of the metric should be further and more precisely defined against different possible kinds of real organizations to be analyzed and classified. In particular, the set of indicators addressing the balanced-scorecard model that has been here used to assess the business performances should be better specified so that a more rigidly group of indicators could be established for precisely individuated organization. The indicators used along this Study were definitely individuated in fact following the guidance of the representatives of the involved organizations because of the lack of standard set of indicators in the literature of the field. At the same time the set of indicators addressing the intellectual capital should be better defined to obtain more deeply meaningful information about the impact produced by the knowledge-management system. That requires further and deeper analysis on real cases of different organizations.

The here defined theoretical model to extend the knowledge-audit should be further specified and experimented by a wider analysis including either the organizational knowledge and the knowledge-management capabilities of the same organization. Contemporary, another more highly focused analysis should be conducted on the design phase of the knowledge-management systems which follows to the application of the here proposed model of knowledge-audit; in particular, the knowledge-management design strategies outlined by such should be better analyzed and tested on real cases. That requires also that further and deeper empirical applications of the model should be implemented on real cases.

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