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The Theory of Knowledge Fields: A Thermodynamics Approach

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Abstract: The emergence of knowledge economy and knowledge management revealed the need for reconsidering the concept of knowledge in a larger framework than that created by philosophers from ancient times. While the epistemology as a theory of knowledge and justification considers knowledge as a justified true belief, experts in knowledge management consider knowledge as a strategic resource. The new economic interpretation of knowledge as a strategic resource and a key contributor to achieving a competitive advantage generated a search of new metaphors to supply the attributes needed in constructing the new framework of understanding and operating with a working concept of knowledge in management. The most widespread knowledge metaphors are based on analogies with stocks, flows, and stock-and-flows. These metaphors induce, beyond some useful attributes, the Newtonian mechanics paradigm which is limited by the properties of linear spaces and reversible processes. The purpose of this paper is to show how we can enrich the theory of knowledge by introducing the concepts of knowledge fields and knowledge dynamics based on metaphorical thinking and the thermodynamics principles. The focus of our research is the energy metaphor which considers energy as a source semantic field. The main outcome of the present research is that knowledge can be considered as a field, which is manifesting in different forms like energy. This thermodynamics framework opens new directions for research in knowledge management, decision-making and leadership.

Keywords: knowledge management; knowledge metaphors; knowledge fields; knowledge dynamics; thermodynamics

1. Introduction

In the strategic management process based on the resource-based view (RBV), the basic philosophy is that competitive advantage is an integrated result of using efficiently strategic resources and dynamic capabilities of the firm [1–3]. Due to its intangible nature and contextual creation, knowledge reflecting the knowing *what* in organizations became a strategic resource [4,5]. Knowledge may be also used in developing a firm's capability due to its capacity of showing *how to do* things [6,7]. The main advantage of knowledge is its invisible contribution to all decision-making and organizational processes. Amongst them, the most important are knowledge creation, knowledge sharing, and organizational learning [8–10].

Understanding knowledge is a mental process mediated by metaphorical thinking [11,12] since knowledge is an abstract concept. As Andriessen [13], (p. 5) remarks, "Knowledge can only be analyzed, talked about, and understood by using metaphors". A metaphor is a semantic construction

by which we make a parallel between a physical realm we already know and a conceptual realm we want to understand better. A knowledge metaphor's structure is composed of a source domain where we place the well-defined concept, a target domain where we place knowledge, and a mapping function which transfers some attributes from the source domain to the target domain, as illustrated in Figure 1.

In the first generation of knowledge metaphors, researchers used for the source domain *objects* or *stocks*. Thus, the main meanings transferred to knowledge in the target domain were accumulation, capitalization, delivering, dissemination, distribution, exchanging, measuring, packaging, and storing [13]. A special case may be considered the *iceberg* metaphor used extensively by Nonaka and Takeuchi [8], because of its capacity of presenting both explicit knowledge and tacit knowledge. *Explicit knowledge* is that form of knowledge that we can express by using a natural or a symbolic language. It is the knowledge we get through education and use in our everyday life in social contexts. *Tacit knowledge* is personal and acquired through our sensory system by direct experience. "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" [8], (p. 8). Since tacit knowledge is processed in the cognitive unconscious zone of our brain, we hardly are aware of how much we know. As Polanyi [14], (p. 4) reveals, "we can know more than we can tell".

