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# Chapter 1

## The Elusive Definition of Knowledge

Ettore Bolisani and Constantin Bratianu

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### Abstract

Knowledge is an abstract concept without any reference to the tangible world. It is a very powerful concept, yet it has no clear definition so far. From the Greek philosophers up to present experts in knowledge management, people tried to define knowledge but the results are still very fuzzy. This chapter has the intention of showing the most significant aspects of the dispute over the definition of knowledge, and the main conceptual barriers in that endeavor. In the first part of the chapter we discuss about the knowledge nature and the attempts made in epistemology to define knowledge. The well-known definition that *knowledge is justified true beliefs* shown to have the limitations given by the justification condition and the truth nature. In the second part, we consider the metaphorical approach to knowledge explanation and we present the main metaphors used for knowledge in the managerial literature: knowledge as objects, knowledge nuggets, knowledge as an iceberg, and knowledge as stocks and flows. In the last part, we introduce a new paradigm of metaphorical thinking based on the knowledge energy. This metaphor opens new opportunities for understanding knowledge as a multi-field paradigm composed of the rational, emotional, and spiritual knowledge fields.

## 1.1 Searching for Knowledge Definition

### 1.1.1 Knowledge Nature

*Knowing* is one of the most specific human processes and *knowledge* is its result. That means that knowing and knowledge have been subjects of human inquiry from the ancient times. Philosophers, starting with Plato and Aristotle developed *Epistemology* as a theory of knowledge, trying to answer to the fundamental question: What is knowledge? There were many answers and many arguments used in supporting them, but none of those theories has been accepted so far as being fully satisfactory. Defining knowledge and explaining its nature proved to be elusive and without a convincing and universally accepted result (Neta and Pritchard 2009; Russell 1972). Most of the theories have been integrated into two major perspectives: rationalism and empiricism. Simplifying, we may say that both theories accept that knowledge is *a justified true belief*, but they depart in showing the ways through which one can find the truth or justifying the true belief.

Rationalism, for which Plato is a pioneering philosopher, argues that knowledge is a result of a reasoning process and that our sensory experience plays no role. Knowledge can be obtained only from rational reasoning grounded in axioms, like in mathematics, and it should be distinguished from opinion which is a product of our senses. In his theory about ideas, Plato makes a difference between a “cat” which represents a particular object in the real world and the concept of “cat” coming from the eternal world of *cattyness*. While the real “cat” is born and sometimes will die, the concept of “cat” remains in the eternal world of ideas. Knowledge belongs to that eternal world. Explaining the Plato’s framework of knowledge, Bertrand Russell (1972, p.152) shows that “We perceive hard and soft through touch, but it is the mind that judges that they

exist and that they are contraries. Only the mind can reach existence, and we cannot reach truth if we do not reach existence". We cannot know the real world through senses alone since they can mislead us. In conclusion, "knowledge consists in reflection, not in impressions, and perception is not knowledge" (Russel, 1972; p.153). We may agree with Plato when discussing about mathematics and mathematical propositions. To understand that  $y = a + bx$  reflects a correlation between two variables we don't need any sensory perception. We need only a reasoning process with abstract symbols. But that is just a particular domain of science and cannot be generalized over the whole human existence.

René Descartes made rationalism the basis of modern philosophy by integrating in his conceptual universe many new scientific discoveries. He founded the famous method of doubting everything and searching for certainty: "I can do nothing else, until I have learned for certain that there is nothing in the world that is certain" (Descartes, 1997; p. 139). By analyzing comparatively his thoughts coming from the mind and the information coming from the sensory system, Descartes reached the conclusion that thought is the only attribute that belongs to him that cannot be detached of him: "What of thinking? I find here that thought is an attribute that belongs to me; it alone cannot be separated from me. I am, I exist, that is certain" (Descartes, 1997; p. 141). That means that the only test of our existence is the fact that we think and through thinking we acquire knowledge. In his famous formulation "*Cogito, ergo sum!*", mind and body are like two different worlds, and while bodily sensations fail the reliability test, thinking proves to be the unique characteristic that is reliable and certain. Finally, he remarks: "I am, however, a real thing and really exist; but what thing? I have answered: a thing which thinks" (Descartes, 1997; p. 142). This dualism of mind and body had a great impact on science, philosophy and education in Europe, and later on in America. Even today, many authors consider knowledge to be rational and based on solely mental processes.

Empiricism emerged as an opposable perspective to rationalism. Aristotle, a former student of Plato, considered that ideas and forms cannot be separated from physical objects and sensory information.

Knowledge is not created a priori and is not innate in a deterministic form. It is created through our sensory interface with the real world, and it is processed finally by our mind. John Locke continued that approach emphasizing that objects do exist in the outer world and that our sensory perception is the most important source of our knowledge. Many contemporary philosophers tried to bridge the gap between rationalism and empiricism by generating conceptual frameworks based on different syntheses between them.

In sharp contrast with the Cartesian dualism of mind and body, the Japanese intellectual tradition based on Buddhism and Confucianism created an integrated perspective of mind and body with three overarching premises (Nonaka and Takeuchi, 1995; p. 27): “(1) oneness of humanity and nature; (2) oneness of body and mind; and (3) oneness of self and other. These traits have formed the foundation of the Japanese view toward knowledge as well as the Japanese approach toward management practices”. That means that knowledge is rooted in the sensory system and only in its final processing stage is open to abstract considerations. Their relation with the real world is through their senses and they don’t need to make appeal to any eternal or metaphysical world in order to understand the nature of knowledge. Mind and body are not two distinct realities but an integrated one which creates the whole personality of people. “For the Japanese, knowledge means wisdom that is acquired from the perspective of the entire personality. This orientation has proved a basis for valuing personal and physical experience over indirect, intellectual abstraction” (Nonaka and Takeuchi, 1995; p. 29). This integrated view can be seen in the *samurai* education, where internal meditation was used together with physical training, and in the knowledge management practices developed within Japanese companies where the focus is on tacit knowledge which reflects the best people’s direct experience. It is interesting to see how Miyamoto Musashi, the legendary Japanese martial artist, emphasizes in his famous *Book of five rings* the importance of learning with the whole body the correct motion during a fight (Kaufman, 1994; p. 31): “Proper movement of the body depends entirely on the manner in which you carry yourself. The feet carry the body and the

body directs the feet. Tread firmly with the heel touching the ground first and then roll forward to the ball of your foot. Practice this until you appear to move without motion”.

