The Evolution of Information and Communication Technologies:

Towards uses oriented collaborative practices

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Abstract— **In all sectors of activity, knowledge is the most important strategic lever in the organizations' management. The informational practices induced by Web technologies and data exploitation are accompanied by a paradigm that disrupts the process of sharing and communicating information in organization. Knowledge generated by human and social activities broadens the scope of knowledge management systems. New forms of technologies are changing system's design approaches. It is on these evolving aspects of Information and Communication Technologies (ICT) that we will highlight the different challenges faced by organizations. In reviewing the literature on ICTs, several researches work highlight the importance of digital revolutions in the development of IS in general, and in particular Knowledge Management (KM) systems. In order to understand the evolution of KM Systems, we carry out the postulate that different angles of view have a positive correlation with our research perimeter: We identify that collaborative practices and decision-making approach are positively related to Knowledge Management systems' design. The conceptual model links our hypothesis with the concept of knowledge management systems. We develop a conceptual model according to a review of literature in information science. Research finding can be used for designing Knowledge Management systems. Several actors can benefit from the repercussions on a pragmatic level. System designers can identify modern developments to provide more pragmatic applications. Decision-makers can identify how to harness Knowledge Management systems and also identify good practices in terms of collaborative approaches and decision-making processes.**

Keywords-Information and Communication Technologies; Collaborative practices; Decision-making practices; Knowledge Management systems; Web technologies; big data.

I. INTRODUCTION

Modern management relies on intangible capital, information and knowledge, both in large companies and in SMEs. Today, in all business sectors, knowledge is the most important strategic lever for the management and organizations' development. Knowledge management and business intelligence are the foundations of creativity and innovation. The global companies' performance relies on the knowledge acquired and its capitalization by human resources. We propose to investigate the following research question: How do the digital revolutions, in particular the approaches resulting from Web technologies and big data, allow understanding the evolution of Knowledge Management's Systems and intelligence process? In this context, we faced a double challenge: what is the field covered and what are the main viewpoints related to Knowledge Management Systems? Our research perimeter is considered as multidisciplinary, focusing on functional, organizational, technological, human, social and societal dimensions. Although we often associate digital progress with technological revolutions, we must consider human and social resource aspects.

The new informational practices developed by Web technologies are accompanied by a paradigm that disrupts the process of sharing and communicating information. The knowledge generated, by human and social activities, broadens the scope of knowledge management and business intelligence systems. The collaborative and strategic dimension and new forms of mediation have a major impact on systems' design.

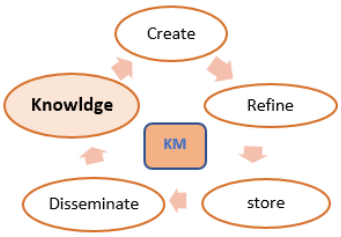
II. FROM "CLASSIC" INFORMATION SYSTEM (IS) TO COMMUNICATING IS

Every human actor, whatever his function, profile or needs, is required to use, produce and disseminate information and knowledge as part of his activity and to share it with other actors. Knowledge management and business intelligence systems are consolidated by the integration of ICT.

A. *The evolution of IS and ICT*

The evolution of IS has long been linked to technological progress (Delmond et al., 2003). ICTs are defined in the literature by considering their functions and also their components. ICT include techniques for creating, refining, storing and disseminating knowledge. This process affects the cycle of knowledge management evolution (figure 1).

Figure 1: Knowledge Management cycle.



The introduction of ICTs aims to maintain IS in order to improve managerial and functional process. IS are defined as "an interpretive system of a set of social actors who, in a finalized and recursive organizational context, store and transform representations via information technologies and operating modes" (Rowe, 2007). It is generally accepted, by researchers working in the digital field, that IS groups all the information and process optimizing the activity management. The latter is composed by two complementary levels: the pilotage system and the operational system (figure 2). The first level is related to the actors managing the activity, including decision-makers such as the general management and the board of directors. The operational level covers the human and material resources directly involved in the production of goods or services. Globally, IS is based on the interaction between information flows generated from operational and pilotage systems (Le Moigne, 1990). The IS of companies has at least two purposes:

- The functional dimension covers information management tools, whether it is for operational function (automated tasks dedicated to the day-to-day activity's management), or for strategic function (decision-making aspects).
- The human purpose is to develop social connections and create a corporate culture.

The technological breakthrough of the last thirty years has had an impact on the integration of ICTs into functional and managerial process and on the evolution of 'classic' IS towards communicating and strategic IS.