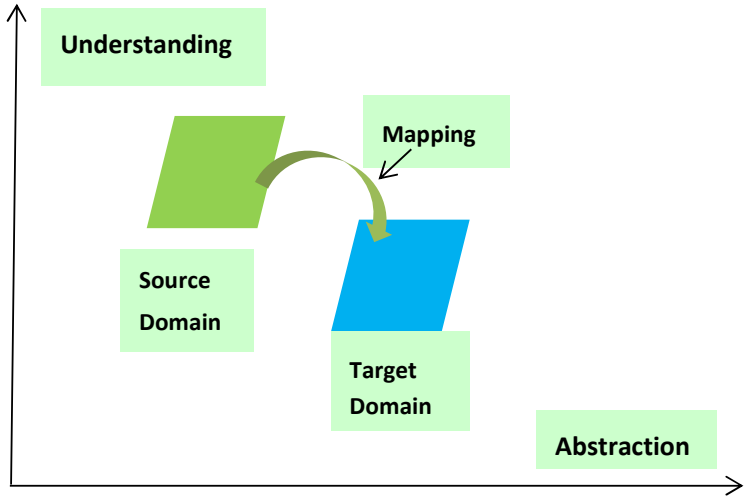

Figure 1. The structure of a conceptual metaphor.

The second generation of knowledge metaphors introduced in the source domain the concept of *flows* or *stocks-and-flows* [15–17]. Knowledge is compared with a flow of fluid from one part of the organization to another one, or with a flow in time. That is a very simple and intuitive metaphor, which was used also in the beginning for understanding heat and electricity. However, applying fluid mechanics to knowledge dynamics yields a mechanical thinking model with its tangibility and linearity limitations. The *flows* and *stocks-and-flows* metaphors cannot explain organizational learning processes which are based on knowledge transformations. Also, these metaphors cannot explain managerial decision-making processes and organizational changes.

The linearity-induced attribute of these metaphors created real difficulties in evaluating intellectual capital (IC), which is based on knowledge and other intangible organizational resources. Even the definition of the intellectual capital has been influenced by this linearity attribute: "Intellectual capital is the *sum* of everything everybody in a company knows that gives it a competitive advantage" [18], (p. XI). Linearity implies the possibility of using algebraic operations in measuring quantities, and a linear correlation between the output and input variables of a given process. For instance, the measuring systems of the physical properties like mass, length, area, volume,

or temperature are based on linearity. Also, the accounting operations in business are based on linear metrics. As Dumay [19], (p. 205) remarks, "these contemporary IC measurement frameworks are reifying IC in the same manner in which tangible assets are portrayed within accounting, which is akin to attempting to make the intangible tangible. This is what the author defines as an 'accountingisation' of IC". Overcoming those limitations can be done by creating new metaphors and new mental models [20,21].

The rest of the paper is structured as follows. In Section 2, we introduce the metaphor *Knowledge as Energy* and show its enlarged semantic field. In Section 3, we describe the basic *knowledge fields*: Rational, emotional, and spiritual. In Section 4, we explain how we can interpret and use in practice the concept of *knowledge dynamics* based on thermodynamics and the entropy law. In Section 5, we present some theoretical and practical implications of the theory of knowledge fields. In Section 6, we summarize some concluding remarks with respect to our research.

2. Knowledge as Energy: A Mental Challenge

Since any object or stuff positioned in the source domain would induce the attributes of tangibility and linearity to the concept of knowledge, Bratianu and Andriessen [22] suggest using *energy* as a source of analogy, *thermodynamics* as an inspirational domain for explaining energy *transformations*, and *entropy* as a measure of the irreversibility of these transformations. The most important attribute of energy we are interested in is the fact that energy is a *field*. A field is not tangible. It cannot be seen and it cannot be touched. However, it can be felt in some specific conditions, like the gravity field when somebody jumps or a thermal field as a result of the temperature variation. Unlike physical objects which have well-defined geometries and sizes, a field represents a *continuum* of forces. Due to its semantic power, the *field* concept has been extended to social sciences [23–25]. Although linearity may be present in some simple fields of mechanical forces, fields are non-uniform and nonlinear continua. Their non-uniform intensity in space generates forces and fluxes directed against the field gradient. That is another type of dynamic other than fluid flows, and it can be explained by the second law of thermodynamics. For instance, heat which represents a thermal flux is directed from a region with a high temperature towards another region with a lower temperature. If we map these attributes onto the knowledge domain, we get that *knowledge is a field* with a non-uniform distribution within our brain and body, or within a social context like an organization. This interpretation overcomes the limitations imposed by the Newtonian mechanics.

