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The companies involved in the energy sector must reinvent themselves to be innovative and adaptable to contemporary environmental changes. The promotion of renewable energy in rural communities is a great challenge for these companies. They should focus on improving the environment scanning actions and the knowledge management (KM) system and enhancing the collective intelligence to avoid the loss of information, to foster innovation, and to maintain a competitive advantage. To achieve these goals, energy companies require appropriate management tools and practices. The purpose of this study is to propose a theoretical framework of organizational intelligence (OI) supported by a cross-perspective analysis of various aspects: economic intelligence (EI) and KM practices, entropy processes, and organizational enablers. A pilot investigation for testing the framework in the case of Transelectrica S.A. has been elaborated. The findings reveal that the elements of the OI framework are embedded in Transelectrica's system and they need to be further developed. As an intelligent company acting in the Romanian energy market, Transelectrica has a higher potential to promote projects in the renewable energy sector. The main conclusion highlights that OI is a multidimensional construct that provides the organization the ability to deal with environmental challenges in a "new economy".

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Article

Theoretical Framework of Organizational Intelligence: A Managerial Approach to Promote Renewable Energy in Rural Economies

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Abstract: The companies involved in the energy sector must reinvent themselves to be innovative and adaptable to contemporary environmental changes. The promotion of renewable energy in rural communities is a great challenge for these companies. They should focus on improving the environment scanning actions and the knowledge management (KM) system and enhancing the collective intelligence to avoid the loss of information, to foster innovation, and to maintain a competitive advantage. To achieve these goals, energy companies require appropriate management tools and practices. The purpose of this study is to propose a theoretical framework of organizational intelligence (OI) supported by a cross-perspective analysis of various aspects: economic intelligence (EI) and KM practices, entropy processes, and organizational enablers. A pilot investigation for testing the framework in the case of Transelectrica S.A. has been elaborated. The findings reveal that the elements of the OI framework are embedded in Transelectrica's system and they need to be further developed. As an intelligent company acting in the Romanian energy market, Transelectrica has a higher potential to promote projects in the renewable energy sector. The main conclusion highlights that OI is a multidimensional construct that provides the organization the ability to deal with environmental challenges in a "new economy".

Keywords: economic intelligence; knowledge management; organizational intelligence; renewable energy; entropy process; organizational innovation; business strategy

1. Introduction and the Purpose of Study

The "new economy" is the space of action in which an organization's performance and competition do not depend on the access to information but essentially on the ability to obtain, process, and interpret information. In a global market, the best opportunities for an enterprise's business strategy are linked to cost reduction, investment in information communication technology (ICT) infrastructure, and redesign of business models, among others. However, what is the next step? Where might an organization find new resources for becoming more efficient, more effective, and more competitive? It seems that a great part of the answer lies in the capitalization and development of an entire immaterial potential that an organization disposes of. Such a step brings into discussion, on the one side, the development of individual intelligence as a central objective of human resources management and, on the other side, the implementation of new practices able to develop an enterprise's ability to continuously understand and learn, generating the general framework of organizational intelligence

(OI). In this paper, OI is seen in a multiperspective interrelation of different practices that are founded on information and knowledge management (KM). Moreover, the construct of OI is affected by particular aspects of entropy phenomenon and organizational enablers (i.e., business strategy and organizational innovation). Different approaches of OI have been addressed over the past decades in many researches [1–4]. Starting from the initial idea accredited to Wilensky [5], OI has evolved into a concept that encompasses particular organizational aspects (e.g., learning, communication, culture, information, perception, cognition, and individual intelligence). Nevertheless, the development of OI based on economic intelligence (EI) and KM complementarities, entropy phenomenon influence, and organizational enablers is missing. This paper attempts to fill this gap and provide another perception of OI that might be useful for companies to adapt on the contemporary environmental paradigm. Moreover, in the innovation management area, intelligence variations among companies are explained with the concept of knowledge management [6], strategy, leadership and management [7], and factors affecting the process and outcome of organizational intelligence [8]. The tight correlation between OI and KM is highlighted by Nazem et al. [7], who provided a structural model to assess the OI in the technical and vocational training organization based on knowledge management.

The research question is how EI and KM practices, entropy phenomenon, and organizational enablers affect OI development. The aim of this paper is to propose a conceptual framework of OI that is supported by these elements. An integrative structure of OI will be presented in the first part of this paper. Then, a pilot system of the OI framework in a case study of the Romanian energy transporter Transelectrica S.A. will be discussed in the second part of this article.

2. Theoretical Hypotheses

There are four essential statements that we put forward in our approach to OI. The first one is linked to the necessity of a systematic supervision of the environment, with the purpose of detecting the threats in and use of opportunities in an organization. These practices that are focused on identifying strategic information from an external environment and their use for providing what an organization needs for decision-making represent the central philosophy of EI. Another basic statement refers to the necessity of identifying, capitalizing, and exploiting the knowledge produced within the organization to develop a knowledge-intensive culture and to build a knowledge infrastructure (a network connection among people). Thus, an organization focuses on the development of a KM system that can be fully institutionalized. A third basic statement is related to the level of entropy of an organizational system that influences the development potential of OI. In the field of thermodynamics, entropy is a measure of the disorder in a bounded system; in a knowledge-based organization, entropy refers to the loss of individual or collective intelligence, which cannot be mobilized toward achieving OI. To achieve a gain of intelligence, an organization should maximize the negative entropy (negentropy) of its intelligence system resources. The final statement is based on the idea that the OI construct should be associated with different factors it indirectly affects. These are the organizational enablers that we considered to support the development of OI (i.e., business strategy and organizational innovation). Based on the above statements, three hypotheses are proposed:

- H1:** There are complementarities between EI and KM practices that can serve as pillars for OI development.
- H2:** The entropy process generated by a continuous change in the environment requires efforts to avoid the deterioration of an entire organizational system. The control of entropy process inside certain limits is needed for the development of OI.
- H3:** Business strategy and organizational innovations are two important enablers that are positively correlated with OI development.