The Internet has gone through three main phases (figure 3). In the web 1.0 phase, consumer is informed via search engines and has access to a multitude of information. Web 2.0 is the phase where consumer uses social networks, conferring a process of interaction. Web 3.0 is distinguished by the fact that Internet have the capacity to interprets information, with the introduction of algorithms and artificial intelligence. Regarding e-commerce studies, Internet offers targeted content based on actor's browsing habits, tastes and preferences.

Figure 2: Web evolution.

From a chronological point of view, the evolution of technological devices, covering the 1960s to 1970s, was characterized by the automation of organizational process. The systems were limited to data management and process related to the operational level. The integration of technological tools was mostly represented by the computer, to process information in the form of structured databases. The use of the first computers was limited mainly because of the high cost of acquisition and the complexity of devices' uses. IS covered essentially operational functions in the organization management.

Since 1980s, with the development of IT for "individual" use, the devices' design considers human and social practices. This period is characterized by users' autonomy, made possible by the growing use of microcomputers, the development of interfaces and office automation tools. The integration of ICT, at the strategic level, has completed the foundation of IS implementation. Communication tools was one of the main priorities of researchers, particularly with the development of two main levels:

- The first covers internal communication with the growth of tools helping the emergence of collective communication and cooperation (cooperative tools).
- The second level concerns inter-organizational communication, with the development and generalization of Electronic Data Interchange (EDI) and network communication. We are now witnessing a deep evolution of IS with the outbreak of communication tools. IS and ICT fluidizes communication between the organization and its environment (internal and external stakeholders).

The technological revolution strengthened during the 1990s, was characterized by the access to heterogeneous resources and interfaces which are used by a various category of actor. The profusion of Web technologies has made it possible to promote knowledge sharing within organizations through increasingly communicative IS (integration of social and collective dimension).

At the research level, the evolution of IS has been characterized by two levels of analysis (Reix and Rowe, 2002):

- The design's approach: covers the study of implementation and development's process, with the aim to build efficient and operational system.
- The use's approach: covers the study of IS's impact of use on organizational process.

ICT's development has been diversified over the last decade, covering a very broad spectrum of application. Technological progress in mobile tools is contributing to the growth of IS

through the development of devices combining innovation, technical performance and user needs. Technologically, the devices are characterized by a hardware dimension, heterogeneous interfaces (tablet, mobile phone…) and various operating systems as well as information transmission networks.

Internet of Things generate data's source coming from both human actors and machines. The knowledge society integrate connected objects and innovations that provide real interaction with the environment (Pucheral et al., 2016). This development has had an impact on the emergence of IS based on connected technologies.

The 2000s are characterized by the creation of data, providing from organizations and from the web. The human and machines interactions generate a variety and a big mass of data, stored in clouds. Cloud computing is based on the use of the computing capacity of remote devices, including servers and networks. There is a paradigm shift in system design: the traditional IT function are outsourced. The concept of cloud computing, as well as the effects of new consumer practices, are leading to the implementation of "new" design models that constitute a lever for IS's transformation.

The challenges related to digital technologies development concerns both private and public organizations. The concept of "Smart Cities" or "intelligent cities" aims at the optimization of uses (Bibri and Krogstie, 2017). Today's environmental dimension is linked to the IS implementation process involving eco-responsible approaches. Companies are increasingly concerned about the environmental impact of their IS: their use of technologies is described as 'green'. This evolution impacts the technologies' design with the integrate of green dimension (Bouzidi and Boulesnane, 2016).

Table 1: ICT's evolution.

	1960-1970' period	1980' period	1990' period	2000' period	From 2000 …
Technical dimension	-Data base processing -Data-centered approach -Technical paradigm (automation of tasks and process)	-Information processing -Information-centered approach -User paradigm (the increasing use of microcomputers and office automation tools)	-Knowledge processing -Knowledge-centered approach) -Activity paradigm (impact on structures and modes of operation) -ICT mediation (development of specific/ functional interfaces)	-Knowledge processing -Knowledge-centered approach -Connection paradigm (connected objects…) -Green paradigm (Green IT, smart cities…)	-Intelligent processing -Intelligence-centered approach -Intelligent tools -Connecting-paradigm -Green paradigm - Intelligent-paradigm (IA)
Organizational dimension	-Operational level -Administrative productivity	-Strategic level -Managerial productivity	-Strategic level -Human productivity (Internet and Web technologies)	-Strategic level -Collective productivity	-Strategic level -Smart productivity
Human dimension	-Complexity of device's uses and problem of accessibility	-Individual uses -Human practices' integration	-Social uses -Social practices' Integration	-Collective uses and practices -Collective intelligence	-Network uses -Eco-responsible practices

The evolution of 'classic' IS towards communicating IS was possible while considering knowledge as a strategic resource for organizations. This resource is managed through knowledge management systems.