Energy manifests in different forms like mechanical energy, thermal energy, electrical energy, or nuclear energy. Mapping this structure from the source domain onto the target domain of the *energy metaphor* leads to the idea that *knowledge may exists in different forms*. The well-known forms of *tacit knowledge* and *explicit knowledge* used frequently in knowledge management [8,9] should be re-considered since tacit knowledge represents a conglomerate of forms of knowledge, which makes it difficult to work with it. Starting with the energy metaphor and the well-known mechanical, thermal, and electrical fields, and being inspired by the cognitive sciences we shall consider three fundamental fields of knowledge: *Rational knowledge field, emotional knowledge field, and spiritual knowledge field*. These fields can be identified at individual level, by the analogy with the traditional belief in mind, heart, and spirit, and at organizational level by the analogy with the nonlinear integrators of management, organizational culture, and leadership.

A comparable view has been presented by Vemuri and Bellinger [26] in their adoption of systems thinking in organization. However, there are some differences in defining and interpreting the knowledge systems. The framework presented by Vemuri and Bellinger [26] is composed of: Systems of spirit, systems of mind, and systems of body. The analogy with the human body is obvious, but the functional interpretation of all these systems may reveal some contradictions because they ignore the quality of information and knowledge processed. For instance, systems of the body include knowledge management systems although some of them could be better associated with the systems of the mind.

Also, management, leadership, and organizational culture do not appear although they are essential in any organization.

Our approach closely follows the energy realm and the way we think and process knowledge. Kahneman [27], (pp. 20–21) explains that there are two systems of thinking, called generically System 1 and System 2: "*System 1* operates automatically and quickly, with little or no effort and no sense of voluntary control. *System 2* allocates attention to the effortful mental activities that demand it, including complex computations". System 1 represents the sensory system which can "perceive the world around us, recognize objects, orient attention, avoid losses and fear spiders" [27], (p. 21). System 1 processes *emotional information* received by the sensory system and transforms it into *emotional knowledge* which creates impressions, intuitions, and feelings. System 2 processes *rational information* and transforms it into *rational knowledge* which creates concepts, ideas, theories, and mental models [20,28,29]. These two thinking systems interact continuously across the invisible interface between the cognitive unconscious and our consciousness [30,31].

Social life developed in time a set of *moral and ethical values* as a reference system in human behavior. In any decision-making process, we find beyond rational and emotional knowledge a contribution coming from *spiritual knowledge*, a type of knowledge focused on our existential values and vision for the future [32–34]. We learn from the energy metaphor that these three fields of knowledge interact and can be transformed one into another, a property which will be discussed in the next sections.

3. Knowledge Fields

3.1. The Rational Knowledge Field

Philosophers were interested from ancient times to find the *truth* and its *justification*. As a first result of this approach, perception's outcome was not considered as knowledge. Plato was one of the first philosophers to make a clear distinction between subjective and objective knowledge and the role of reflection in creating rational knowledge. Explaining the position of Plato, Russell [35], (p. 153) posits that "we cannot know things through the senses alone, since through the senses alone we cannot know that things exist. Therefore knowledge consists in reflection, not in impression, and perception is not knowledge". For instance, mathematical equations and demonstrations do not depend on our senses and they have the quality of knowledge. That is rational knowledge since it is a result of the mental work. Even if the roots of knowledge are in our experience, knowledge is a result of reflection and logical analysis. Beliefs emerging from experience should be justified in order to become knowledge. Justification is a necessary condition for a belief to be considered knowledge. A false belief cannot be accepted as knowledge. Audi [29], (p. 247) concludes: "it seems that knowledge is at least justified true belief – that we know something only if we believe it, it is true, and our belief of it is justified". An important contribution to this interpretation of knowledge as *rational knowledge* comes from Descartes who created the famous dualism of mind and body. He considered that thinking is the only process that leads to certainty, and that mind is more important than body in understanding existence.