3. Background and Literature Review

3.1. Economic Intelligence

In the first phase, the notion of EI has its origin in the action of monitoring the competitive environment [9]. The studies of Michael Porter in the 1980s discussed the concept of “competitive intelligence” in the United States, which insists on the role of competitive analysis in consolidating an organization’s market position. In France, the first works of Baumard [10] and Lesca [11] signalize the role of supervising a competitive environment in making strategic decisions and in adapting an organization to the requests of a market in dynamics. In the context of globalization and increasing competitive pressure, the term “environment scanning” becomes limited. Thus, it does not sufficiently express the new aggressive and proactive character of the global economic space’s monitoring by economic actors. They have become interested in developing actions that have environmental influence (lobbying). This one will impose at the level of conceptual approach the term of EI in the Francophone literature and competitive intelligence in the Anglo-Saxon literature.

In this paper, we agreed on the term of EI, having in our opinion closer connotations to the cognitive potential development at an organizational level than the competitive intelligence one, which is mainly focused on the environment’s scanning techniques. The concept’s maturity took place once in Martre’s report in France in 1994, which marked a new perspective in approaching EI. Thus, the report published by the Commissariat Général du Plan (France) states that EI is the coordinated actions’ ensemble of research, processing, and distribution of useful information by economic agents to exploit it with strategic and operational purposes [12]. These actions are legally developed, with the guarantee of protecting and preserving an organization’s patrimony in the best quality and cost conditions. Note that EI is considered to be an informational process that mainly intends to obtain a greater efficiency of the decisional process [13]. According to this goal, Cohen [14] referred to EI as a formalized process of research, collection, and processing of external information, which is characterized by a strong anticipative and proactive dimension in relation to the competitive environment. The fundamental philosophy of EI is based first on the competitive environment’s scanning system and second on the action on it, with the purpose of detecting threats and exploiting opportunities [10]. Baumard’s [10] approach highlights the proactive role of EI, as reflected in influencing actions (lobbying) of the competitive environment.

According to Bournois and Romani [15], EI is an administration practice of collecting all the information and knowledge regarding the main competitors of an organization, which determines the ways that can affect organizational interests, as well as its competitive position. Fleisher and Blenkhorn [16] said that EI is a project based on the collective cognitive abilities of an organization, which is represented by all the procedures necessary for turning information into active knowledge. EI is closely linked to other information management approaches such as KM, which regards information available inside an organization, or business intelligence, which excels in the use of software tools for business strategy. Nevertheless, the EI concept has to be analyzed from a much more ample perspective. Beyond the necessary technological instruments for the use of the environment’s scanning practices and for the processing of collected information, the EI process induces a new approach at the organizational level based on the development of cognitive capacity and organizational learning. Therefore, EI is a new concept of economic analysis in a knowledge-based value system [13]. By researching the manner of action in understanding and anticipating the environment, Levet [17] stated that EI appeals to notions of collective learning, knowledge, and competence management. These discussions open a reflection plan over this paper, which is related to the EI and KM inputs in developing OI.

Another relevant approach for the purpose of our paper belongs to Marcon and Moinet [18] who affirmed that, in an EI process, an organization-competitive environment relation has to be globally capitalized by developing collective intelligence. This means that EI is not limited to information gathering from the environment or of lobbying actions but is also about the development of the human

factor's interpretation capacity that generates an OI through a synergetic process. It is also of interest to mention the opinion of Guilhon and Levet [19] that EI should not be only limited to practices of environment scanning. Moreover, it is a strategic approach that allows an organization to go through a necessary but insufficient adaptation process to the environment and to increase the capacity to anticipate possible future strategic scenarios.

3.2. Knowledge Management

Regarding the implementation of KM practices in an organization, there is an extremely strong economic and managerial justification. First, in a globalized economy, organizations have become aware of the necessity to exploit an unlimited resource they can dispose of—knowledge. The innovation capacity is tightly linked in an organization's ability to transform its knowledge into collective strategic intelligence. The traditional power sources, such as financial capital, weigh less and less in the competition balance in comparison to experience, competence, and creativity [20]. Second, the KM contribution in an organization excels in the optimization of knowledge exploitation practices and in the generation of information to produce new knowledge. Organizations adopt KM for several reasons, such as, for example, increasing the innovation within the company, and creating a knowledge sharing environment [21].

Before exploring the KM concept, a distinction between information and knowledge has to be made. This distinction is important for the aim of this paper because the two practices (i.e., EI and KM) that we consider to support the development of OI are focused on apparently different notions: information in the case of EI and knowledge in the case of KM. Analyzed in a strategic context or in one of the decision-making processes, information itself does not lead to performance. Information mediates the relationship with the environment and supplies the creation of knowledge, but it does not substitute it. It becomes knowledge through an individual's own cognitive process, developed in a certain context. Information gets strategic value when it is transformed in operational knowledge within a learning process. Hence, the need for filtering and structuring information accumulated from an external environment is necessary according to the organization's strategic options. Companies employ systems of environmental scanning within the EI practices, getting strategic information that contributes to generating knowledge within organizations. This tight correlation between information and knowledge is one of the important premises of the OI development. Good information management is the essential foundation to good KM. The two go hand-in-hand [22].

According to a usual perception, KM can be seen as a set of processes for generating, codifying-validating-storing, sharing, utilizing, and evaluating the huge set of knowledge that each organization uses in its activities [4]. Massie [23] stated that KM is a systematic process of finding, selecting, organizing, and presenting information in a way that improves an employee's comprehension in a specific area of interest. Note that a similar approach belongs to Davenport and Prusack [24], who defined KM like a process of knowledge capture, sharing, and reuse that organizations used to become more productive and allowed them to get closer to their customers. In fact, KM defines a systematic, explicit, and deliberated building process required to manage knowledge, the purpose of which is to maximize an enterprise's knowledge-related effectiveness and to create values [25].

An interesting point of view is about the KM influence on organizational culture. To be exact, it is about the KM influence on those elements that justify the knowledge shared among employees and the development of a culture based on continuous learning. Thus, there is an opinion that, to move an organization to succeed in knowledge sharing or learning, it is not necessary to have a great dimension of knowledge database [26]. An organization needs a culture that celebrates sharing and teaming. This is an important factor impacting success of KM. Figallo [27] observed that KM should be supported in a knowledge-sharing culture, and trust is its most important component. Successful KM systems also need an organizational structure that is in line with business strategy and links individual performance with organizational performance.

Another tendency arises from the KM perception outside an organization's boundaries, bringing into attention characteristics related to the economic cluster development. Cappelin [28] talked about KM at the level of territory, mentioning that this one focuses on the cognitive dimension of enterprises in the cluster, allowing the conversion of tacit knowledge into explicit knowledge that is collectively shared by all actors in the cluster. This aspect is relevant in addition to the competitive environment's scanning system for all companies in the cluster. Consequently, this relationship has to be regarded as a piece of the OI framework.