### **1.1.2 Knowledge Definition**

As mentioned before, a frequently adopted definition of knowledge is that of “justified true belief” (Nonaka and Takeuchi, 1995; p.87). That definition incorporates three basic conditions, fact for which some authors call it the *tripartite account of knowledge*. These conditions are the following (Neta and Pritchard, 2009).

- *The truth condition*. It requires that if one knows a proposition then that proposition must be true. If the proposition is not true, then that person does not know what he claims to know. The truth condition makes the difference between opinion and knowledge.
- *The belief condition*. That condition demands that if one knows a proposition then he believes that proposition.
- *The justification condition*. That condition requires a practical way of justifying that the belief one has is true.

Putting together these conditions for knowing, one may conclude that “the necessary and sufficient conditions for knowing that something is the case are first that what one is said to know be true, secondly that one be sure of it, and thirdly that one should have the right to be sure” (Ayer, 2009; p. 13). The right to be sure can be earned in different ways which are culturally and contextual dependent. These conditions are usually synthesized in a logical format. Considering S to be the subject or the knower, P to be the proposition the subject is supposed to know, one may write (Gettier, 2009; p. 14):S knows that P if:

- P is true,
- S believes that P, and

- S is justified in believing that P.

However, Gettier (2009) constructed some counter-examples to demonstrate that this formulation does not constitute a sufficient condition for the subject S to know that P since justification might not be reliable. A person may be completely justified in believing something (i.e. P) which can be false. In literature, this case is known as the “Gettier problem” with respect to justification. Lehrer (2009) introduces a fourth condition to solve that problem, but it is too abstract to discuss it here. It is much more appealing to discuss how Nonaka and Takeuchi (1995) consider the justification problem in practice, which means in a company.

In their famous theory of organizational knowledge creation, Ikujiro Nonaka and Hirotaka Takeuchi (1995) adopted, for knowledge, the classical definition formulated by Plato that “knowledge is justified true belief”. However, there is a significant difference in interpreting that definition. While the Western epistemology focuses on *truthfulness* as being the main characteristic of knowledge, Nonaka and Takeuchi (1995, p. 58) focus on *justified belief* arguing that: “While traditional epistemology emphasizes absolute, static, and nonhuman nature of knowledge, typically expressed in propositions and formal logic, we consider knowledge as a dynamic human process of justifying personal belief toward the truth”. In other words, the authors change the philosophical discussion into a managerial practice and consider that the best way of justification is against the social context where new knowledge is created and shared, which means the organizational context. However, by doing this switch the authors show that, in practice, the emergence of new knowledge should be evaluated with a usefulness metric and not with a logical one: “Justification involves the process of determining if the newly created concepts are truly worthwhile for organization and society” (Nonaka and Takeuchi, 1995; p. 86). They go further giving as practical justification criteria like cost, profit margin, and degree to which a product can contribute to the company’s economic performance. However, by means of this switch, they changed the very nature of justification from a logical construct to an economic one, implemented by managers. Top managers would ask for a concordance with the strategic vision of the company, while the middle

managers would be looking for some practical requirements. In conclusion, the approach of Nonaka and Takeuchi clearly changed the nature of the problem and offered solutions for the practical organizational context instead of solving the original truthfulness problem formulated by Plato and refined by the Western epistemology. It is like Alexander the Great who not being able to unfold the famous Gordian knot cut it with his sword and changed the history of the world.

We see that truth and its justification is mostly a matter of interpretation, and although the epistemological approach looks like a precise and logical formulation the final definition of knowledge may be just an illusion. The truth is far away and can be distorted by the justification attempt due to misunderstanding of the organizational context. Metaphorically, we may think of the *Fata Morgana* phenomenon. *Fata Morgana* is a mirage that appears on land or at sea, in deserts or in polar regions. It is an optical phenomenon resulting from the passage of the light rays through layers of air of different temperatures. In essence, it manifests as inverted floating images right above the horizon. Metaphorically, defining knowledge may result in such a mirage since considering the framework of epistemology we may already have different layers of relative truths.

The definition of knowledge remains a problem, at least in the managerial sense, since knowledge, becoming a strategic organizational resource, needs to be defined as an operational concept adequate for a business environment and not as an abstract one for a transcendental world of ideas. Knowledge definition is elusive since premises for initial conditions have been formulated on pure rationalistic grounds and a Cartesian perspective on human nature. In the following sections of this chapter we will change the conceptual paradigm of Greek philosophers with the new paradigm of cognitive sciences and will continue our journey to finding a better definition for knowledge.

### **1.1.3 Three Kinds of Knowledge**

Adopting an integrated view on the nature of knowledge, some authors (Dombrowski et al. 2013) explain that there are three kinds of knowledge: a) experiential knowledge; b) skills; and c) knowledge claims. They are interconnected, but have some specific features of their own.

*Experiential knowledge* is what we get from the direct connection with the environment, through our sensory system, and then it is processed by the brain. For instance, if we want to know what snow is then we must go where there is snow and touch it, smell it, taste it and play with it. We cannot get that knowledge only from books or seeing some movies with people enjoying winter sports in beautiful mountain areas. People living in geographical zones where there is never snow have real difficulties knowing what snow is. They lack the experiential knowledge about snow. Experiential knowledge is personal since it can be acquired only through direct interface of our sensory system and then processed by our brain. It is essentially based on perception and reflection. Several people having together the same experience may acquire different experiential knowledge since reflecting upon a living experience means actually integrating it in some previous similar experiences and knowledge structures, if they do exist. "Things are not always as they appear to be and our own perspectives influence our interpretations. Still, watching out for errors in thinking can improve tremendously the quality of our reflections on our experiences"(Dombrowski et al., 2013; p. 38). As we will show later, experiential knowledge can be seen as created by a powerful interaction between emotional, rational and spiritual knowledge since it is a result of the whole body and mind active participation (Bratianu 2015).