In knowledge management, *rational knowledge* is considered to be *explicit knowledge* because it is expressed by using a natural or symbolic language. Cognitive scientists show that language is fundamental in expressing our ideas and communicating them. Language is a basic instinct [36]. Explicit knowledge can be codified and stored in knowledge bases or embedded in technological procedures and organizational routines. Explicit knowledge plays a dominant role in managerial decision-making and organizational learning. As a consequence, the *rational knowledge field* remains the most important component of organizational knowledge, especially in the Western culture [5,6,8]. Decision-making is almost entirely rational, supported by economic and mathematical models in concordance with the basic assumption that rationality, or bounded rationality, is the dominant logic of management and business [37,38].

3.2. The Emotional Knowledge Field

Contrasting with the Cartesian dualism of mind and body, the Japanese tradition based on Zen Buddhism focused on the oneness of mind and body. The whole samurai training was built on the organic view of human beings and on the need to integrate the body experience with the mental work of the mind. "Zen profoundly affected *samurai* education, which sought to develop wisdom through physical training" [8], (p. 29). This oneness philosophy of mind and body has been confirmed recently by cognitive sciences, which demonstrated that "emotions are central, not peripheral, to both marketplace and workplace behavior" [39], (p. 2). Emotions and feelings create *emotional knowledge*, which is not expressed in words. It is wordless, but it is expressed by our body reaction and the face configuration. Emotional knowledge is used in the non-verbal language of the body and it communicates something about the emotional state of a given person. Facial microexpressions are almost open books for experts in reading and interpreting them [40]. They reflect the human emotions and feelings, as a result of the action of the external environment on our body and mind. "The world of emotions is largely one of actions carried out in our bodies, from facial expressions and postures to changes in viscera and internal milieu" [30], (p. 117). Feelings are more complex phenomena reflecting the interaction between the conscious and unconscious zones of the brain. "As far as the body is concerned, feelings are images of actions rather than actions themselves; the world of feelings is one of perceptions executed in brain maps" [30], (p. 117).

Emotional knowledge is processed by our System 1 of thinking to generate a fast bodily action, especially in dangerous situations [27]. When emotional knowledge is seen only as a part of tacit knowledge, it cannot be individualized and explored directly by managers and leaders [41]. That situation is completely changed when we consider the emotional knowledge field as a part of integrated knowledge and managers have direct access to it. Emotional knowledge represents the raw material for *emotional intelligence* [42,43], and emotional intelligence can be used in designing and operating successfully the recognition and rewarding system in any organization. Emotional intelligence acting as intrapersonal and interpersonal forms of intelligence [44] contributes in recognizing our personal and other individuals' emotions and feelings, and interpreting them for that specific social context. This is essential in improving working together and sharing knowledge. Although in many cultures people learn how to hide their emotions to protect privacy and to save their face in difficult situations, knowledge managers encourage socializing and creation of communities of practice, where psychological barriers for knowledge sharing and cooperation are much lower. Many researchers demonstrate that for successful managers and leaders, emotional intelligence is more important than rational intelligence.

Emotional knowledge and emotional intelligence play a decisive role in leading change. Research shows that the change paradigm of *analyzing–thinking–changing* based on rational knowledge does not produce efficient results and it should be substituted with the new paradigm of *seeing–feeling–changing* based on emotional knowledge [45,46]. Seeing means to manage attention and perception to catch fast enough the message of urgency of change. Feeling reflects the emotional knowledge acquired and the need for its interpretation. As a result of knowledge dynamics in our brain, the emotional knowledge is transformed into rational knowledge which becomes instrumental in decision making for change. Moreover, any organizational change involves uncertainty which is associated with some kind of knowledge risks. Perception of risk is also related to emotional knowledge and its processing. Education may help in developing the competence of decision-making under the pressure of uncertainty, but risks cannot be eliminated and they must be managed. That is more visible for entrepreneurs and investors.

