Comparative educational study between online and offline interactions in the knowledge-based economy

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ABSTRACT: The aim of this paper is to analyse from the educational point of view which are the interactions between online and offline, starting from a set of values that contribute to the stability and functionality of the knowledge-based economy. There are four factors that allow the integration and sharing of values through online and offline interactions: organizational culture, digital technology, implementation of creative methodologies and digital transformation. In this respect, the interactions specific to systems based on open governance were analyzed. Interactions between online and offline are also very important in the educational process. For this reason, we introduced a new concept, called TOTO ("Teaching Online, Transfer Offline" ↔ "Transfer Offline, Teaching Online"). This slogan is meant to promote the acquisition and transfer of knowledge in the future. Particular importance was given to studying the effects of the interactions between Personal Online Learning Networks and Offline Learning Teams. Since social media is a common tool for most socio-economic activities, it has been considered necessary to carry out a case study on the interactions specific to this environment.

Keywords: knowledge, creativity, engineering, education.

I. INTRODUCTION

The scientific paper is based on a study conducted by the authors within an educational program of PhD training and where a number of students were involved who, together with the authors, reached some conclusions that were then validated. The final studies and conclusions are applied within a master study program at the Polytechnic University in Bucharest. It is obvious that the Internet has become a global phenomenon that has profoundly changed the nature of communication between people and business. The internet infrastructure is a network of networks that connect computers and other electronic devices through telecommunication networks. Technological advances in the Internet domain have been achieved through APIs (Application Program Interfaces) for web services; developing groups of interconnected techniques for developing interactive applications; integration of social software; integration of human staff and computers in a new and innovative way. In view of the aforementioned concepts, this paper comprises five sections as follows: section (i) contains an introductory approach, section (ii) presents an analysis of the knowledge-based economy values, section (iii) highlights interactions specific to open governance systems, section
(iv) develops the theoretical support for the acquisition and transfer of knowledge by means of the TOTO effect, section (v) builds a case study for interactions in the Social Media environment. The last chapter includes conclusions and discussions with respect to the concepts addressed herein.

II. ANALYSIS OF THE KNOWLEDGE-BASED ECONOMY VALUES

The Value Analysis / Value Engineering concept (VAVE) evaluates the products and the supply chain from a perspective that allows cost savings and the improvement of the quality and relationships with the suppliers. The organizational culture of enterprises allows sharing of values, skills, knowledge or perceptions held by the technical staff within a knowledge-based organization or network. This reflects the interactions between the values, knowledge and behavioral norms of engineers, technicians and students in internships. The value analysis allows a systematic interdisciplinary examination of the factors affecting the cost of a product or service, in order to develop means of achieving the specified goal, according to economic, quality and reliability standards (British Standards Institution, 1992). The workplace values are the guiding principles for current students and future engineers (Grant, R.G. 2005). They are as follows: responsibility, difference, details, quality, and honesty, keeping promises and meeting deadlines, reliability, positivism, tolerance, help, respect for the law, company and colleagues. Productivity, professional satisfaction, maintaining the relations systems (transversal management) and creative potential are impaired in the absence of values when people work for different purposes, with different intentions and different outcomes. The VAVE concept provides answers to three questions: What is the product supposed to do? How much does it cost? What is the value of the components? Through the creative and educational interpretation of this concept, we carried out a methodology, based on which, we defined the "circle value" in Figure 1. The circle value integrates VAVE in the digital economy context: Cloud value (proposition, chain, added services and centric), Knowledge value, Market value, Product value, Creativity value and Innovation value chain. The circle value enables the analysis and evaluation of the creativity of the online and offline interactions, as shown in Figure 2. The circle value provides answers to four questions: What is the value of knowledge? What is the value of creativity? How much of the product value is due to the implementation of creative knowledge and ideas? What is the value of cloud services?

![Figure 1: Circle value](image)

A case study relevant to VAVE is the tools for online evaluation of the creativity of future engineers. To this end, a lot of companies use a 15-minute test in which candidates have to form as many figures as possible, based on a technical task. Subsequently, the participants must associate each figure with its appropriate name. In order to determine whether the titles associated with the figures make sense, an interface connected to Google checks through the search engine how many similar image-text combinations exist on the web. Thus, the creativity of future employees is being assessed by means of the new technologies of the artificial intelligence. Similar tools are also implemented in the e-Governance and M-Governance processes, in order to streamline the work of the public administration staff. The level of development and use of these tools is assessed through both the e-Governance index as well as the e-Participation index. The study was applied within a PhD thesis and its continuation is through to be done within an interdisciplinary team.
III. INTERACTIONS SPECIFIC TO OPEN GOVERNANCE SYSTEMS

According to certain concepts, e-Governance can be viewed as an input, which, modified by a series of variables (context), turns into output, which can be considered, as a particular case, good governance. It articulates a common set of priorities, ensures the coordination of actions and resources in order to maximize efficiency, stimulates activities and raises the accountability of the authorities towards citizens.