*Skills* means knowledge about *how to do* something (know-how). It is based on experiential knowledge but it is a well-structured and action oriented knowledge we get by performing repeatedly a certain task and learning by doing it. This is the way of learning swimming, biking, skiing, playing piano or doing many other similar activities. It is like learning un-

consciously to perform a certain procedure or to follow a given algorithm. We don't learn swimming by reading in a book about fluid mechanics and objects floating. We have to learn by doing it with the whole body and reflecting upon it to improve coordination between breathing and moving our arms. *Know-how* knowledge is often called *procedural knowledge* since it is about performing a task in concordance with a given procedure or algorithm. We discussed about some skills associated to physical activities but they can be developed for any kind of task or activities, including thinking processes. For instance, thinking skills are extremely important for knowledge workers and decision makers. One of the most important skill in designing strategies is *intuition*. According to Klein (2003, p. 36), "The key to using intuition effectively is experience – more specifically, *meaningful* experience that allows us to recognize patterns and build mental models. Thus, the way to improve your intuitive skills is to strengthen your experience base. The most meaningful type of experience, naturally, is real-life experience".

*Knowledge claims* are what we know, or we think we know. We don't know how much we know since knowledge means both explicit knowledge and tacit knowledge, which means experience existing in our unconscious zone and manifesting especially as intuition. Explicit knowledge is something we learn in schools and reading books, or just listening to some professors or conference speakers. Knowledge claim is what we frame in an explicit way by using a natural or symbolic language. Thus, language is an essential component of the transforming our emotional and spiritual experience into rational or explicit knowledge. With explicit knowledge we are entering the zone of exchange between personal and shared knowledge. "Because ideas are stated in language, they can be examined and discussed, questioned, evaluated, refuted, or published and passed on. Knowledge claims enable us to learn from each other and built our shared knowledge" (Dombrowski et al., 2013; p. 44).

## 1.2 Knowledge Metaphors

### 1.2.1 Metaphorical Thinking

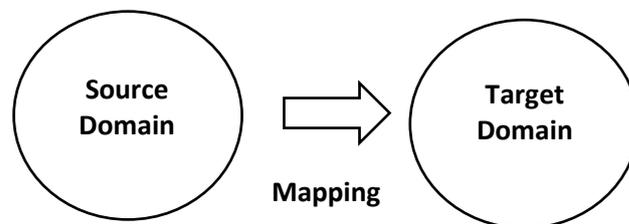
Cognitive scientists discovered that thinking is a conceptual process which is primarily metaphoric. That means that metaphors represent much more than just linguistic expressions. They are involved in our thinking process, helping us to understand new concepts and ideas. Steven Pinker, a famous cognitive scientist and professor in the Department of Psychology at Harvard University, explains that: "Conceptual metaphors point to an obvious way in which people could learn to reason about new, abstract concepts. They would notice, or have pointed out to them, a parallel between a physical realm they already understand and a conceptual realm they don't yet understand" (Pinker, 2008; p. 241).

Fundamentally, metaphors are embodied in our experience and through a progressive abstraction process they lead to new meanings for less known objects or concepts. As underlined by Lakoff and Johnson (1999) in their captivating book *Philosophy in the flesh. The embodied mind and its challenges to western thought*, any complex metaphor can be decomposed into primary metaphors, and "each primary metaphor is embodied in three ways: (1) It is embodied through bodily experience in the world, which pairs sensorimotor experience with subjective experience. (2) The source-domain logic arises from the inferential structure of the sensorimotor system. An (3) it is instantiated neutrally in the synaptic weights associated with neutral connections" (Lakoff and Johnson, 1999; p.73).

Metaphors are similar with analogies which create comparisons between a known object or concept and a less known one. They allow us to map one experience in terms of another experience, making it possible to understand complex and new situations in terms of what we already know. A metaphor is composed of two different semantic domains: a) a source domain where we describe the known object or concept with its

structural and functional attributes, and b) a target domain where we place the less known object or concept. Metaphorical thinking means to analyze the attributes and relationships from the source domain and to compare them with the situation from the target domain trying to identify which of these elements can be transferred from the source domain into the target domain. Theoretically, we perform a structural mapping of the known attributes and relationships from the source domain onto the target domain (see Figure 1.1).

**Figure 1.1** The structure of a conceptual metaphor



As a result of this process, the less known object or concept receives new semantic attributes which lead to its better understanding. As Lackoff (1990) suggested, metaphors can create meaning and enlarge the semantic horizon of the less known object or concept. That means that in a metaphorical process a conceptual system is projected from one domain to another, which is usually more abstract. It is a progressive abstraction effort, which will be clearly demonstrated in the case of knowledge metaphors (Gentner et al. 2001). However, not all structural and functional attributes from the known semantic domain can be transferred into the less known semantic domain which means that we discuss about a selective mapping based on some sound hypotheses and principles. For instance, in the well-known metaphor *Time is money*, the source domain contains the semantic field of the concept *money*, and the target domain contains the semantic field of the concept *time*. In this metaphor, *money* represents a tangible object with some physical or structural attributes

and some functional or intangible ones. *Time* represents an intangible object only with intangible structural and functional attributes. Thus, the metaphor cannot map the physical attributes of money onto the target domain, but it can map the functional intangible attributes like *spending* and *saving*. For instance: *I saved one hour by driving the car on a different route.*