3.3. The Spiritual Knowledge Field

Spiritual knowledge is about shared values and moral judgments which emerge in any social context as a reference system in making judgments and decisions. As Maxwell [47], (p. 274) posits, "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". Furthermore, we should see meaning and value in our work, especially when we consider knowledge workers and their expectations for meaningful contributions to this world. Knowledge workers cannot accept to work only for money necessary to their daily livelihood. They want to create knowledge and to become part of the scientific and technological progress. Thus, their meaning for work goes beyond the elementary biological needs. "We know today that human beings are by definition primarily creature of meaning and value (that is, of 'self-actualization'). We need a sense of meaning and driving purpose in our lives" [33], (p. 17). This quest for recognition and self-realization comes mostly from the fact that knowledge workers own their knowledge and expertise. Unlike the tangible assets of a given company which are fully owned and controlled by managers and shareholders, personal knowledge and expertise cannot be owned by the company.

Understanding spiritual knowledge and working spirituality in the knowledge society is a new requirement for managers and leaders, a requirement which is already reflected in many new regulations and cultural changes, especially those related to governance and leadership. In physics, we have contrasting concepts like matter and anti-matter, or positive and negative electrical charges. By a metaphorical mapping, we may consider contrasting concepts within the spiritual knowledge field, like values and anti-values. *Values* have a positive meaning with respect to the interest of organizations and their stakeholders, while *anti-values* have a negative meaning. Managers who base their decisions on positive values can attain a real business success and a high level of satisfaction coming from stakeholders. Managers who focus their decisions on anti-values (i.e., negative values) follow their own interests in maximizing shareholders' profits and their financial rewards, even if that will destroy the natural or social environment as a result of pollution or other phenomena. Thus, spiritual knowledge helps us to distinguish between *management* and *anti-management*, between corporate social responsibility and corporate social irresponsibility [48–50].

Values are learnt mostly through education in a given cultural environment. Economic education emphasizes the principle of business competition in a free market, which induces the idea of self-interest. However, there is no visible border between self-interest and greed, and in many practical situations, managers and shareholders completely ignore such a limitation for the sake of profit maximization. That is why economic education should also include, besides rational knowledge and economic principles, emotional and spiritual knowledge, and to switch the emphasis from learning knowledge to developing skills and learning to learn [51].

4. Knowledge Dynamics and the Entropy Law

Thermodynamics developed as a science with the emergence of technological revolution of the 19th century and the construction of the heat engines [52,53]. Sadi Carnot was amongst the first engineers interested in the transformation of heat in mechanical work to generate power, and he studied the necessary conditions for improving the efficiency of the thermal cycles. Rudolf Clausius made interesting observations concerning the spontaneous heat flow from a hot body toward a cold one, and stated that "heat does not pass from a body at low temperature to one at high temperature without an accompanying change elsewhere" [54], (p. 42). Since classical mechanics could not help him in describing the energy transfer, he introduced the concept of *entropy*, defining the *change in entropy* (dS) of an isolated system as being the ratio between the heat transferred (dQ), and the absolute temperature (T). He postulated that *entropy* is a state function associated to any system and "when a spontaneous process occurs, the entropy always increases" [53], (p. 6). Lord Kelvin studied the transformation of heat into mechanical work and stated that "no cyclic process is possible in which heat is taken from a hot source and converted completely into work" [54], (p. 41). Although these statements look different, they reflect the same law of thermodynamics applied to macrosystems, like machines and complex thermal and nuclear technologies. Atkins suggests that both statements formulated by Clausius and Kelvin for the second law of thermodynamics can be synthetized by

using the concept of entropy: "the entropy of the universe increases in the course of any spontaneous change" [54], (p. 49).