B. Knowledge Management Systems

Knowledge Management Systems have been developed around 1980-1990. The growth of these systems is largely related to the rapid development in term of storage and processing capacity of ICT.

The acceleration of this phenomenon can be explained mostly by the accessibility, diversity and heterogeneity of information and the evolution of digital media. Knowledge is becoming ever more important for the optimization of managerial practices and innovation process.

All the programs identified within the French community GecSO (Gestion des Connaissances, Société et Organisation / Knowledge Management, Society and Organization) consider knowledge as a 'cognitive activity rather than an object' (Ermine et al., 2014). The concept of knowledge is generally characterized by a multidisciplinary and even polysemous use. In the strict sense of the concept, data, devoid of any semantic content, cannot be interpreted either by technological systems or by human actors. The transition from data to information is possible when users' attributes meaning to the manipulated data. The processing of information in a "process of interpretation" or "cognition" makes it possible to obtain knowledge (table 2). There are different kinds of knowledge:

- Explicit knowledge: can be easily formalized, codified, shared and stored (in physical or electronic form).
- Tacit knowledge: belongs to the world of "mental" objects and includes personal elements linked, for example, to the knowledge, know-how and personal experiences. This knowledge is essentially related to intangible facts, difficult to be formalized and shared between actors.

The research conducted in the field of Information and Communication Science, covering the concept of knowledge, are interested in two fundamental aspects: the process of production and/or interpretation of knowledge (KM cycle) and the actors who take part in the knowledge process (focus on persons, groups of individuals and even on the mediation devices that generate and exploit knowledge).

Table 2: Classification - Data, Information and Knowledge.

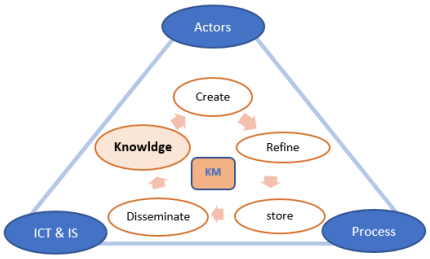
CONCEPTS	REPRESENTATION
Data	Symbols without meaning
Information	Symbols + semantic values
Knowledge	Informations + process (generation, operation, transformation…)

Knowledge Management Systems refer to the use of IS for knowledge processing. The actors, through their representations, attribute meaning to the information generated by the IS. It is the representations and practices of individuals that generate, exploit and transform knowledge for strategic target. These systems involve several levels: technological devices, information and knowledge, actors and informational practices, procedures and operating rules.

Cyberspace, where networks are interconnected and large quantities of information circulate constitute a source of opportunity in terms of industry and market change, social innovation creation, competitive lever, research and development opportunities and creation of new knowledge. Cyberspace cause difficulties linked to the variety and heterogeneity of Web data as well as a source of threat for the organization (cybersecurity). The competitive advantage of an organization depends, among other things, on the way it actively monitors its environment and capitalizes on the information linked to this monitoring process. Business intelligence approaches, as highlighted by (Sybord, 2015), aims at 'gaining competitive advantage through the search for, collection and transformation of key information that engages the future and evolution of the organization, in relation to changes in its environment'. The business intelligence specialist must use cyberspace to enhance the organization's knowledge and at the same time to protect itself against external aggression that could, for example, damage the organization's reputation or its security.

Decision-making and the strategic dimension represent a driving force in the design strategies of business intelligence systems (Sfez, 1993). In this context, the challenge facing organizations, in particular decision-makers, consist in the ability to manage and exploit an ever-growing mass of data. IS and decision support systems are the backbone of an economic intelligence project. These systems are dedicated to management activity and to individual and collective decision-making process. The IS is approached from a strategic, decision-making and communication point of view.

We can deduce that a Knowledge Management System is based on the interaction between different actors (functional, technical and users); ICT and IS (hardware and software tools); process of organization (operational and strategic levels) (Figure 4). IS facilitate knowledge management or the implementation of business intelligence procedures by optimizing all operations related to the acquisition, indexing, archiving and exchange of knowledge between actors or groups of actors.



The use of knowledge management and business intelligence systems is based on a division of tasks between human actors (intelligent operations, related to the interpretation of the results provided by these systems) and technological systems (repetitive operations, linked to the "mass" processing). The data generated are transformed into information, then into knowledge allowing to guide the decision-making process.