3.3. Overview of the OI Concept

OI is one of the newest and interesting problems for strategic management. The concept's essence highlights an organization's capacity to develop an efficient behavior that ensures a proper reaction to the environment's dynamics and incertitude. Such ability depends on an organization's connections to the environment or on the interpersonal relationships from its own system as well as human intelligence that depends on neuronal connections. In the Global Knowledge Economy an intelligent organization is called to solve the problem of "knowledge obsolescence" by using a just-in-time access to learning content, and finding the better way to access increasingly distributed knowledge sources [29]. From this point of view, the approach of OI is based on the theories of web learning systems which must be strong integrated with KM systems [29].

The first definitions of the concept began from the idea of intelligence at a group level named by some authors as collective intelligence [30–32]. The essential dimension of collective intelligence is reflected in the optimal mobilization of individual competences through a synergetic process, with the purpose of realizing a right objective. An overview on collective intelligence concept related to the creation of more entrepreneur-centric ecosystems belongs to Elia et al. [33], who proposed a model to support technology entrepreneurship initiatives through an innovative approach which is global, project-specific and dynamic. Although a great majority of authors refer to collective intelligence by means of the individual one, there is a consensus to the fact that the first one does not represent the sum of the other ones [34]. This aspect is also highlighted by Glynn [35], who affirmed that OI is a social outcome related to individual intelligence by mechanisms of aggregation, cross-level transference, and distribution. As with human intelligence, OI is oriented to solving problems and to developing certain behaviors to react effectively to external inputs. In this respect, OI is an organization's capability to process, interpret, manipulate, and access information in a purposeful, goal-directed manner so it can increase its adaptive potential in the environment in which it operates [35]. Most scholars highlight the definition of OI in terms of the capacity of an organization to gather information and to generate knowledge to adapt to its environment [36–39]. An interesting approach based on human cognitive abilities belongs to Mayer et al. [40], who extended the concept of OI by a new competency named emotional intelligence.

According to [41,42], OI is a systematic processing of information and knowledge from external and internal sources to enhance the ability to foresee the future and to adapt to the changing environment from a business point of view. This statement reveals the interaction between the organization and their environment, a process that imposes the development of some coordination, action, and behavioral mechanisms, which might be operationalized by means of EI practices. At the same time, the internal processes in an organization required intellectual resources, which imply the development of KM systems, intended to ensure a better usage of the knowledge potential of an organization. We have in this point a good reflection about the possibility of linking EI and KM to develop OI. These will be extended in the next section of this paper.

The research related to OI has focused on the use of tools for developing the responsibility, the creativity, and the adaptability of an organization, allowing the adoption of decisions in conditions of reducing the resistance to change [43]. In other words, we can say that OI is a cultural and organizational emergence, resulting from the relation to the environment and also from a formalized process of producing and exploiting the knowledge in an organization. OI is able to increase

competitiveness through a systematic approach of three intelligence levels (i.e., individual, relational, and strategic) in an organization [44]. The individual level is focused on individual intelligence, which consists of the individual's skills to identify what information is needed for solving a certain problem. The relational level or operational intelligence is based on the processes of information collection and producing new knowledge. This level emerges from the existing cooperation and synergy between individual intelligences. Note that the collective intelligence developed at this level does not appear spontaneously. Supplementary time and effort are needed for reducing group tensions. The strategic level represents the amplified intelligence or the level of building integrated knowledge (meta-knowledge). Information technology (IT) and KM tools (e.g., Groupware, Data mining, Data warehouse, and so on) are used.

4. Theoretical Framework of OI

This section examines the three hypotheses that have been proposed within this study to create a conceptual framework of OI.

H1: *There are complementarities between EI and KM practices that can serve as pillars for OI development.*

As shown above, the fundamental mission of EI is in the supply of information and knowledge about an organization's main competitors with the purpose to identify opportunities and threats that might affect their own interests. At the same time, through the EI practice, an organization is permanently informed about the technical, economic, and legal systems that influence their competitive position. On the other side, the KM process is oriented to the capitalization and distribution of knowledge within an organization, beginning from pertinent information or from previous knowledge. Thus, the KM architecture provides support for solving problems, innovating products, and, finally, making competitive strategic decisions. Therefore, both EI and KM are premised on turning information into knowledge that is strategically valuable and decision relevant [45]. Although the two practices operate at different management levels (i.e., top and middle management for EI and tactic and operational management for KM), there are some specificities between them that can be taken into consideration. Blondel et al. [46] underlined these specificities, responding to the following questions.

- What kind of information?

Both practices transform information into knowledge to take action. EI uses predominantly external information sources, whereas KM focuses on the ones in an organization's own system. Therefore, the need to manage simultaneously the internal and external information and knowledge is required. For this, two main actions are necessary: (1) a coordination management of external connections of organization by creating network communication systems, partnerships, and strategic alliances; and (2) equilibrium between tacit knowledge that ensures competitive advantage and explicit knowledge that can be communicated through the organization members.

- For whom is the information?

The information that is gathered by EI practices has a strategic, often confidential, character and is intended for the company's managers. The field from where they are collected is well defined by the managerial team, the real or potential competitors, the technology market, or risk management. KM mainly actions in an organization's internal perimeter ensuring the instruments to be shared and the preservation of the knowledge that is useful for the experts' network or for the company's managers. It seems that EI and KM have the same finality, but the process of information filtering is different for each of them [47]. This is crucial within the EI practice, allowing the managers to make a relevant selection from the external environment, for their strategic actions.

In contrast, KM is not mainly oriented on filtering information but on its transformation into knowledge that might be later integrated in the EI process. From these considerations, the EI and

KM complementarity is obvious. According to Blondel et al. [46], this one essentially appears in the following manner. First, KM represents support for EI, which means it provides a set of techniques for the optimal usage of information by EI (e.g., Groupware, Workflow, Data mining, and Data warehouse). Thus, the creation of a global knowledge base with a federalized structure (products, applications, procedures, prospection, and geographical areas) represents a knowledge warehouse for EI that benefits from past experiences in the life of an organization. It might be said that EI is based on KM for creating an informational network and detecting human intelligent agents. Second, EI leads the KM processes, in the sense that information is actualized and processed for the new generation of knowledge. This type of complementarity between the two practices is based on the temporality element [45]. Thus, if KM operates past and present information and knowledge, being orientated on an organization's present business model, EI detects strategic information vital for its future business model. This strategic information that is fundamental for an organization's future supplies tomorrow's KM practices. Therefore, the complementary nature of the two practices consists of the fact that KM is preponderantly focused on exploiting existing knowledge, whereas EI offers a cognitive frame for exploiting new knowledge, more adapted to competitive environment changes. The complementarities between EI and KM are reflected through the following issues in Table 1.