Looking from a microuniverse framework (e.g., the motion of molecules within a gas), Ludwig Boltzman adopted a probabilistic approach in defining the concept of *entropy* and stated that *entropy* is proportional with the logarithm of the total number of microstates which can define a macrostate of the system [53,54]. From a mathematical viewpoint, entropy may be considered as a measure of a given distribution of probabilities and this very abstract meaning linked entropy to order and disorder and contributed to its extension to many other research areas like engineering communications, information systems, and economics [52,53,55].

The first idea we may get in interpreting knowledge fields through thermodynamics lenses is that knowledge flows always from a higher level of knowledge intensity toward a lower level of knowledge intensity of a certain field. For the moment, we may call metaphorically this intensity *knowledge temperature*. That is a very important insight which underlines the non-uniformity of the knowledge field and the creation of a knowledge flux directed against the gradient of the field. Processes like knowledge sharing and organizational learning become possible due to that gradient of the knowledge field.

A second idea is related to the *order* existing in each field of knowledge. *Emotional knowledge* is like motion of free molecules in a gas, since there is almost no imposed structure on all the information coming through our sensory system. They go directly to the cognitive unconscious brain and orient the body to a fast reaction, if necessary. That is a very low level of order, or high level of disorder, which implies a high level of entropy. *Rational knowledge* is a result of reflection and of using a natural language. "Language serves not only to express thoughts, but to make possible thoughts which could not exist without it" [56], (p. 92). That means to create structures which may have a high level of order, depending on the type of rational knowledge. For instance, a mathematical equation implies a higher level of order than a simple written text. Generally speaking, scientific knowledge involves much more order than daily operational knowledge. Transforming emotional knowledge into rational knowledge, or codifying rational knowledge based on some scientific principles, can be done only by consuming some cognitive work like thinking and learning. *Spiritual knowledge* represents a condensed knowledge with a very high level of order, and with a low level of entropy, respectively. If we compare the order of emotional knowledge with that of a gas, and the order of rational knowledge with that of a fluid, then the order of spiritual knowledge looks like that of a solid. If we would like to keep the framework of the energy metaphor, then we compare emotional knowledge with thermal energy, rational knowledge with mechanical energy, and spiritual knowledge with the electrical energy. This understanding of knowledge goes beyond a simple classification or codification model of knowledge.

The third idea comes directly from the second law of thermodynamics which states that any transformation of knowledge implies a change in the entropy of the universe considered (i.e., personal knowledge or organizational knowledge). Knowledge management becomes, in this perspective, *entropy management*. If we make the analogy between the motion of molecules in a gas and their distribution of probability and the personal knowledge and the dynamics of people within an organization, we can analyze the probability distribution of them and to compute the *knowledge entropy* for a given state of the organization. Thus, managing knowledge means actually to manage that knowledge entropy such that we can obtain the configuration we want. Knowledge sharing does not create new knowledge. It changes the knowledge distribution within organization, by offering access to a larger number of employees to the existing knowledge. Knowledge sharing is like a diffusion process which increases the overall disorder of organizational knowledge. Figure 2 illustrates how a well-structured knowledge field within an organization can be re-structured as a result of knowledge sharing. The final state of organizational knowledge has an increased level of disorder, i.e., an increased level of knowledge entropy.

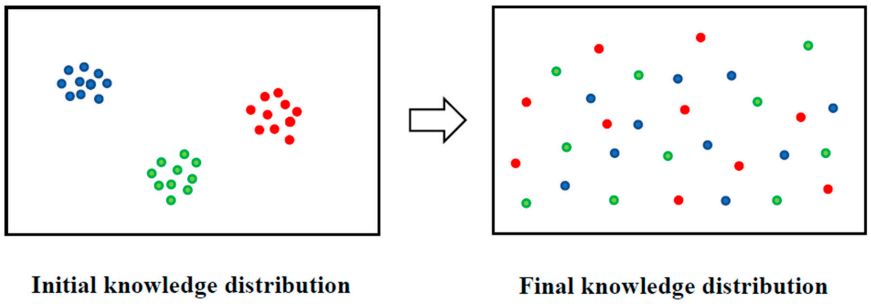

Figure 2. The effect of knowledge sharing on knowledge distribution.