The manipulation of the information through e-democracy is represented by the intersection of a number of three areas: technology, creativity and governance act. The electronic governance and e-democracy are essentially related, but as a way of manifestation they are different: The way of conveying the information in electronic governance, perceived as an interaction between the governance system and the citizens, performed through electronic means, is carried out from the top (system of government) downwards (citizens); The electronic democracy starts from the bottom (citizens) upwards (system of government).

These particular ways of manifestation are generated through interactions between online and offline, as shown in Figure 2. Citizens interact online through social networks, e-mail, blogosphere, or other available technologies. Citizens continue to interact in offline as well. They meet and discuss personal, social, professional or other issues at various locations (contact points): at the marketplace, at work, at the hypermarket, at the mall, at the gym or in the social protests. Governors interact online through videoconferencing or other specific technologies, but are not limited to these, interacting in offline as well: working group discussions, meetings, formal or personal gatherings, etc. Discussions take place in both areas, online and offline, but decisions are actually made offline (Wang, B. 2013). Extending public space in online leads to a "cyber-democracy", even if the online activism does not automatically mean more political participation in polls. The interactive dimension of the internet leads to the fragmentation of the public space into "identity enclaves" and to the "disconnection" of the users from the public agenda, from the political information and thus from the civic culture. Transparency and accountability of institutions can be enhanced by open governance. This approach can help public sector institutions improve the quality of their decision-making processes and of public services, with the following features: refers to "governance information proactively disclosed and made available online for everyone's access, reuse and redistribution without restriction" (United Nations, 2014a, p.163); promotes effective participation in decision-making processes, reduces waste of resources and creates opportunities for innovation in order to generate economic growth; combined with tools such as Big Data or Open Data, it can support public administration institutions anticipate future scenarios, including natural disasters. The main questions related to the effects /the necessity for digital transformation are as follows: What does digitization mean for the leadership of an organization?; What does a company leader do to create a digital organizational culture?; What are the factors that facilitate the transition to a digital culture?. In order to answer these questions, it is necessary to first understand the perspective from which leaders can make the difference: The way they connect to change in order to capitalize the cloud-focused and mobility oriented digitalization and the way they internalize advanced technologies in their operations; The way they manage the vast amount of information and how they use the analytical tools - with clever people and clear processes; The way they use digitalization as a source of innovation for their customers; The way they design new value-added products and services so as to generate economic growth. The digital culture, the leadership role in change management and economic growth are based on the acquisition and transfer of knowledge in the educational process.
Before becoming a leader or employee, any individual has gone through a higher or lower number of educational "steps" (McCully, W. 2011).

**IV. ACQUISITION AND TRANSFER OF KNOWLEDGE BY MEANS OF TOTO EFFECT**

In order to be effective in the process of maintaining the interactions between teachers and students, universities need to combine data from various contact points (education, production, research, internet etc.). This previously stated issue has been applied in one of the studies undertaken within the PhD training. This can also be achieved through interactions between online and offline. The contact time and offline data are generally used in order to enhance conversion and efficiency. Data integration is carried out to meet students’ expectations and to meet specific educational goals. Online data can be used to improve offline interactions and experiences. The use of offline data is very important in order to optimize online experiences. Implementing strategies based on the proactive combination of online and offline data, proves the importance of cross-channel interactions needed to initiate an integrated dialogue with the modern student (Hockly, N. 2011). This type of dialogue will generate some signals and certain behavior from the student as feedback.

The knowledge-based economy involves various types of interactions and relationships between students, teachers and businesses. The student's attachment to certain disciplines or to certain activities carried out in enterprises refers to cognitive, emotional and behavioral aspects that are promoted through social media and which can be measured under certain circumstances. In the context of internet development (including the IoT industrial internet), the involvement of the students (future specialists) is a social phenomenon, fundamentally different from customer engagement, specific to marketing. Choosing a product is mainly done based on the degree of utility and design, in order to be used for a certain amount of time. If these two criteria are not taken into account then the product is purchased based on the advice received from friends. Counselling tips specific to social trade are used in online, whereas in offline we count on the advice received from our colleagues, relatives or friends with whom we interact in daily activities. Selecting a particular form of education or specialization is a choice of indefinite duration. The accumulated knowledge and experience will be used and improved throughout the entire life. Choosing a dual specialization may be a random combination (if a domain is no longer in trend, the second option can be used, thus increasing the employability rate) or well thought out (two specializations based on existing skills). Increasing the level of interaction in digital media and social media networks can lead to the accumulation and / or change of the experiences accumulated by pupils and students with respect to a particular university, faculty or company (Cadec, K.V.E. 2014). According to the various contact points of a student's path, for example when he/she attends the courses of two faculties, he/she uses the Internet not only as a source of information, but also for actions that facilitate his access to technology. For each educational unit, multiplying content across social networks has become a critical factor in producing an online public (Example: attracting high school graduates to a certain university, faculty or specialization). The prerequisites for pupils and students involvement in social-media interactions, presented schematically in Figure 3, are as follows: the existence of an appropriate infrastructure; the efficient use of knowledge and technologies (in order to meet the