Table 1. Complementarities between economic intelligence (EI) and knowledge management (KM).

EI	KM
Perception modalities	
Thinking and action manner, a culture type, a state of mind; a strategic instrument, a strategic measure	Management of the organizational processes; a measure, a collective action
Processes they refer to	
Collection, validation, analysis, diffusion of the external information	Identification, creation, capitalization, sharing, and diffusion of the knowledge
Aimed objectives	
Strategies elaboration, assisting the decisional process Gaining the competitive advantage Preserving an ethic and deontology of the labor	Knowledge control and exploitation Organizational learning Knowledge creation, innovation perfecting Sustaining the interpersonal relations system
Relation elements	
Technologic, commercial, competition, financial, socioeconomic environment Globalized economy Economic actors' networks States, nations, territories	Strategic management Economy of the immaterial, the informational, and knowledge society Managerial innovation Human resources management

We conclude that EI and KM are complementary under the procedures and techniques that they are using. Both of them ensure the strategic management of information and knowledge based on transversal information flows, which create an iterative relationship between information, knowledge, and action. The complementarity of EI and KM practices might confer the sustainable competitive advantage to the organization by serving as a pillar for OI development.

H2: *The entropy process generated by a continuous change in the environment requires efforts to avoid the deterioration of an entire organizational system. The control of entropy process inside certain limits is needed for the development of OI.*

An organization is functioning as a system, conceived as interconnected elements capable to react with the environment that surrounds it. The continuous exchange of energy and information with environment leads to the entropy process that affects the organizational system. In effect, entropy is a measure of disorder in a system given by the number of states in those the system can be present.

Entropy seems to be a typical tendency of organizations, and it denotes the loss of available energy caused by various forms of disorder. Being on the origin a thermodynamics concept, the entropy has become a part of economic systems theory. In his book entitled *The Entropy Law and the Economics Process*, the Romanian economist Nicholas Georgescu-Roegen highlighted the importance of the entropy law in the economic process saying that a good administrator cannot be left without a clear knowledge of this law [48]. As mentioned before, the OI is a complex system fundamentally based on the capacity of organization to gather information from the environment, to create knowledge, and to act according to these. An organization is becoming an information conglomerate and a veritable knowledge processor. The mechanisms of aggregation, transference, and distribution of information and knowledge may produce different forms of disorders in organizational system, which may then translate to malfunctions, such as incompetent decisions, disaffected employees, malorganization, underperforming leadership, or strategic inertia. The entropy process that emerges is generated by a progressive loss of the relationship inside the organization. Under these conditions, the development of OI requires internal control elements to ensure that the organizational system evolves towards higher-order levels. This is done through the mobilization of the intelligent system resources and putting together ideas, learnings, communications, information processing, and feedback of organization to the environment. In other words, to make the organizational system more sustainable, it should decrease the entropy. The entropy becomes an indicator of OI and supports its development.

H3: *Business strategy and organizational innovations are two important enablers that are positively correlated with OI development.*

Obviously, many internal factors that indirectly affect OI can be considered (e.g., organizational symbols, organizational structure, organizational culture, and advanced technological systems). According to Kalkan [49], these factors form the organizational setting and support OI. Besides these, two other factors are related to OI development. As key drivers of organization, business strategy and innovations are important enablers for enhancing the competitive position. The business strategy sets priorities for the company and management team according to their vision and mission to achieve the competitive advantage. Because the global economy is coming under growing pressure to respond to environmental challenges, an intelligent organization should be able to align the business strategy with sustainable development concepts. The organizational responsibility exceeds the traditional sphere of obtaining profit, thus making it engage in a demarche of sustainable economic growth, according to its medium- and long-term interests.

Innovation is another factor that potentially affects the OI by its various forms, such as new goods and services, new technologies, or new management practices. Although these two factors do not directly support the OI development, they are relevant. An intelligent organization has a high level of adaptive capability that leads to better define the main objectives according to new environmental constraints and stakeholders expectations. Moreover, for an intelligent company, innovation is a systematic, rather than casual, process that allows the adoption of differentiation strategy as a way of gaining competitive advantage. Consequently, business strategy and organizational innovation are indications for OI development.

The discussion in this section created the premises for developing the theoretical framework of OI. These are the following:

- (1) The complementarities between EI and KM practices are pillars for OI.
- (2) Entropy process is an aspect of OI development and it should be managed.
- (3) Business strategy and organizational innovations are positively correlated with OI development.

Based on the specific elements included in each of the above propositions, a framework for evaluating the OI is proposed, as shown in Figure 1.

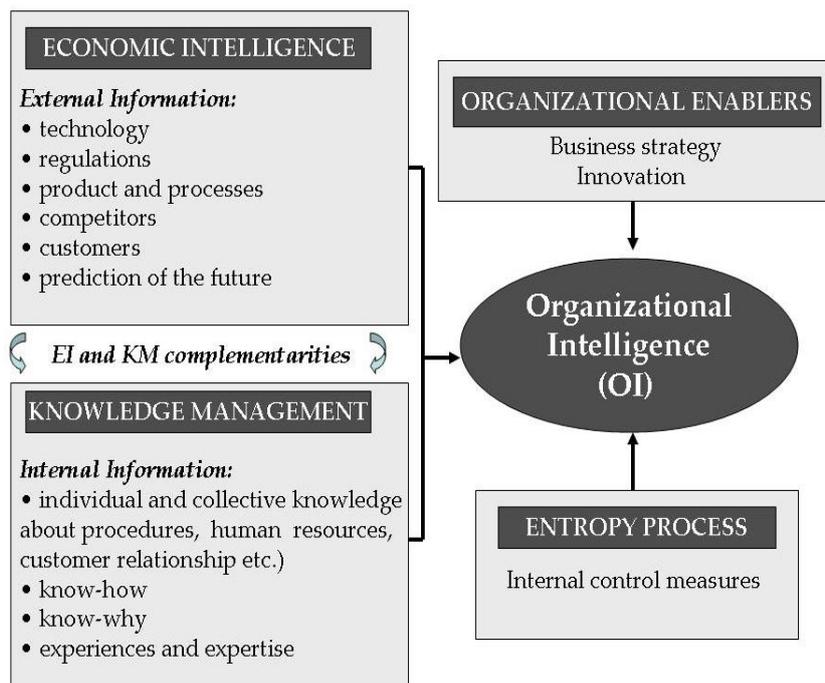


Figure 1. Theoretical framework of OI.