III. THE EVOLUTION OF APPROACHES TO SYSTEM DESIGN

The system design process is defined as an intellectual and technical operation, generated by a need, identified by the organization and expressed in terms of objectives and results. The result of the design process (final product) must combine the needs and expectations of the organization's stakeholders.

The knowledge management approaches proposed by (Hansen & al., 1999), then developed by (Scheepers & al., 2004) constitute a reference in several research studies. The result is a typology based on two visions: the "codification" strategy, which emphasizes the formalization and storage of knowledge, and the "personalization" strategy, which focuses on the relationships between individuals. The codification/personalization dichotomy has been developed by several researchers. In the literature, we find works that start from this theoretical foundation and qualify the "personalization" strategy by the "behavioral dimension" (Cho & al., 2009).

Two fundamental approaches are exposed: a decision-making approach, dedicated to knowledge modelling and an exploratory approach synthesizing heterogeneous information (Crié, 2003). According to (Bayad and Simen, 2003), these trends have had an impact on the emergence of knowledge management approaches. The implementation of Knowledge Management Systems is based on two main approaches that are often complementary. On the one hand, the "Human

Resources" approach emphasizes the "personalization" of knowledge. On the other hand, the "technical or IT" approach focuses on the "codification" of knowledge.

A review of the literature on knowledge management and business intelligence reveals a multitude of definitions and approaches often oriented towards the technical paradigm (McDermott, 1999). More profoundly, according to (Mailhot & al., 2007), there is a dilemma between 'Technology' and 'Human' centered approaches. Within the "Technological" angle of view, knowledge management consider essentially the technical tools, hardware and software interfaces. The focus is on technical methodologies based on the recording and archiving of knowledge (Niwa, 1990; Boisot, 1998). The human-centered current considers knowledge management as an activity involving actors with social interactions and links. In the field of knowledge management, notions such as tacit and explicit knowledge are fundamental. Moreover, from the technology/human dilemma emerges two antagonistic visions of knowledge management (Hansen & al., 1999; Mueller and Dyerson, 1999). The first vision is based on a process that makes it possible to manage essentially explicit knowledge. The transmission of this knowledge, ensured by ICT, means that we have to adapt actors to the system in place. A second vision focuses on organization that manages tacit knowledge and ensures that this knowledge is socially transmitted among its members. ICTs represent a device for aggregating all human and social interactions. This dichotomy is often questioned in several research works. In this way (Jacob and Pariat, 2002) call for knowledge management to be considered as "a strategy aimed at formally structuring the explicit and tacit knowledge capital of an organization". In this perspective, a number of works draw attention to the need to adopt an approach resulting from the combination of the two strategies: "codification" and "personalization". In this way, authors such as (Laudon & al., 2006), identify an approach qualified by sociotechnical and other authors refer to "hybrid" methodologies (Jasimuddin, 2008) based on the study of both technical and social aspects of ICT. This vision of the IS and ICT apprehension process is more appropriate to current research and generally with the reality of business.

Focusing on 'codification' can generate inappropriate knowledge management and economic intelligence systems with organizations' needs. The evolution of these systems is at the origin of the emergence of three groups of actors:

- The "computer actors" in charge of purely technical development and information processing.
- The "functional actors" who try to use technological tools to carry out their support or business functions.
- The "technical and functional actors" able to ensure the link between the two precedent groups (this constitute the role of the Information Systems Department).

We can summarize the KM system's approach in the following table, considering categorization from a different perspective: technical paradigm; human paradigm; sociotechnical paradigm.

Table 3: KM System's approaches.

	Knowledge Management System's approach
Technical paradigm	-"Codification" strategy (formalization and storage of knowledge). -Technical or IT approach: "codification" of knowledge (Bayad and Simen, 2003). -Lack of consideration of actors' needs. -Technological angle of view: knowledge management is the implementation of an IS and ICT (technical tools, hardware and software interfaces) (Mailhot & *al*., 2007). -Technical methodologies based on the recording and archiving of knowledge (Niwa, 1990; Boisot, 1998). -Managing essentially explicit knowledge: adapt actors to the system in place. -Focus on computer actors and technical component.
Human paradigm	-Personalization strategy (relationships between individuals). -Behavioral dimension (Cho & *al*., 2009). -Human Resources approach: "personalization" of knowledge (Bayad and Simen, 2003). -Human-centered: knowledge management is an activity involving actors with social interactions and links (Mailhot & *al*., 2007). -Managing tacit knowledge: knowledge is socially transmitted among its members (human and social interactions). -Focus on functional actors (uses and practices).
Sociotechnical paradigm	-Approach resulting from the combination of the two strategies: "Codification" and "Personalization". -Knowledge management: structuring the explicit and tacit knowledge (Jacob and Pariat, 2002). -Sociotechnical approach (Laudon & *al*., 2006). -Hybrid methodologies (Jasimuddin, 2008). -Study of both technical and social aspects of IS and ICT. -Focus on computer actors (technical component) and on functional actors (managerial/functional uses and practices).