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**Figure 2: Interactions specific to good governance**

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high level of commitment); the existence of opportunities generated by a variety of contact channels; the use of techniques based on inputs and outputs that complement each other; the possibility to monitor and report interactions - for example, through web analysis or Search Engine Optimization (SEO).

**Figure 3: Conditions required for the involvement in social media interactions**

Considering the GfK / Google study in 2008 regarding the ROPO effect, based on the mutual interaction between online and offline channels ("Research Online, Purchase Offline" ↔ "Research Offline, Purchase Online") in the marketing process, we generated a similar effect in the educational process specific to the knowledge-based economy. The new effect, called TOTO ("Teaching Online, Transfer Offline" ↔ "Transfer Offline, Teaching Online") is meant to become a slogan that promotes the acquisition and transfer of knowledge. It has to give a new meaning to the connected creative communities, specific to knowledge-based economy. Improving the performance of these communities will be reflected primarily in the development of regional clusters. Reciprocal interactions between learning and sharing the learning outcomes enhance the quality and efficiency of learning. Under these circumstances, we will witness the emergence of an intellectual capital adapted to the interactions between the digital economy and the knowledge-based economy.

The environment specific to the implementation and development of online learning technologies is generically called Virtual Learning Environment (VLE). Online learning is largely due to the proliferation of systems such as Massive Open Online Courses (MOOCs). An important role is also played by the Personal Learning Networks (PLN). They need to undergo a process of specialization in various fields of activity (technical, economic, legal, socio-human education; knowledge based management, transversal management, creativity, etc.). Interactions between Personal Online Learning Networks and Offline Learning Teams will lead to two situations favorable to the development of the society: the emergence of mixed learning / research teams (online and offline, by age groups) and the emergence of new domains, subdomains or specializations, generating new jobs. The main advantages of online interactions over offline ones are as follows: generate long-term effects due to the high number of interactions; generate a strong psychological impact due to the amount and variety of information; generate new knowledge, ideas and questions (through knowledge accumulation and capitalization). The offline teams will be primarily made up of older people with an average level of technophobia, however minimized by a high level of knowledge. The question specific to the occurrence of the TOTO effect is the way in which this can be made visible and measurable. In this respect, we need a follow-up system, focusing on a number of seven main directions: reducing drop-out at university level; adapting the disciplines studied to the requirements of the labor market; increasing the number of agreements and partnerships between universities and companies; increasing the percentage of students who find a job (during school or after the graduation); increasing the number of public relations actions between higher and secondary education; increasing the number of SMEs set up by young entrepreneurs; increasing the life of new companies (a company is considered viable if it resists on the market for at least five years from the date of its establishment). In all these activities, the development of ecological awareness must also be pursued, so that young generations can effectively contribute to the process of smart sustainable development. The results of the measurements performed within the member entities of a regional cluster enabled the determination of a certain degree of importance depending on the level (type) of interactions between online and offline, according to the data in Table 1. The
assigned numerical values, from 1 to 5, have the following meanings: 1 - irrelevant; 2 - low importance; 3 - medium importance; 4 - important; 5 - highly important.

Table 1: Degree of importance specific to interactions

| No. crt. | Interactions level | Online | Offline |
|----------|--------------------|--------|---------|
| 1.       | Educational        | 5      | 3       |
| 2.       | Industrial         | 3      | 5       |
| 3.       | Urban              | 5      | 4       |
| 4.       | Rural              | 3      | 3       |
| 5.       | Administrative     | 4      | 5       |
| 6.       | Economic           | 5      | 4       |
| 7.       | Cultural           | 3      | 5       |
| 8.       | Social             | 5      | 4       |

Enhancing the quality and efficiency of knowledge transfer can be achieved through specific standards - such as "Knowledge Manager" or "Methodologies and procedures specific to knowledge transfer" – as well as through interactions in the social media.