5. Research Methodology

This section presents the methodological approach, which underpins the proposed theoretical framework. Starting from the research problem related on how EI and KM practices, entropy phenomenon, and organizational enablers affect OI development, a qualitative approach is used. Thus, the observational research methods that are common in qualitative measurement are included. In particular, step-by-step this approach can be described as follows:

- Observation of the EI and KM practices within an organization and their potential complementarities.

In this context, the methodological process requires to investigate one of the most important functions of EI, which is the environmental scanning that allows decision makers to understand the external environment and the interconnections of its various aspects. The study focuses on ad-hoc approach of environmental analysis that is useful for collecting information for specific project, detecting trends of the environment, and defining the potential changes. After defining the techniques to monitor the external environment, the methodology proceeds with the assessment of KM practices, which represents support for EI. For this purpose, an observation method of the common tools available for the optimal usage of information is developed.

- Observation of entropy phenomenon.

At this stage, a qualitative method based on direct observation has been followed to identify events that reflect a low amount of information stored in the company system, leading to entropy phenomenon on various time periods. The direct observation allows identifying both internal weaknesses and external threats that are susceptible to create entropy processes.

- Identification of the internal factors that are positively correlated with OI development.

The approach proceeds with the analysis of documents and materials for the identification of the most suitable key drivers of organization that allows recognizing the connection to the OI features. This interpretive methods is focused on two factors that reflect organizational adaptive capability

(i.e., business strategy and organizational innovation), showing how these enablers are indications for OI development.

Due the fact that information and data for the particular components of the OI framework are unstructured, the assessment of the EI and KM practices, the entropy phenomenon, and organizational enablers is qualitative and therefore the observation as a data collection method was used. The scope of the observational research is to understand the ongoing behavior of a company related to the aspects that reveals the characteristics of an intelligent company. Thus, a realistic approach is based on direct observation as a data collection method. This is focused on the description of events, behaviors and processes that are connected with the proposed theoretical framework of OI. In particular, a plan for observation was done, as follows:

(1) Defining the focus

Given the research problem, direct observation is looking at certain activities and processes that are central in the construct of OI. Thus, the focus areas are the interactions of the company with the environment, the KM practices that the company uses, the events that lead to the entropy processes, and the factors that are correlated with OI development.

(2) Collecting observation data

In this phase, a way of collecting observation data is used, based on field notes. This method can serve as a useful tool for the purpose of the study, allowing the recording of observation in a descriptive style. In this context, field notes can be used to capture information that includes:

- General information about the company, which is the major player for electricity transport and distribution in Romania.
- Characteristics of the area of the Romanian energetic sector, which has a great potential of renewable energy sources (i.e., the Centre Development Region).
- Information that refers on how the company operates the main function of EI (i.e., environmental scanning), and uses common tools available for KM.
- Information that allows understanding the events and situations that leads to entropy phenomenon on various time periods.
- Information generated from the observation of the processes that can support the OI development (i.e., organizational innovation and business strategy).

It is noted that for the purpose of this approach, selecting an adequate number of sites can be useful as a tool to collect data. Once the focus areas of the observational research have been identified, several sites are necessary to obtain a reasonable understanding of the aspects that refers to Romanian energetic sector, as well as the elements that are specific for an intelligent company.

(3) Interpreting notes

After collecting the observation data, a careful examination of information that describes behaviors, events and processes is required, in order to evaluate the premises for developing the theoretical framework of OI. This examination highlights certain assumptions, such as:

- Are there particular elements or characteristics associated with the EI and KM practices that can be used by the company?
- Are there situations and events that lead to entropy processes inside the organization?
- Do certain internal factors affect the construct of OI?

Based on the proposed methodology, the next section presents a pilot investigation in a Romanian company, in order to identify the aspects that are in line with the theoretical framework of OI.

6. Pilot Investigation to Evaluate OI Framework: The Case of Transelectrica

This section presents Transelectrica as a case for OI development. This company is a Romanian major player for electricity transport and distribution founded on Government Decision No. 627/2000 [50]. The activity of the company is a natural monopoly regulated on the national level by the Romanian Energy Regulatory Authority. Started in 2006, Transelectrica is the first state-owned company listed on the Bucharest Stock Exchange from the program “A Powerful Market” initiated by the Romanian Government [51].

One of the most important challenges for the Romanian energy sector (RES) is the start of green power generation. The major companies in the energy business are trying to make big investment projects to exploit the huge potential of renewable energy resources that Romania disposes on their development regions. In such context, Transelectrica needs to complete the technical competencies related to the energy sector with new business abilities and management practices to adopt a more flexible approach of environmental challenges. It becomes important for such a company to develop better methods for improving the information processing capacity and organizational adaptive potential as well as enhancing the internal processes that lead to sustainable performance and innovation. As such, it is desirable to evaluate the aspects of OI in the case of Transelectrica, which can be considered as dimensions of the company’s intelligence. Based on the theoretical framework of OI, a qualitative case study of Transelectrica is presented.

6.1. Evaluation of the EI and KM Practices

The basic idea of EI is to manage the information and knowledge from an external organization’s environment with the purpose to create a strong competitive advantage. This consists of a collective cognition capacity to transform information in actionable knowledge. The main function of EI is the environmental scanning that allows decision makers to understand the external environment and the interconnections of its various aspects.

To show how this function is operated by Transelectrica, we selected the Centre Development Region (CDR) from the eight development regions in Romania. This is an important area for the Romanian energetic sector, which has a great potential of renewable energy sources. The CDR was founded in 1999 and included six counties (i.e., Alba, Braşov, Covasna, Harghita, Mureş, and Sibiu). A variety of renewable energy sources are located in the rural area, which can ensure energy autonomy on the local level (Table 2).

Table 2. Characteristics of renewable energy sources in CDR [52].