The process of structural mapping from the source domain onto the target domain is unidirectional and asymmetric. It is *unidirectional* since mapping is done only in one way according to our purpose to enlarge the semantic field of the less known concept. It is *asymmetric* since the target domain has a deficit of semantic attributes by comparison with the source domain. By means of structural mapping, the degree of asymmetry is decreased and the target domain is enriched with new semantic attributes. We will illustrate this phenomenon in the following sections with some significant knowledge metaphors. Knowledge is an abstract concept with no physical counterpart. Defining knowledge from pure theoretical point of view proved to be difficult and fuzzy, especially when interpreting the justification condition. Metaphorical thinking opens a new way of understanding and defining knowledge by placing it in the target domain and searching for meaningful tangible or intangibles entities placed in the source domains. But that means that there is an endless series of objects and concepts which can be used in the source domain, and that knowledge definition depends on the metaphor used for its explanation. As Andriessen and Boom show, "Knowledge is not a concept that has a clearly delineated structure. Whatever structure it has it gets through metaphor. Different people from different cultures use different metaphors to conceptualize knowledge. They may be using the same word; however, this word can refer to totally different understandings of the concept of knowledge" (Andriessen and Boom, 2007; p. 3). That is a fundamental idea in defining knowledge and using that definition for research purposes. It would be a mistake to take for granted a knowledge definition without understanding the supporting metaphor and its semantic limitations. Unfortunately, many researchers in knowledge management use knowledge definitions formulated by famous authors without

checking for their metaphorical framework and their semantic limits. For instance, one of the most frequently cited working definition of knowledge has been formulated by Thomas Davenport and Laurence Prusak (2000, p. 5): “Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms”. It is a descriptive definition trying to capture the main attributes of knowledge in an organizational context. Although we need such a working definition for knowledge, we should see the supporting metaphor and the limitations induced by it in using that concept of knowledge. In this particular case, the metaphor used is that of *stocksandflows* which will be discussed in one of the following sections of this chapter.

### **1.2.2 Knowledge as Objects**

The first class of metaphors developed by people who were in search for knowledge understanding and using it in practical organizational contexts is that of knowledge as *objects*, *stocks*, or *resources*. The explanation comes from the fact that objects are tangible with clear and easily identifiable attributes. In a research on the nature of intellectual capital and on the metaphors used by different authors, Andriessen (2006) shows that Davenport and Prusak used this kind of metaphors in the first chapter of their book *Working knowledge. How organizations manage what they know* in proportion of 59% of the total number of all metaphors used in that chapter, and Nonaka and Takeuchi used in chapter 5 of their book *The knowledge-creating company. How Japanese companies create the dynamics of innovation* metaphors based on physical objects in proportion of 29% of the total number of metaphors used in that chapter. We

provide these examples because both books have been very influential among all academics and practitioners involved in knowledge management and intellectual capital, and have contributed significantly to promoting knowledge metaphors based on physical objects and their attributes. The followings are just some examples of such metaphors, where we introduced italics to underline the main elements of these metaphors:

- (1) “The idea of dealing with *knowledge as an object* has been already exploited in a variety of areas across knowledge management and information technology” (Borgo and Pozza, 2012; p.229).
- (2) “A knowledge map can also serve as an inventory ... It therefore can be used as a tool to evaluate the corporate *knowledge stock*, revealing strengths to be exploited and gaps to be filled” (Davenport and Prusak, 2000; p. 72).
- (3) “The realization that *knowledge* is the new competitive *resource* has hit the West like a lightning” (Nonaka and Takeuchi, 1995; p.7).
- (4) “Codification can be defined as a process of *storage, indexation* and *distribution* of formal *knowledge* independently of any context” (Janicot and Mignon, 2012; p. 6).
- (5) “Just as food and manufactured goods can be packaged and sold, there are ways to *package knowledge* for commercial benefit, using the intellectual property laws” (Sullivan, 1998: p. 143).

The first example shows explicitly that knowledge should be understood in terms of an object, which means that the metaphor defines a framework with some structural and functional attributes coming from objects. That is confirmed by the second example where knowledge is considered to be like a stock, and the third example where knowledge is considered like a tangible resource in a company. The last two examples refer to the functional attributes of objects which have been transferred to the target domain. Thus, knowledge can be stored, indexed, distributed and packed like physical objects. Although these properties are very intuitive in describing knowledge, they induce the idea of considering knowledge like some individual entities which can be stored on a shelf, can be distributed

like physical objects and it can be subject to packaging operation like any commercial product. Some people may ask what is wrong with such a perspective or why should we be careful in treating knowledge in this way. First, if we consider knowledge existing as individual entities like products in a supermarket which can be arranged on shelves and stored one upon the other, then we accept the idea of linearity and the summation operation. That leads to the idea of measuring the quantity of knowledge by counting the number of knowledge entities and performing the summation mathematical operation. Actually, this kind of attitude has been already produced and most of the metrics designed to evaluate knowledge and other intangible resources in organizations are linear metrics (see Chapter 8 for an additional discussion about this issue). Second, when distributing physical objects the initial quantity of them is progressively diminishing. In reality, when a person shares her/his knowledge with somebody else or disseminates it to a group of people, the initial quantity of knowledge does not diminish; it remains at the same level since knowledge is not composed of individual well-defined pieces which are removed from the initial inventory. Third, when physical objects are used frequently and for a long time they suffer a degrading process. Knowledge can be used as much as we need it without any process of losing any of its properties. Just think of the Pythagorean theorem in mathematics or the Newtonian laws of physics.

These metaphors have been promoted mostly by researchers coming from information science and engineering who work with the Shannonian concept of *information*, which is devoid of any meaning (Brietianu, 2015) and is a pure mathematical concept reflecting a certain distribution of probabilities. Due to its mathematical nature, this concept of information is objective, and its objectivity inspired some researchers to extend mathematical methods to the concept of knowledge and to find ways of its objectification. In this perspective, Bolisani, Borgo and Ultramari (2012, p. 203) remark that if “knowledge can be objectified, this means that it can be handled, reproduced, stored and transferred, largely independently from the individual that produces or possesses it”. That objectified knowledge can be embedded into documents, software codes,

databases, and different platforms for sharing it among the employees with a high probability of getting the same interpretation.