Systems implementation process is generally based on several decisive phases: the pre-design (information needs specifications), the design (solution adaptation) and the development (integration of a solution and its implementation). From a methodological point of view, a positioning in the technical paradigm (system-oriented approach) implies that all these phases must be carried out only by computer actors. Towards the 1980s, the Human paradigm (user-oriented approach) allowed a progressive involvement of users in the system design process. The sociotechnical approach results from the combination of technical aspects and user needs and practices.

The approaches to the design and use of IS have been diversified by the development of ICT: from approaches based on text mining we switched to Web mining (with the advent of the Internet and Web technologies offering a gigantic data storage space). These different developments have promouved the implementation of new knowledge management logics (Crié, 2003).

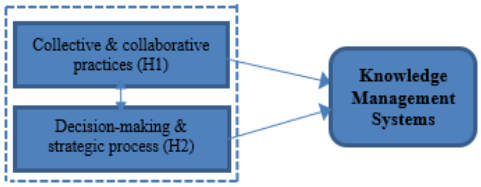
The current objective, in terms of IS design, is no longer to test or experience new tools, but to reconsider existing systems (Favier and Coat, 1999). The studies focus more on the concepts of information, knowledge, actor and community of practice than on the technical components. However sophisticated and advanced they may be, IS cannot and must not operate without the involvement of human actors and the considering of their social and professional framework and, more recently, their environment.

IV. THE CONTRIBUTION OF DIGITAL REVOLUTIONS

In reviewing the literature on ICTs, several researches work highlight the importance of digital revolutions in the development of IS in general, and in particular knowledge management and business intelligence systems. Indeed, the advent of ICTs has considerably changed the way that organizations operate. In order to understand the evolution of Knowledge Management Systems, we carry out the postulate that different angles of view have a positive correlation with our research perimeter (figure 5):

- Collective and collaborative practices (Hypothesis 1 - *H1*).
- Decision-making and strategic process (Hypothesis 2 - *H2*).

Figure 4: conceptual model architecture.



We carry out the assumption that the connection between these different hypotheses can create a favorable context for Knowledge Management System design.

A. Collective and collaborative practices

As we have just highlighted in the previous paragraphs, the evolution of technological tools and the generalization of ICT have brought about crucial changes in system design. For many years, design methods were oriented towards data processing and the question of knowledge management and business intelligence systems was often pushed into an engineering logic, in terms of integrating ICTs to increase the efficiency of monitoring devices, mapping information and communication spaces and networks. With the advent of Web 2.0 and Web 3.0, systems have come to adapt to user requirements. Under the pressure of the environment and competition, organizations integrates formal and informal information and tacit and explicit knowledge. This has led to the focus on communicative, strategic and cooperative IS design process. Modern systems include a human and social dimension which, moreover, mobilizes a whole collective and collaborative approach. In their research, (Quoniam and Lucien, 2009) identify three key dimensions of Web 2.0 and Web 3.0:

- The collaborative dimension materialized by the contribution of actors.
- The semantic dimension qualified by "interoperability between information".
- The community dimension understood in the sense of creating networks of actors.

At a deeper level, digital technology, with Web 2.0 and Web 3.0, are reexamining knowledge management and economic intelligence systems within and between organizations through the development of a participatory knowledge culture. According to (Lehmans, 2015), it is essential, when dealing with the issue of dynamics and interactions, to address three fundamental principles: openness, accessibility and connectivity. Through the principle of openness, knowledge sharing is promoted through the establishment of common digital spaces. The principle of digital accessibility covers at least two aspects: the first is related to the competence of actors to use digital tools and the second aspect concerns the provision of digital tools (software and hardware). The principle of linking or connectivity refers to "the action of linking and connecting and its results" (Lehmans, 2015). Web 2.0 and Web 3.0 tools enhance the convergence between individual info-communication practices and networked social functioning. They constitute knowledge mediation devices that make it possible generating a logic of creation, exchange, circulation, storage of knowledge and innovation, which are central to knowledge management and economic intelligence systems.