By increasing the probability of any employee to access needed knowledge, at a given time and in a given place, knowledge sharing increases the organizational entropy and positively influences innovation. Thus, we may say that by managing knowledge entropy we can positively influence innovation and firm performance (see Figure 3).

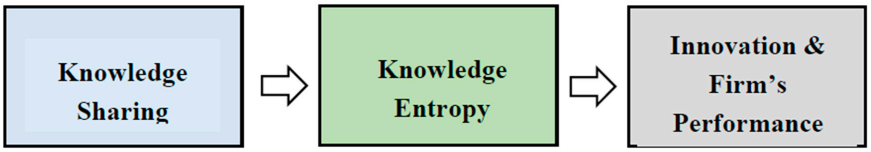

Figure 3. Knowledge sharing influences knowledge entropy and innovation.

Mechanical energy can be transformed into thermal energy and electrical energy. Thermal energy can be transformed into mechanical energy and electrical energy. Electrical energy can be transformed into mechanical energy and thermal energy. All of these transformations can be mapped onto the knowledge fields and get by analogy similar transformations. The transformations between emotional knowledge and rational knowledge are governed by *experience* and expertise. The transformations between emotional knowledge and spiritual knowledge are governed by *culture*, and those between rational knowledge and spiritual knowledge by *wisdom*. Thus, we obtain a holistic view of knowledge dynamics (see Figure 4).

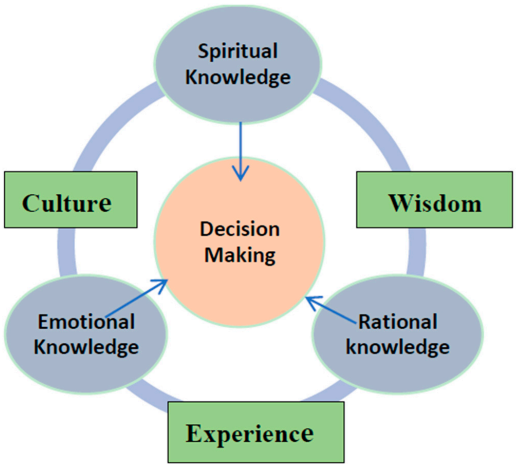

Figure 4. The knowledge dynamics model.

In economics and management, decision-making is considered as a rational process [57,58], supported by mathematical models and software applications. However, in many situations, under pressure of time and uncertainty, managers use mental shortcuts which can be put under the umbrella of *intuition* [59]. While rational decision-making is based on rational knowledge, intuition is based on emotional knowledge. Although the two systems of thinking (i.e., System 1 and System 2) explained

by Kahneman [27] interact, it is hard to conceive the direct switch between rational and emotional knowledge. Our model of knowledge dynamics may be useful in understanding decision-making as a complex process influenced by all the knowledge fields (i.e., rational, emotional, and spiritual) and their dynamics, based on the unity of knowledge: "A most methodological study is of the multi-causal circular causation relations in the epistemic perspective of unity of knowledge" [60], (p. 380).

5. Discussion

The theory of knowledge fields impacts both research and practice. In research, there is a change from the Nonakian dyad of tacit–explicit knowledge to the triad of rational–emotional–spiritual knowledge, and from the SECI (Socialization-Externalization-Combination-Internalization) model for knowledge dynamics to the thermodynamics interpretation of transforming one form of knowledge into another one. In practice, there are many consequences since management complexity is not reduced anymore to only rational knowledge and rationality. The most important implication of the theory of knowledge fields is the integration of managerial decision-making with the recognition and motivational system of employees, organizational culture, and organizational behavior. Also, it is necessary to develop a new working spirituality and use it for supporting corporate social responsibility and organizational change. Managers act as a result of their economic education mostly on rational knowledge field. However, motivating people and managing change require thinking models which include emotional and spiritual knowledge. Leaders influence people mostly through emotional knowledge and develop their vision by using both rational and spiritual knowledge. Managers and leaders act as organizational nonlinear integrators of all these knowledge fields, i.e., rational, emotional, and spiritual knowledge fields.