### **1.2.3 Knowledge Nuggets**

The temptation of using simple and intuitive metaphors leads to the creation of the interesting expression of *knowledge nuggets*. From the well-known *chicken nuggets* you can order in McDonald's fast food restaurants, *knowledge nuggets* captured the imagination of IT experts who use it quite frequently in data processing, especially in data mining, knowledge discovery, and knowledge production processes (Carayannis and Campbell, 2011; Delen and Al-Hawamdeh, 2009; Williams and Huang, 1997). According to the Oxford Advanced Learner's Dictionary (2004), the word *nugget* may have the following meanings: a) a small lump of a valuable metal or mineral, especially gold, that is found in the earth; b) a small round piece of some type of food: *chicken nuggets*; c) a small thing such as an idea or a fact that people think of as valuable: *a useful nugget of information*. Thus, the concept of *knowledge nuggets* reflects the metaphorical thinking based on small and usually valuable objects. Also, it suggests an extension of the concept of *shannonian information* toward *semantic information*, although the first one is a mathematical concept without embedding any concrete meaning. The concept of *knowledge nuggets* leads intuitively to the idea of defining small pieces of information or knowledge which can be aggregated into larger structures, stored, retrieved, distributed and used. The exponential increase in data gathered and stored in huge databases generated a great conceptual effort to create new models and technologies for searching and retrieving useful information. In this context, Data Mining is "the process of identifying valid, novel, potentially useful, and ultimately understandable patterns in data stored in structured databases, where the data are organized in records structured by categorical, ordinal and continuous

variables” (Delen and Al-Hawamden, 2009; p. 142). By novel information experts in data mining mean new correlations, trends, or patterns that can be discovered in the very large databases of the Big Data systems. The novel information is structured as knowledge nuggets which can be delivered to the interested users. The concept of knowledge nuggets is also used in e-learning and micro-learning programs, where it represents well-defined and meaningful structures of knowledge. Here, we have to make a clear distinction between the string of signs which corresponds to a knowledge nugget and the semantic content of that nugget. For example, we may consider as a knowledge nugget a trend found in a large database, expressed as a sentence. We may put together such sentences and sum them up into a paragraph. That is a linear operation applied to the strings of letters or to their digital correspondents which can be stored, retrieved, transferred or distributed. However, the meanings of the nuggets cannot be aggregated on the same principle, since meaning is nonlinear and the result of such an aggregation may have no meaning at all. The conflicting situation is generated by the different significance of the concept of shannonian information used in computer science as a pure mathematical construct without any semantic content, and the concept of semantic information used in knowledge management.

In practical terms, knowledge nuggets can be the result of presenting some ideas, tips, rules, or practical suggestions very synthetically, by using both texts and images, like in a series of humorous videos for field sales agents which are posted on Youtube. Also, the Organization Migration4Development (M4D) uses knowledge nuggets as extractions of key concepts and ideas from projects, e-discussions, live chats and reports to inform the community with M4D issues at the local level. In a larger sense, knowledge nuggets may be conceived as a result of piecewise discretization process of a continuum of knowledge contained in a book, paper, program, conference or live chat and selection of most significant of them for the users. We can make a parallel with complex nonlinear phenomena in mathematics which cannot be solved as they are, and experts use different discretization methods to transform those continuum fields

into discrete ones for which can be applied numerical methods to get useful solutions.

#### **1.2.4 The Iceberg Metaphor**

The iceberg metaphor has been used extensively by Ikujiro Nonaka and his colleagues since it is very simple and very intuitive for the conceptual dyad of explicit knowledge - tacit knowledge (Nonaka1994; Nonaka et al., 2008; Nonaka and Takeuchi, 1995; Nonaka and Von Krogh, 2009). As they recognize, the fundamental aspect of their epistemology is the distinction between explicit and tacit knowledge, distinction that can be easily understood by using the iceberg metaphor. "Thus, knowledge that can be expressed in words and numbers represents only the tip of the iceberg of the entire body of knowledge" (Nonaka and Takeuchi, 1995; p. 60). Explicit knowledge is the rational knowledge that can be formulated by using any natural or symbolic language, and can be easily transferred in a social context. It is like the visible part of the iceberg. Tacit knowledge is personal knowledge and comes mostly from direct experience, which is processed by the cognitive unconscious. According to Nonaka and Takeuchi (1995; p. 8), "Tacit knowledge is personal and hard to formalize, making it difficult to communicate or to share with others. Subjective insights, intuitions, and hunches fall into this category of knowledge. Furthermore, tacit knowledge is deeply rooted in an individual's action and experience, as well as in the ideals, values, or emotions he or she embraces". Metaphorically, tacit knowledge can be represented by the hidden part of the iceberg. We know that it is there, under the water line, but we cannot see it and we have no idea how big that part of the iceberg is.

The iceberg metaphor captures our attention since it is simple and intuitive, but on the other hand it has serious limitations since the iceberg is a solid and there is no flow between its visible and hidden parts. Thus, there is no dynamics in the source domain which can be mapped

onto the target domain to illustrate the conversion process of tacit knowledge into explicit knowledge. In addition, the split of the iceberg into two distinct parts can be only seen from an observer's perspective, since the iceberg is a homogeneous solid without any intrinsic differences between the upper and the lower parts. Thus, the distinction between tacit and explicit knowledge comes from a contextual attribute of the iceberg seen in the ocean's water and not from a material distinction between the upper and the lower parts, which questions the effectiveness of the structural mapping from the source domain onto the target domain of the metaphor.

### **1.2.5 Knowledge Flows**

In order to eliminate the limitations introduced by the discrete nature of objects and their static forms, a new metaphor has been created by using the image of *fluid flows*. Thus, in the source domain, we have the semantic field associated to flow of fluids, while we have the semantic field of knowledge in the target domain. In the source domain, in a more advanced and complex metaphor, some authors consider both *stocks and flows* combining the attributes of the two semantic fields. Thus, *knowledge as stocks and flows* constitutes one of the most frequently used metaphors. Bolisani and Oltramari (2012; p.280) explain the essence of this metaphor effectively: "We can denote knowledge stock as the amount or 'level' of knowledge possessed at a particular time in an organization, while knowledge flows identify knowledge that is transferred from one economic player to another. According to this interpretation, knowledge flows can affect the amount of knowledge stocked by the two players". We shall illustrate these metaphors with some examples taken from literature. We introduced italics for the metaphors used in the texts.

- "For this *flow of knowledge* to prevail, the organizational culture must be extraordinary" (Davenport and Prusak, 2000; p. 109).