The emergence of new dynamics, around social media, means that knowledge is socially constructed, modified and shared by members of virtual communities. The coverage of social media includes social networks, wikis, blogs, collaboration and e-learning tools. Wikis are based on the principle of collaboration between actors in order to enrich databases' content. The best-known example is Wikipedia, the universal free encyclopedia, network building on the knowledge's co-construction. Users have access to a variety of content, both reading and writing. They have the status of actors and contributors to the functioning of the system.

The irruption of social networks, into the private sphere, has considerably modified our relationship with digital technology and information environment. Indeed, we are certainly consumers of information, but also producers. Within social

networks, whether personal or professional, such as Facebook, Twitter or LinkedIn, the actors themselves create individual and collective codes of communication. They identify the information sources that seem relevant to them, the ways of searching, accessing, sharing and validating information, as well as the storage media. Knowledge is socially shared and the actors themselves co-construct the devices. In this context, methodological research on these systems focusses on various approaches: sociological approaches (based on interviews and surveys, to analyses informational activities and research practices, processing and knowledge representation); linguistics and semiology approaches (analyzing the structures of discourse in a context of knowledge construction).

It is possible to apprehend the process of actors' interaction of in a cyberspace through four complementary stages: production, routing, retrieval and analysis (Lévy, 2015):

- In the production stage, the data generated, whatever its nature (text, image, sound or video), or its origin (internal sources generated from organizations or external sources coming from the web), is generally introduced in a system (using hardware and software tools).
- In a second stage, the produced data is processed and then forwarded to the potential actors. It is on the basis of the "digital activity" of these actors that the systems manage information.
- Then, when the actor formulates a query on a search engine, a whole data mining mechanism is triggered with the ultimate goal of proposing personalized results, in line with the identified profiles.
- Finally, the analysis of the collected data aims at defining 'patterns and regularities' for solving complex operations and making decisions.

The design process of knowledge management and business intelligence systems are part of an open, accessible and communicating systems approach. Actors organize themselves in networks and define community codes and rules based on the social sharing of knowledge, the co-construction of the info-communication space and participatory dimension. Web 2.0 and Web 3.0 are transforming informational and social practices and encouraging a "bottom-up" knowledge management models in which information is generated by the end-users.

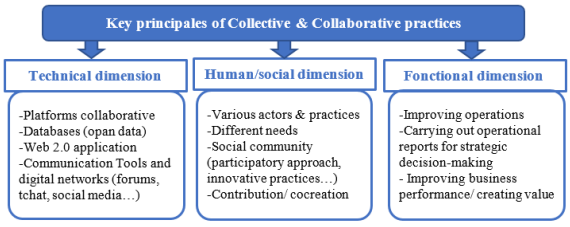
The exploitation of open data is a major issue in the design process of knowledge management and economic intelligence systems. Indeed, in business intelligence practices, the acquisition of information is a fundamental step. Open data represents the provision of open, available and voluminous data, covering a variety of needs and application' fields. The movement is approached, on a technical level, through the platforms or databases deployed as well as the data integration process, their characteristics, formats and sources. This operation reflects a process based on knowledge sharing and the exploitation of open data, which are at the heart of systems' design approaches.

Web applications are based on a technological architecture but also on a human and social dimension. In fact, for several years, Web application has imposed itself in the development of innovative tools and process that drive the emergence of new forms of knowledge creation. In this context, Massive Online Open Courses (MOOCs) are revolutionizing the education process by creating collaborative learning spaces. They change face-to-face learning mode by considering participatory approach in a learning mode (using of forums, social media…).

Furthermore, the implementation of new knowledge management and business intelligence practices is supported by the emergence of the crowdsourcing principle, which appeared in 2006. The purpose is to make data available to a community that can be exploited and enriched simultaneously. The concept is based on the development of digital networks and communities. Howe (2006) considers that there are four main categories: the first is based on collective intelligence, the second uses the individuals' creativity, the third exploits the actors' opinions and judgements, and finally crowdsourcing, which generate projects' financing with platforms. The different categories are based on the principle of collaborative work and info-communicative practices. Crowdsourcing affects the process of economic intelligence and disrupts digital practices and system design approaches. It represents an innovative practice that mobilizes three categories of actors: the organization that defines the activity, the community of individuals that participates and the intermediary agent whose function is to link the first two categories by using ICT and specialized platforms (Burger-Helmchen and Pénin, 2011). The design of knowledge management and intelligence systems must consider these new modes of production centered around networks of actors and collective intelligence.