Renewable Energy Source	Description
Biomass	High potential of agricultural biomass and forest biomass due to climate condition, soil, and the high relief.
Geothermal	Thermal applications with geothermal heat pumps in rural areas (Toplita and Miercurea-Ciuc-Jigodin).
Hydroelectric	Important potential in the river basin of Olt and Mures and their affluents (Cibin, Sebes, and Raul Negru). The most important hydroelectric potential is in Harghita and Sibiu counties (small hydropowers in Zetea and Arpasu de Sus).
Solar	The most important solar energy potential is in the Transylvanian Depression. A small photovoltaic system was built in rural communities around Alba Iulia town.
Wind	Low wind energy potential that can be harnessed in a discontinuous manner and only in areas located near the mountain zone.

Starting in the 2000s, many projects to support the linkage between the rural development and the renewable energy sources have been developed. In Covasna and Harghita, the biomass was a good solution for thermal energy as well as for cogeneration. Thus, the use of sawdust as fuel has been a solution to produce energy based on biomass for some rural areas (e.g., Intorsura Buzaului and Vlahita). Because of a favorable geographical position, many communities can benefit from the

advantages of solar energy (e.g., Sebeș, Ocna Mureș, Agnita, Toplița, and Târnăveni). The use of solar energy is a profitable energy solution, especially for the isolated rural communities. Concerning wind energy, although the CDR has a great potential to harness it, there are a lot of problems to exploit this energy source (e.g., funding policies). The geothermal energy of CDR is also used in rural communities for heating, agriculture, or food industry.

Romania has an appreciable potential of renewable energy sources, which can be exploited to support the development of rural areas that have a weak connectivity to the energy network. According to the Romanian Energy Strategy 2007–2020, the potential of renewable energy sources is shown in Table 3.

Table 3. Potential of renewable energy in Romania [53].

Source	Annual Potential	Use
Solar energy	60 PJ	Heating
	1.2 TWh	Electricity
Wind energy	23 TWh	Electricity
Hydroelectric energy	36 TWh	Electricity
		Heating
Biomass	318 PJ	Electricity
Geothermal energy	7 PJ	Heating

As the national company of electricity transmission, Transelectrica is involved in the main projects for stimulating the use of renewable energy sources and for increasing the energy efficiency in this development region. According to model that Coates suggested for environmental scanning system [54], to explore this function of EI in the case of Transelectrica, two objectives are proposed.

(a) Detecting technical, economical, social, and political trends and events

Transelectrica ensures the public service of electricity transport and distribution through the National Electricity System. The RES evolution after the latest economic crisis has been strongly influenced by the European challenges related to the security of energy supply or development of renewable energy sources. One of the major trends the company has identified on CDR is the overgrowth of renewable energy sources, especially biomass and hydroelectric. At the moment, through a better exploitation of wood and biowaste, it could provide more than 60% of the production of energy from renewable sources [55]. Moreover, the climatic conditions from CDR allow the increase of biofuel production that can ensure the energy supply for more than 65% of Covasna's citizens [55]. According to the study of Transelectrica conducted through its subsidiary ICEMENERG S.A., the bigger biomass potential is in Mures and Alba counties (60% of CDR's total biomass potential). The hydroelectric potential of CDR (i.e., a number of 73 hydropowers) is also important for industry, agriculture, and domestic needs [56].

Based on the information collected on the regional level, Transelectrica identified measures to promote the utilization of renewable energy sources according to national legislations (e.g., the introduction of the sustainability criteria for biofuels [57]; the installation of heating systems running on renewable energy—"Green House" program for individuals and legal entities [58]). By its mission, Transelectrica is directly interested about the energy projects developed on the local market. The environmental scanning the company has deployed on CDR provides information about the implementation of main pilot projects of using biomass source (e.g., business incubator on Sfântu Gheorghe, district heating system on Miercurea Ciuc, Odorheiul Secuiesc, and heating system for greenhouse in rural communities [52]).

The capability of detecting trends and events from the external environment using them as sources of strategic information and leading to generate new knowledge is an aspect related to the intelligent dimension of Transelectrica, more or less explicitly.

(b) Defining the potential opportunities and threats

This is the second purpose of the environmental scanning function of EI that allows the organization to reconfigure its business options. The capacity of Transelectrica to better identify the opportunities and threats of the energy sector in CDR can be regarded as an aspect of the company's intelligence. Some opportunities and threats related to renewable energy sector on CDR should be noticed.

- Transelectrica provides green certificates to renewable energy producers for the amount of produced energy. The green certificate confirms that a certain amount of energy is produced from renewable energy sources. Therefore, the CDR's investors of the renewable energy sector are interested in obtaining these certificates to develop European projects.
- Due the fact that CDR has an important potential for biomass and biofuel sources, Transelectrica has identified the opportunity of including in RES the most important renewable energy production platforms (e.g., biofuel stations—OMV-PETROM).
- According to the Government Emergency Ordinance No. 57/2013 [59], the limiting of support scheme for renewable energy until 2017 gets pressure on investmental policies of Transelectrica. Therefore, this is a threat for the company, which should be considered on the top management level.

Concerning the KM practices, the usual activities of knowledge generation, storing, sharing, and utilizing are founded in Transelectrica, more or less explicitly. Due to the sector's economic and social impact, Transelectrica is forced to improve the aspects related to OI, such as learning, solving new problems, and adapting to environmental changes. In this context, the company has developed an integrated platform for managing information entitled "Energy Management System-Supervisory Collection and Data Acquisition (EMS-SCADA)" [60]. The database includes information about balancing energy market, green certificates market, supervisory systems, and functional system services. Moreover, the company has implemented information systems (e.g., MIS Oracle System, SAP-HR System, and GIS) [60] that provide informational content in a communicable form (codified), which is correlated with previous knowledge to generate new knowledge and stimulate organizational learning. There are also common tools available for KM that the company uses (e.g., management of electronic content including multimedia files, e-mail, and backbone communication system for energy transport operator). In fact, IT infrastructure enables processing data and digital objects to obtain information that supports knowledge generation.

The discussion in this section is aligned with the first premise for developing the theoretical framework of OI, highlighting the capability of Transelectrica to adopt the EI and KM practices as the expression of an intelligent organization. For the pilot investigation of the proposed case, a qualitative approach focused on exploring the function of EI and KM practices was developed.