- “The way knowledge *flows* in organizations is often a hidden process” (O’Dell and Hubert, 2011; p. 109).
- “Rapid and reliable *flows of knowledge* across people, organizations, times, and places are critical to enterprise performance. Unfortunately, the leader and manager have negligible current guidance for assessing and enhancing *knowledge flows* in practice. A dearth of contemporary research addresses the *dynamics of knowledge*, which are fundamental to understanding *knowledge flows*” (Nissen, 2006;p.IX).
- “With the wider view I am taking, I claim that managing *knowledge flows* is something that can be applied and used in almost any type of organization” (Leistner, 2010; p. 6).
- “So *flow of knowledge* from individuals depends on three broad factors: individual preferences, the social situation and organizational factors” (Oliver, 2013; p. 19).

Fluid flows are well-known phenomena, easily to understand and explain. Unlike objects that have limited and well-defined geometries that are static and unchangeable in a uniform and constant field of forces, fluids have changeable geometries and have the property of flowing under the influence of a pressure field. They are dynamic. Fluids can be accumulated and stored in reservoirs, and distributed through channels or industrial piping systems. In nature, fluid flows in channels or rivers as a result of the gravity field, which means from a higher altitude to a lower one. In industry, cities or buildings, fluid flows through ducts and pipes from a higher pressure level created by a pump toward a lower pressure level. That motion of flow has been used many times in science to explain new phenomena like electrical current and heat flux. Even today, some people think that heat is flowing from a hot physical object toward a cold one, and that electricity is flowing through a wire. Why not to consider that knowledge is flowing through an organizational structure from well-informed people toward less-informed ones?

Knowledge as *stocks and flows* is a complex metaphor composed of several simple ones which form analogies with fluids, their physical property of being a continuum and their functional attribute of flowing. Nissen (2006; p. XX) associated the fluid flow through a piping system

with the knowledge flow through an organizational structure: “To the extent that organizational knowledge does not exist in the form needed for application or at the place and time required to enable work performance, then *it must flow* from how it exist and where it is located to how and where it is needed. This is the concept *knowledge flows*”. The model proposed by Nissen is an extension of the dynamic model developed by Nonaka and his colleagues (Nonaka, 1994; Nonaka and Takeuchi, 1995) since it is based on the SECI construct, but it contains *time* as a new dimension. While Nonaka’s model is an inertial model, Nissen’s one is really a dynamic model because it includes time. Nissen introduces two new dimensions: life cycle and flow time. “Life cycle refers to the kind of activity (e.g. creation, sharing, application) associated with knowledge flows. Flow time pertains to the length of time (e.g. minutes, days, years) required for knowledge to move from one person, organization, place, or time to another” (Nissen, 2006; p. 35). It is useful to underline the fact that *knowledge flows* in the Nissen’s perspective refers not only to the motion of knowledge from one part of organization to another one, but also from one moment of time to another one. Flow of time is important especially for intergenerational knowledge transfer and databases creation. However, Szulansky (1996; 2000) reveals that knowledge flows implies also *knowledge stickiness* manifested as a difficulty in the process of knowledge transfer. He says that knowledge can be *sticky*: “To a large extent, this is because internal transfer of knowledge, rather than fluid, is often ‘sticky’ or difficult to achieve” (Szulansky, 2000; p. 10).

We have to observe the fact that the metaphor *knowledge as objects* can be used only for explicit knowledge, while the metaphor *knowledge as stocks and flows* can be used for both explicit and tacit knowledge. Davenport and Prusak (2000; p.5) used this metaphorical entailment in their famous definition: “Knowledge is a fluid mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information”. However, the *knowledge flow* metaphor cannot explain the conversion of tacit knowledge into explicit knowledge which constitutes the essence of knowledge creation in the Nonaka’s model. Also, the met-

aphor is still based on the Newtonian physics which implies motion in space and linearity when dealing with knowledge. There is no transformation of phase or other type of changing the nature of the fluid to support the knowledge conversion processes postulated by Ikujiro Nonaka in his famous SECI model. For overcoming these limitations we need to change the paradigm of Newtonian logic into the paradigm of entropic transformations as we shall explain in the next sections of this chapter.

### **1.3 The Energy Metaphor**

#### **1.3.1 Knowledge as Energy**

In his seminal book *Corporate Longitude: What you need to know to navigate the economy* (2002), Leif Edvinsson considers that we need to advance in understanding and explaining knowledge by developing new models and new metaphors. Such a new metaphor is *knowledge as energy* (Bratianu 2011, 2013, 2015; Bratianu and Andriessen 2008). In the source domain we consider *energy* with all its attributes, and in the target domain we consider *knowledge*. There are three main attributes we are interested in mapping them onto the knowledge domain:

- Energy is a field.
- Energy manifests in different forms (i.e. mechanical, thermal, electrical etc.)
- One form of energy can transform into another form of energy. The transformation is irreversible.

The first attribute leads us to a new interpretation of knowledge which changes the main paradigm of defining it. Knowledge is not considered like a tangible object or a fluid flow anymore. It is considered like a field of forces which is intangible and forms a continuum both in space and time. For instance, we all are aware of the gravity field although we

cannot see it and cannot touch it. But if we jump we feel immediately the attraction force of the earth. That means an intangible field of forces. Energy fields are usually distributed non-uniformly in space and have variations in time. These properties can be transferred to the knowledge field.

The second attribute is obvious for all of us. Energy can be found in nature in different existential forms like mechanical energy, thermal energy, electrical energy, nuclear energy etc. This attribute mapped onto the target domain leads to the idea that knowledge can manifest in different forms of different nature. The two forms discussed so far (i.e. tacit and explicit knowledge) are different not due to their nature but due to their way of being processed by our brain. Tacit knowledge is processed fundamentally by the unconscious zone of the brain, while the explicit knowledge is processed by the conscious zone of the brain where natural language plays an essential role. We consider three fundamental forms of knowledge: rational knowledge, emotional knowledge, and spiritual knowledge (Bratianu, 2013; 2015). Rational knowledge is the result of the reasoning process and expresses concepts and ideas formulated in a natural or symbolic language. Rational knowledge is the explicit form of knowledge. Emotional knowledge is a wordless form of knowledge which is generated by our emotions and feelings. In Nonaka's theory emotional knowledge is found in the tacit knowledge mixed with spiritual knowledge which expresses our cultural values and ethical principles.