Knowledge dynamics can explain complex social phenomena like organizational change [45], cross-emotional infection among multi-flight groups in mass flight delays [61], epidemics of violence, and crime surge in a certain area or city [62]. Kotter [63], (p. 20) shows that in change management, *complacency* is a powerful inertial force which reflects the interactions between the rational and emotional knowledge fields: "Complacency is not only a thought. It's very much a feeling. It is usually less a matter of conscious, rational analysis than unconscious emotion". Knowledge dynamics can explain many irrational economic phenomena and consumers behavior [64,65], as well as bad strategy design and implementation [66,67]. For instance, one of the frequent mistakes some companies make is keeping the same marketing strategies throughout the world, regardless of the cultural differences between different countries. For instance, when Taiwan Pepsi used the generic slogan "Come alive with the Pepsi generation", the uninspired translation "Pepsi will bring your ancestors back from the dead" produced a strong negative buying reaction in the potential consumers of pepsi-cola. A similar emotional effect happened when General Motors wanted to sell "Chevy Nova" in South America, since "nova" means "It doesn't go" in Spanish [66].

A famous psychological experiment which demonstrates the influence of knowledge dynamics on decision-making was performed at an old British university, where students used to go in their free time to a tea room to prepared themselves a tea or a coffee and eat some snacks. In that room, there was a list with suggested prices and an "honesty box" for students to pay for their consumption. "One day a banner poster was displayed just above the price list, with no warning or explanation. For a period of ten weeks, a new image was presented each week, either flowers or eyes that appeared to be looking directly at the observer" [27], (p. 57). The result showed that students were influenced in their decision of how much to pay by those images. When they felt the eyes looking at them, they put in the "honesty box" more money than when they saw flowers. That explains how emotional knowledge generated by the flowers or eyes transformed into rational knowledge and influenced students in their decision for payment. This emotional–rational knowledge dynamic appears important also in investment decisions, since people accept with difficulty the idea of losing money: "They are reluctant to take risk when there is a huge change of losing because it is hard to overcome the psychological burden of it" [68], (p. 1056).

The theory of knowledge fields may be very useful in the design and realization of virtual agents [68], and emotional robots. Although it looks like a paradox to discuss love relationships between humans and robots, there is a developing research in this new domain called *lovotics* (love + robotics). It is a multidisciplinary domain utilizing concepts and ideas from several research areas like biology, psychology, neuroscience, artificial intelligence, and robotics [69,70]. This theory can explain also the complex process of managing knowledge entropy and influencing the innovation process and firm's performance [71–73].

6. Conclusions

The aim of this paper is to present a new approach to understanding the complex concepts of *knowledge* and *knowledge dynamics* by analogy with thermodynamics, targeting managerial applications. All the knowledge metaphors based on objects, stocks, flows, and stocks-and-flows induce in the semantic field of knowledge the idea of linearity and sometimes that of tangibility. These attributes are serious limitations of understanding the practical value of these concepts, and in designing metrics for intangible evaluations.

Thermodynamics suggests the idea of knowledge fields and that of transformation of one field into another, like in the energy case. Based on that, we define three fundamental knowledge fields: Rational, emotional, and spiritual. We show their characteristics and the transformational processes between them. The whole conceptual model is based on the hypothesis of knowledge unity and oneness philosophy between mind and body. Understanding knowledge fields and knowledge dynamics as a transformational process helps managers and leaders in making decisions and motivating much better the employees. Also, knowledge dynamics plays a key role in leading change and developing a dynamic knowledge ecosystem. Knowledge sharing, a key process in knowledge management, changes the knowledge distribution within an organization, which contributes to increasing knowledge entropy. Thus, knowledge management can be interpreted as organizational entropy management.

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