6.2. Evaluation of Entropy Process in the Case of Transelectrica

Observing the complex activity of Transelectrica, it is expected to identify events that are produced with different uncertainty degrees depending on the capability of the acquisition and application of useful information and knowledge. In the organizational system, this fact induces the entropy processes manifested through a state of scarce information. It is further assumed that entropy can be understood in terms of the theory of information, which defines entropy as a measure of the uncertainty of a message. Considering the environmental challenges in the renewable energy sector, there are uncontrollable factors that influence the activity of Transelectrica (e.g., economical national and international trends, rural renewable energy market with a lower level of competitiveness, the demand of industrial consumers, and the effects of climate change). All these events reflect a low amount of information stored in the company system that leads to entropy phenomenon on various time periods. Moreover, both internal weaknesses and external threats are susceptible

to create entropy processes. For example, the instability of Board of Directors or the frequency reconfiguration of organizational structure has affected the continuity of strategy implementation. Besides, the impediments of regulatory framework concerning the support schemes for renewable energy sources generate undesirable effects on investment policies and energy market.

Consequently, these aspects cause entropy phenomenon generated by underperforming leadership or lack of procedures. Pursuing the development of OI, internal control measures to better organize the company’s system are required, such as, for example, using the Key Performance Indicators (KPI) to ensure the quality level of energy transport services according to the Energy Transport Network Technical Code, using the KPI to achieve the objectives of maintenance strategy, and defining the KPI set to assess the objectives assumed by Board of Directors.

The discussion in this section is aligned with the second premise for developing the theoretical framework of OI, highlighting the ability of Transelectrica to identify and apply internal control measures to maintain entropy inside certain limits. An important element of the pilot investigation was the assessment of certain events that are described by a low amount of information, as well as the promoting of internal measures to control the entropy phenomenon.

6.3. Evaluation of the Organizational Enablers

Business strategy and organizational innovation enable an organization to develop new products or services in response to environmental challenges. Thus, among the other enablers [43], these two factors are correlated with OI development. Transelectrica developed the business strategy by a new approach based on the Balanced Scorecard (BSC) technique, which enables the organization to clarify its vision and strategy and translate them into action. The original model of BSC [61] was adapted according to the management strategy of Transelectrica (Figure 2).

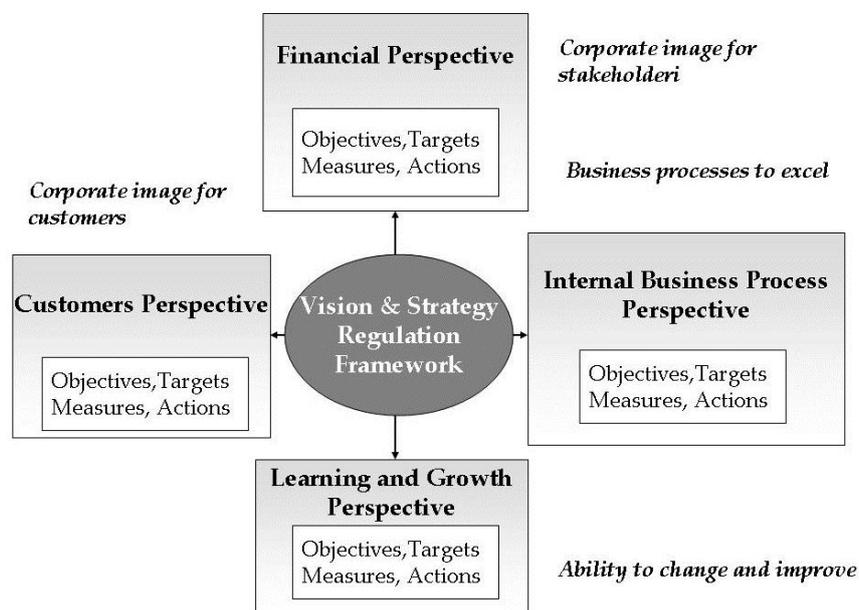


Figure 2. Balanced Scorecard of Transelectrica [60].

Based on the BSC framework and according to its vision and mission, the company established the strategic objectives for the 2013 to 2017 period. As the main transmission and distribution system operator in Romania, Transelectrica is aware of the need to update its energy grid infrastructure. Consequently, for each perspective of the BSC model, the strategic objectives in the renewable energy sector have been defined (Table 4).

Table 4. Strategic objectives in the renewable energy sector (adapted from [60]).

BSC Framework	Strategic Objective
Customer perspective	Developing a new approach that focuses on the client from renewable energy sector
Internal business process perspective	Adopting technical solution and new technologies that promote renewable energy sources and reduce the negative impact on environment
Learning and growth perspective	Exploring new capabilities to enhance intellectual capital that turns organization into knowledge-based company
Financial perspective	Improving the financial structure to support the investment in the renewable energy sector

It should be mentioned that the four perspective of the BSC model are connected with the components of the proposed framework of OI. Thus, there is a relationship between OI (the outcome variable) and the dimensions of BSC. The need to improve the company image for customers and stakeholders requires specialized capabilities to manage the information and knowledge from an external organization's environment, as well as from its own system. For this purpose, EI and KM practices are used, revealing the outline of an intelligent company. Concerning the learning and growth perspective of BSC model, there is a significant connection to the components of the framework of OI, such as the organizational enablers (i.e., organizational innovation and business strategy). As a consequence, the effects of this dimension of BSC on OI are reflected in a higher ability of Transelectrica to develop the business strategy and innovation process. The internal business process perspective of BSC is linked to the framework of OI through the mechanism by which the control measures of entropy process lead to achieve high levels of organizational performance.

These aspects reveal the capability of Transelectrica to adopt an intelligent business strategy by prioritizing the objectives through a complex environmental scanning process. The manner of setting up the business strategy is an indication for OI.

Organizational innovation is the second factor that has been considered to show how the company can build its OI by improving the various forms of innovation (e.g., developing new products and services, implementing new management methods, and reconfiguring organizational design). In this context, Transelectrica adopts new technologies to reduce the impact on environment and promote technical solutions for reducing losses in energy transport network. Moreover, the company makes progress to align on smart metering technologies in the energy distribution area. It is to be noted that Transelectrica is involved in the European projects to develop the future Pan-European transport network (i.e., "e-Highway 2050" Project). Thus, the European Union's initiatives created new opportunities, which intelligent companies turned into successful business solutions. Another form of innovation is related to methods that facilitate the entrepreneurial management of the company. Hence, Transelectrica was aligned to corporate governance principles according to the Government Emergency Ordinance No. 109/2011 [62]. The capability of the company to coming up with new systems for good governance reveals an aspect of its adaptive potential to strategic goals, which can be positively correlated with OI development.