The third attribute comes from thermodynamics and reflects the capacity of energy to transform from one form into another one in some given conditions. For instance, mechanical energy can transform through friction into heat. This attribute mapped from the source domain onto the target domain shows that one form of knowledge can transform into another form in given conditions. For instance, emotions of fear make us to think of some protection or avoiding a dangerous situation. In such a context, emotional knowledge transforms into rational knowledge. These transformations are irreversible and they represent the content of the entropic knowledge dynamics, where entropy is a measure of irreversibility.

The energy metaphor allows us to propose a new paradigm for knowledge based on the multi-field theory of knowledge and the entropic

knowledge dynamics. The multi-field theory says essentially that individual and organizational knowledge is represented by three fundamental fields of knowledge: rational, emotional, and spiritual. The entropic knowledge dynamics is concerned with the transformation of one form of knowledge into another one in some given conditions. We shall present the main ideas of these new domains of research in the next sections.

### ***1.3.2 The Field of Rational Knowledge***

The multi-field theory of knowledge states that at the individual level and organizational level there are three co-existing fields of knowledge: rational knowledge field, emotional knowledge field, and spiritual knowledge field. They are fundamental forms of knowledge manifestation which are generated and constituted in a different way. However, they are not independent fields but in a continuous interaction and transformation such that decision making incorporates contributions coming from all of them (Bratianu, 2013; 2015). We may say that *knowledge* is a construct similar to the *white light* which can be decomposed in monochromatic lights when passing through a prism. That means that knowledge is an integrative concept containing rational, emotional, and spiritual knowledge. The new perspective is in concordance with the multiple intelligences model developed by Howard Gardner (1983; 2006). That model changed completely our idea that intelligence is a single entity which can be measured and expressed numerically by using the concept of *intelligence quotient (IQ)* created by Alfred Binet. Gardner defines an intelligence as “a bio-psychological potential to process specific forms of information in certain kinds of ways. Human beings have evolved diverse information - processing capacities – I term these ‘intelligences’ – that allow them to solve problems or to fashion products” (Gardner, 2006; p.29).

*The rational knowledge field* contains rational knowledge which has been considered as the only form of knowledge for centuries by philosophers. We discussed about these epistemological aspects of knowledge in the beginning of the chapter. Rational knowledge is represented mainly by explicit knowledge since it is the result of the conscious cognitive brain. Descartes (1997; p.147) expressed that conviction as follows: "Even bodies are not properly speaking known by the senses or by the faculty of imagination, but by the understanding only, and since they are not known from the fact that they are seen or touched, but only because they are understood. I see clearly that there is nothing which is easier for me to know than my mind". Rational knowledge is considered to be objective and this attitude made it suitable for developing scientific and technological knowledge. Also, education in the western countries has been conceived in objective terms and stressed the importance of science and technology which means the primacy of rational knowledge. Rational knowledge is framed into explicit knowledge by using a natural or symbolic language: "Language serves not only to express thoughts, but to make possible thoughts which could not exist without it" (Russell, 1992; p. 58). Organizational rational knowledge is obtained by integrating all individual rational knowledge fields and all documents and databases which contain data, information, and knowledge. Classical decision making theory is based on rational knowledge and expressed mostly in the symbolic language of mathematics. Knowledge management has been developed in its first phase on rational knowledge as an extension of the information management which is centered on the concept of shannonian information and information technology. That is why managers developed their generic strategies based on rational knowledge and information technology.

### ***1.3.3 The Field of Emotional Knowledge***

The emotional knowledge field contains knowledge generated by emotions and feelings. Emotional knowledge is a wordless form of knowledge which is processed by the unconscious part of our brain. Emotional knowledge is generated in the direct contact of our body with the external world and integrated into what we call experience. Also, emotional knowledge can be obtained by processing information coming from our internal body. Emotional knowledge emerged as a component of tacit knowledge, especially after the work of Michael Polanyi (1983). In his seminal book about the tacit dimension of knowledge, Polanyi considers our direct experience with the environment as a source of knowing. It is a bodily experience which generates emotional information through perception, information which becomes then emotional knowledge. "I said that by elucidating the way our bodily processes participate in our perceptions we will throw light on the bodily roots of all thought, including man's highest creative powers" (Polanyi, 1983; p. 15).

Human resources management demonstrated that emotional knowledge plays a crucial role in motivating people for working very hard and achieving performance. Motivation becomes critical during change processes when there is a need for greater efforts without immediate rewards. Understanding and using emotional knowledge in influencing people makes the difference between managers and leaders, since managers prefer numbers and rational decisions while leaders influence people acting on their emotional and spiritual knowledge fields. John Kotter, who studied organizational change and leadership involved in performing them, demonstrated that in any change process emotional knowledge is much more important than rational knowledge. Kotter showed that analytics could be interesting, but not always convincing. Rational knowledge is needed for understanding the logic of change but could be not enough in determining changing employees' behavior. Much more convincing could be for them to feel the need of change as a result of emotional knowledge transferred to them by the leaders. "The single biggest challenge in the process is changing people's behavior. The key to this behavioral shift, so clear in successful transformations, is less about analysis and thinking and more about seeing and feeling" (Kotter and Cohen, 2002; p.

179). In change management, the old paradigm of *analyzing-thinking-changing* should be replaced with new one of *seeing-feeling-changing*. Thus, the action of *seeing* creates the perceptions able to generate through *feeling* the necessary emotional knowledge needed to contribute together with rational knowledge to *changing* people's behavior. That means that emotional knowledge contributes significantly to the decision making both at individual and organizational levels. As Dan Hill (2008; p. 2) remarks, "Breakthroughs in science have revealed that people are primarily emotional decision makers". Based on this idea and many psychological investigations of the decision making Malcolm Gladwell introduces in his famous book *Blink* the concept of "thin-slicing" decision making: "Thin-slicing refers to the ability of our unconscious to find patterns in situations and behavior based on very narrow slices of experiences" (Gladwell, 2005; p.24). Many people say that is *intuition*, since intuition is a result of our condensed and filtered experience powered by emotional intelligence. These two fields of knowledge are related to the multiple intelligences structure of our thinking. In a synthetic way, Daniel Kahneman (2011) explains the fact that people developed during the history of humanity two modes of thinking that are interacting dynamically: 1) the emotional system that operates automatically and quickly, with almost no effort or sense of voluntary control, and 2) the rational system that operates slowly due to many computations and choices it does. While the classical management theory in its effort of proving that is a science ignored the work of the first system on the basis of its subjectivity, knowledge management considers both of them. Looking at the literature in this domain, we may say that authors coming from western countries are still emphasizing the role of rational system while authors coming from Japan emphasize the emotional system and tacit knowledge.