We can represent the key principals of Collective and collaborative practices in the figure 6.

Figure 5: collective and collaborative practices.



B. Decision-making and strategic practices

IS design process have evolved with the focus on the increasing proliferation of heterogeneous and massive data providing from the Web. Traditional data processing systems found their limits in the face of the "tsunami of data" generated by the massive use of digital technology and the Web. Big data involves advanced technologies and complex IS whose capacity exceeds the current technological devices (Azan, Bolidum, 2015).

Big data addresses structured or unstructured data, emanating from disparate sources (computers, mobile phones, tablets, sites, blogs, social networks, connected objects, sensors…) and produced in real time. According to (Brasseur, 2013), the phenomenon is seen as the meeting of "the multiplication of unstructured data, the needs for analysis of this data and the progress of technology". Big data does not refer exclusively to data, but also to the digital tools that enable it to be managed. The mass of data generated in this process is characterized by common indicators that are qualified in the literature by the « 3Vs » (Ollion, Boelaert, 2015):

- The "Volume" indicator should be considered in reference to the quantity of massive data to be stored and analysed, as well as its exponential evolution.
- The "Variety" of data allows to emphasize the diversity of sources (internal or external to the organization) and heterogeneous formats of data (images, texts, sounds, digital traces, tweets…). Generally, the data is unstructured and it is difficult to manage it using tools such as Database Management Systems.
- The data are characterized by a high speed, "Velocity" is the third indicator.

Big data analytics is challenged to deal with these different indicators that are accentuated on the web.

The digital data's accumulation is related to the accessibility of technological devices and the capacity to process and store information. Big data projects rely both on advanced and complex data collection tools and on analysis and processing procedures. The data, collected, both at the level of organizations and from the web, is analyzed by using specialized tools and IS. The mass of data produced is stored in clouds. IS plays an essential role in the management of automatic operations. Big data is characterized by data originating from internally IS (organizations) and externally IS (Web):

- Internally IS: one of the major challenges is to process the data "actively" and in real time in order to contributes to a common performance.
- Externally IS: it is not only a simply operation of collecting data on customers and Internet users, but also an operation to exploit it, with powerful and efficient IS. There operation has an impact on strategies actions (personalization of product and service offers).

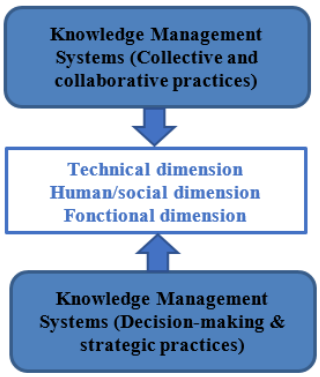
The management of massive data is made possible thank to computational and mathematical methods. Advanced IS have the ability to cross-reference data based on indicators and using highly complex algorithms (predictive' models). The big data project requires technological tools that ensure rapid processing, correlating data from predefined combinations.

In this context, the design of knowledge management and business intelligence systems integrates the notion of big data where indicators are generated and calculated by using operational and strategic IS. The category of IS that responds to big data projects is the decisional one, because the IS must transform information flows into decisional flows in order to provide strategic action. Decision support systems are used to support the data's strategic management.

Big data is certainly accompanied by a technological revolution, but also by human and societal features: the aim is no longer to know which tools will be used to process the data, but rather to know the purpose and goal. From a societal point of view, Big Data is moving our ways of thinking, our social codes and our way of understanding the world around us. The human or "cognitive" logic consists in interpreting and analyzing the data collected to meet strategic objectives or for decision-making purposes. Indeed, the information gathered from the systems will be transformed into knowledge by analysts, decision-makers or managers. Human actors include in the cognitive process the anticipation of complex situations, their judgements and intuitions, the personal and collective experience.

We can represent the key principals of decision-making and strategic practices in the figure 7.

Figure 7: the interactions between dimensions.



V. DISCUSSION AND CONCLUSION

Actors, increasingly connected to the Internet, mobile technologies and social networks, provide heterogeneous, unstructured data, emanating from disparate sources and characterized by diversified formats and use's contexts. The administration of this mass of data cannot be made by using traditional tools or classic database management procedures: the development of knowledge management and business intelligence systems relies on a complex and powerful technological base. However, these systems encounter limitations in the level of the enormous data mass collected and the diversity of analysis process' nature.