The discussion in this section is aligned with the third premise for developing the theoretical framework of OI, revealing the capability of Transelectrica to design the business strategy and innovation process according to the characteristics of an intelligent company. The objective of the pilot investigation was to assess the manner in which the setting up of the business strategy and the improving of innovation reflect the organizational adaptive capability, as well as the connection to OI.

7. Discussion

The pilot investigation presented in the previous section reveals certain aspects that consider Transelectrica as an intelligent organization. Pursuing the theoretical framework of OI, the following assertions can be exposed:

- The company deploys environmental scanning actions on CDR as a function of EI practices. This is done mostly through technological and informational perspective to identify projects for stimulating the use of renewable energy sources and for increasing the energy efficiency in this development region. Opportunities and threats related to the renewable energy sector on CDR were also identified as a result of collection, validation, analysis, and diffusion of the external information provided from the environment. The company also uses IT tools to share, create, and codify knowledge (e.g., EMS-SCADA system and ERP System). Although these aspects reveal, on the one hand, the capacity of the organization to gather, interpret, share, and utilize information in the context of environmental challenges and, on the other hand, the ability to use some KM tools for the optimal usage of information, the outline of an intelligent company is missing. Transelectrica needs to introduce systematic environmental scanning processes as a core competency and develops knowledge-intensive processes mainly focusing on more communication and collaboration tools. Moreover, as an intelligent company, Transelectrica should develop the e-Business transactions by using the mobile and wireless technology which allows new kind of services and business models in the energy sector [63].
- By exploring the second component of the OI framework in the case of Transelectrica, the typical tendency of a company's system toward entropy process can be observed. Certain factors in terms of leadership, internal procedures, national regulations, organizational structure, and technological capabilities induce the entropy phenomenon, which is expressed by the amount of lost information inside the working actions of company. To control the level of entropy process, the company can take the resources of its environment to avoid the loss of information and to maintain the functions that achieve its goals. This process has to be initiated and managed by the very own human elements of the organization by putting together people, ideas, resources, and leadership. Internal control measures are required to maintain entropy inside certain limits, adapted to the organization's structure and culture. Part of Transelectrica's success in becoming an intelligent company is its ability to identify and apply these measures as a part of OI.
- The third aspect of the OI framework is related to the factors that reflect organizational adaptive capability, referring to the potential of the organization to identify and harness technical, economical, and environmental trends and events. Business strategy and innovation expresses the ability of the company to adapt to the dynamic and uncertain environment to achieve competitive advantage. Under this perspective, Transelectrica has designed its business strategy based on the BSC technique, which provides performance measurements and a full strategic planning and management system. This new approach to strategic management, which is not common in the state-owned companies in Romania, has to do with individual and collective skills and knowledge encompassed through an intelligent construct. This aspect concludes a positive correlation to OI. The organizational innovation is an essential aspect that an intelligent company is expected to reveal. Some degree of innovation has been identified in the case of Transelectrica, which is related to developing new products and services, implementing new management methods, and reconfiguring organizational design. Although the organizational innovation process is random, rather than a systematic one, the company has the potential to mobilize the research efforts toward processes that involved the full range of human cognitive abilities. This means that an organizational innovation is tightly linked to OI.

8. Conclusions

As a result of the contemporary environmental paradigms and the increased need to search for new actions of sustainable development, this study presents a managerial approach for developing a theoretical framework of OI by focusing on an energy company. There is a need to investigate the intelligent companies from this crucial sector, which are able to deal with challenges arising from the renewable energy sector. OI has a strong interdisciplinary character regarding various aspects such as interaction with a competitive environment, KM in a systematic manner, entropy process control,

or fostering organizational enablers to improve the collective intelligence. Accordingly, the observation of Romanian energy companies has been addressed from these various perspectives, leading to the following assertions: an intelligent organization has the potential to scan the environment with the purpose of detecting the threats and use of opportunities, an intelligent organization develops a knowledge-intensive culture and builds a knowledge infrastructure to improve the information processing capacity, an intelligent organization has the capacity to identify processes that generate entropy phenomenon and adopt measures to avoid the loss of information, and an intelligent organization is able to foster innovation and preserve competitive advantage.

Based on these observations, three hypotheses are proposed to develop a theoretical framework of OI: (a) there are complementarities between EI and KM practices that can serve as pillars for OI development; (b) the control of entropy process inside certain limits supports the development of OI; and (c) business strategy and organizational innovations are two important enablers that are positively correlated with OI development.

The evaluation of the suggested hypotheses was applied to an electricity transport and distribution company (i.e., Transelectrica) by considering its activity in the renewable energy sector on the CDR of Romania. In fact, in the second part of this paper, a qualitative pilot investigation was done to assess the company's intelligence level through the aspects of the OI framework. Transelectrica has elements related to OI that reveal a number of characteristics associated to an intelligent company, which activate in the energy sector: the potential to identify opportunities and threats in the renewable energy sector as a result of an environmental scanning process, the capacity to use integrated management systems for decision making and also for ensuring the security level in the national energy system functioning, the introduction of internal control measures to decrease the level of entropy phenomenon, and the integration of intelligent resources to improve organizational innovation and clearly define its business strategy.

The main contribution of this study is reflected in a double perspective. First, it is provided a theoretical framework of OI that can be used to a qualitative investigation of various aspects that define a company as being intelligent. Second, considering the items of the OI framework, an organization can stimulate processes and activities to properly manage its intellectual capital and its strategic tools in a competitive environment. Thus, an intelligent company has a higher potential to develop better methods for identifying relevant sources of information, to collect and analyze information, and to manipulate information for providing what the user needs for decision-making. In such a context, Transelectrica, which has particular aspects embedded in the OI framework, is able to improve the actions in the renewable energy sector better than the other energy companies.

Despite these considerations, there is an essential limitation of this study that is related to the qualitative approach of OI development. Future research should consider developing a quantitative model to assess the OI maturity level achieved by an organization. This could be done by setting a set of indicators to quantify the OI elements and comparing them to an appropriate standard (benchmark). Once the assessment is completed, a score is received, indicating the maturity of the OI process. To analyze the type of maturity level (i.e., from an ad hoc, immature process to a mature, disciplined process), the capability maturity model (CMM) can be used. Knowing the OI maturity level, the organization can identify the key points to improve all the dimensions of its intelligence potential.

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