#### **1.3.4 The Field of Spiritual Knowledge**

Spiritual knowledge has been included by Nonaka and Takeuchi in tacit knowledge, mixed up with emotional knowledge (Nonaka and Takeuchi; 1995). We consider spiritual knowledge essential for our existence, fact for which we introduce it as a fundamental field in the new multi-field theory of knowledge. Spiritual knowledge integrates values and beliefs about life and about our existence and represents the backbone of the spiritual capital of any organization (Zohar and Marshall, 2000; 2004). "Our spiritual capital is our shared meaning, our shared purpose, our shared vision of what most deeply matters in life – and how these are implemented in our lives and in our behavioral strategies. It is the capital that is increased by drawing on the resources of the human spirit" (Zohar and Marshall, 2004; p. 27). If rational knowledge reflects the objectivity of the physical environment we are living in, and emotional knowledge reflects the subjectivity of our body interaction with the external world, spiritual knowledge reflects our understanding about the meaning of our existence. As Maxwell (2007; p. 274) states, "We have to learn to see aspects of the world around us: stones, people, trees, sky. Equally, we have to learn to see meaning and value in the world around us, in our environment, in events, in human actions and lives".

Individuals working together in a company share their values and beliefs about life, work and future generating in time an organizational culture and an working spirituality. It is a way of thinking and feeling inextricably connected with caring, hope, kindness, love and optimism. Spiritual knowledge is essential in decision making since rational arguments are strongly influenced by the value settings. We are all aware of the fact that positive values correlate directly with the business success, while negative values lead managers toward business failures. Thus, spiritual knowledge which reflects positive values and positive spiritual intelligence is essential in conceiving successful strategies and in achieving competitive advantage. Spiritual knowledge is intrinsically related to the concept of Corporate Social Responsibility, a concept requesting responsible governance and a vision driven by social values and not profit maximization (Basu and Palazzo, 2008; Branson, 2011; Pinto et al., 2008; Wang et al., 2011).

## 1.4 Conclusion

Knowledge is a universal concept which attracted the attention of philosophers from ancient times. There were countless efforts to define it following the rules of scientific inquiry, but always the resulting definition was not able to integrate all the semantic attributes of knowledge. Searching for an objective perspective and a rational approach many philosophers eliminated all subjective aspects related to perception and bodily involvement claiming that knowledge is *a justified true belief*. However, the precision and logical coherence used in the theoretical approach to knowledge generated uncertainty in the practical modalities of justifying the truth. If we agree with Nonaka and Takeuchi (1995; p. 87) that “justification criteria need not be strictly objective and factual”, then the philosophical meaning of truth is almost lost. Truth and its justification cannot have the same degree of objectivity anymore. We may think of the Heisenberg’s uncertainty principle applicable to quantum mechanics that states in the case of nuclear particles position and velocity cannot be measured exactly at the same time. Knowledge is created by human brain and then it is amplified and integrated into organizational knowledge by social interaction. That means that knowledge comprises both objective and subjective attributes. Objective attributes can be conceived as being independent of the social context, but the subjective attributes are context dependent and cannot be transferred easily to some other similar contexts. Knowledge sharing can be a good example for such kind of situations.

Cognitive scientists demonstrated that our mind works metaphorically. That means that we use metaphors to understand and explain a less known concept or experience in terms of other well-known one. Conceptual metaphors have a simple structure composed of a source domain

where we place the well-known concept and a target domain where we place the new or less known concept. By using structural mapping, some of the main attributes of the concept framed within the source domain are transferred to the concept put in the target domain, enlarging this way its semantic field. Since knowledge is an abstract concept without any reference to some tangible objects, authors use explicit or implicit metaphors in dealing with it and with knowledge management. The first class of metaphors developed for knowledge explanation is based on those that contain physical objects with tangible attributes in the source domain. It is the favorite class of metaphors used by authors dealing with knowledge as strategic resources. Thus, knowledge can be accumulated, stored, distributed, packed and delivered like tangible objects. From that class derived lately the iceberg metaphor which has been used extensively to explain the pair of explicit and tacit knowledge. Knowledge nuggets are an extension of the same category of metaphors, but resulted from a discretization of a continuum of knowledge (i.e. a text containing a narration or a story). The most advanced class of metaphors are those based on stocks, flows, or stocks and flows used in the source domain. Thus, knowledge is conceived like a fluid flowing through organizations from where it is created to where it is needed.

All of these metaphors presented above induce a series of limitations in understanding and using the full potential of knowledge. These limitations derive from the Newtonian logic, the linearity property and the illusion of measuring knowledge by using the methods developed for tangible objects and their attributes. In an effort to overcome these limitations, a new metaphor based on energy is proposed in Bratianu and Andriessen (2008). According to this new perspective, knowledge is conceived like a field without any tangible attributes. Moreover, following the analogy with co-existence of multiple forms of energy (i.e. mechanical, thermal, electrical, nuclear etc.), the existence of three fundamental fields of knowledge is postulated: rational, emotional, and spiritual. Rational knowledge is basically the explicit knowledge since it is framed by our reasoning mind and natural language. It is a construct following the Cartesian spirit. Emotional knowledge is a wordless expression of our

body response to the external environment and it is a direct result of emotions and feelings. Emotional knowledge is subjective and context dependent. Spiritual knowledge contains values and ethical principles and it is essential in decision making. Both emotional and spiritual knowledge have been embedded in tacit knowledge and mixed up in the fuzzy description of experience. The energy metaphor constructs a new paradigm which allows us to have a better understanding of knowledge and to offer managers and leaders new opportunities to influence people in times of change and uncertainty.

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