The advent of social media phenomenon makes it possible to feed knowledge management and business intelligence systems with data that is described as 'social' mediation. The process of designing systems is correlated with changing practices, consumption habits and the increasing profusion of communicating technologies. Indeed, the study of the functioning of groups and social relationships is crucial for the system design process. If we take the case of crowdsourcing, the analyze of a crowd of actors, around common data, makes it possible to map customer behavior on the basis of their interactions. In this context, it should be remembered that the principle of community is at the heart of economic intelligence approaches: the exploitation of collective information constitutes the basis for the development of such systems.

The added value of Big Data is not related to the accumulation of large data flows, but on their interpretation, exploitation and valorization. This principle is certainly based on tools that provide calculation, correlation and analysis capabilities, but the essential part of the process is cognitive and therefore human. Computer system, with its hardware and software components, is only a sub-set of the IS. The IS constitute the 'supports' for data management and it is essentially up to the data scientist to transform them into useful information, to constitute exploitable knowledge and therefore a wealth for companies' strategy and performance. As Lafrance (2017) points out, 'data and algorithms will not replace the instinct and vision of the entrepreneur. But they will make that instinct more reliable and more in tune with the reality of things". Despite the 'ease' with which data is collected in many contexts, this does not necessarily lead to systematically making the most of it or gaining useful insights.

We would like to point out that each of these dimensions plays an undeniable role in the system design process. Avoiding a 'Codification/Customization' dichotomy, we believe that the design process should be based on a socio-technical approach (Laudon, Laudon, 2006) using a 'hybrid' methodology (Jasimuddin, 2008). More profoundly, despite the evolution of the digital world and its omnipresence in the private or professional sphere, the process of designing systems must not be limited to the technical-economic aspects: the human dimension plays a primary role. Once we ask ourselves questions about the efficiency of these systems, it seems difficult to exclude the human aspects and the societal context of the evolution of the actors, their practices and their needs.

Nevertheless, there are many problems posed by knowledge management systems. Among the authors who have examined this debate, (Lévy, 2015) identifies three main limits of the 'contemporary algorithmic medium': cognitive limits, semantic limits and limits of statistical positivism. Cognitive limits are related to the skills of the actors. Semantic limits do not cover the technical capacities of the system, but those related to the "communication of meaning", a phenomenon often accentuated by the diversity of the language and socio-cultural universes of individuals and groups of individuals. The limits of "statistical positivism" where we find a whole questioning of the real capacity of big data to transform the data contained in a system into exploitable and profitable knowledge. The basic principle, before any analysis method, is to find and above all ensure that the data generated is relevant and meets quality criteria.

The exponential growth of data goes hand in hand with its problems in terms of privacy protection. Indeed, the digital revolution is creating mega data on our information searches, our financial transactions, our consumption habits, our movements or our communication network. The exploitation of this "ocean of data" raises limits related to moral and ethical issues. In his research, (Chamaret, 2014) proposes an analysis of the "big data revolution" based on a synthesis of the authors' work (Mayer-Schonberger and Cukier, 2013). As with all innovative and topical subjects, it emerges that the big data revolution is hardly risk-free. The authors point out several limits like the fact that: Google knows which websites we use for our searches and which ones we visit regularly, Amazon is informed about our shopping and consumption preferences, not to mention the social networks that know our personal and professional 'universe'. The authors underline the existence of a real danger in the case of massive recourse to big data and the risks inherent in the misuse of data. In particular, they highlight the role of specialist "auditors" who would play the role of "regulators" in this digital ecosystem.

Another controversial framework on the issue of privacy is the collection of data on the location of an actor. Advanced geolocation systems manage to provide personalized information, search results or targeted advertising in line with the user's geographical location. But beyond this seemingly "practical" aspect, this raises much deeper questions in terms of respect for privacy.

Moreover, with the big data phenomenon, the issue of people tracking for those who are connected to ICTs (Ramonet, 2015) is increasingly raised. In the field of health, for example, the systems manage personal data, and the risk that often arises is linked to the 'profiling of individuals' (Sybord, 2016).

At the functional and organizational level, (Brasseur, 2013) highlights the risks associated with investment in complex IS. The author emphasizes in particular the degree of maturity of the organization in terms of 'data governance and previous experience in the implementation of decision-making IS'. In this context, the business intelligence manager must contribute to the implementation of the technological policy, in conjunction with the Information Systems Department and the IS Security Unit. His or her contribution lies in the protection

of information assets and the definition of the overall strategy (Kempf, Mazzucchi, 2015). The implementation of an economic intelligence system is built around a "global" project and mobilizes all the players at both operational and strategic levels.

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