V. INTERACTIONS IN SOCIAL MEDIA ENVIRONMENT. CASE STUDY.

Taking into account the results obtained in the previous chapters, we were interested in analyzing the relationships between terms such as engineering, creativity, education and other related word families, in online posts. In this respect, the words flow used for extracting messages from Social Media is represented by the Word vector = "creativity, knowledge, trademark, education, engineering, thinking and evaluation" and the lang vector = "English, French and German" (the words have been searched in three international languages). The total number of collected posts was 356,837, out of which 96,451 messages with unique content, posted by 193,135 users. The data were collected from social media – Twitter (Teodorescu, H.N., 2016), processed with BigData algorithms and grouped according to frequency of occurrence of Word vector elements, the results obtained in this way being shown in Table II (Han, E.H., 1997).

Table 2: Frequency of occurrence of the word vector

| Values          | word vector       |          |          |          |          |          |          |
|-----------------|-------------------|----------|----------|----------|----------|----------|----------|
|                 | engineer          | creativity| knowledge| trademark| education| thinking| evaluation|
| number of recordings | 7197       | 3293     | 11444    | 631      | 30677    | 43485    | 80       |
| frequency of occurrence | 0,075   | 0,034    | 0,119    | 0,007    | 0,318    | 0,451    | 0,001    |

Furthermore, for this analysis, we identified associations for any two words in the Word vector found in the analyzed posts, and the result was shown in Table III. In case we follow only the associations between the word "engineer" and {creativity, knowledge, trademark, education, thinking and evaluation}, their evolution will be according to the diagram in Figure 4. The values in these cells enable the assessment of the interdependence between education and other fields.
Figure 4: Associations of the word "engineer"

Table 3: Number of words associations in the analyzed posts

| Associations       | Engineer | Creativity | Knowledge | Trademark | Education | Thinking | Evaluation |
|--------------------|----------|------------|-----------|-----------|-----------|----------|------------|
| engineer           | 7197     | 10490      | 18641     | 7828      | 37874     | 50682    | 7276       |
| creativity         | 10490    | 3293       | 14737     | 3924      | 33970     | 46778    | 3372       |
| knowledge          | 18641    | 14737      | 11444     | 12075     | 42121     | 54929    | 11523      |
| trademark          | 7828     | 3924       | 12075     | 631       | 31308     | 44116    | 710        |
| education          | 37874    | 33970      | 42121     | 31308     | 30677     | 74162    | 30756      |
| thinking           | 50682    | 46778      | 54929     | 44116     | 74162     | 43485    | 43564      |
| evaluation         | 7276     | 3372       | 11523     | 710       | 30756     | 43564    | 79         |

They reinforce the fact that education is the main pillar of a creative, decent, dynamic, modern, civilized and sustainable society. There is interest in identifying which are the most common three word associations in the analyzed Word vector. 56 posts have been identified containing three word associations. For these, the frequency of occurrence was calculated according to Table IV.

Table 4: Word associations

| Word associations       | Number of recordings | Frequency |
|-------------------------|----------------------|-----------|
| Engineer creativity education | 35                   | 0.625     |
| Engineer creativity evaluation | 38                   | 0.678     |
| Creativity education evaluation | 29                   | 0.517     |
| Education evaluation thinking       | 43                   | 0.767     |
| Engineer knowledge education       | 48                   | 0.857     |

Due to the fact that all these associations have a frequency of occurrence greater than 0.5, they can be considered as a consequence of the enhanced creativity of the educational act, especially through the knowledge acquired online. Posts with respect to education in the engineer context go beyond posts containing creativity.
VI. CONCLUSIONS

The circle value integrates the "cloud value" digital concept along with "creativity value" and "innovation value" in building the real value of the knowledge market. Interactions between e-governance, e-democracy, Big Data, Open Data and digital organizational culture create a cyber-democracy based on knowledge and a change based on digital citizenship. The new TOTO concept mainly sets out: the conditions for pupils and students involvement in social media interactions; the conditions for the emergence of an intellectual capital generated by the interactions between online and offline communities; the advantages of the online interactions compared to the offline ones; the degree of importance corresponding to the various levels of interaction. The case study regarding the interactions in the social media environment enables the assessment of the interdependence between education and other fields. The present case study seeks to analyze the interactions in the social media environment of the interdependence between education and other related fields. Thus, we highlighted that using Big Data specific algorithms one can analyze a series of relationships between the words "creativity, knowledge, trademark, education, engineering, thinking and evaluation", based on online posts collected from Twitter. The results obtained were grouped according to the frequency of occurrence of the analyzed elements, thus calculating a frequency of occurrence of associations between the words of the vector "Word" greater than 0.5. This leads to the idea that the words analyzed in Section 5 may be considered a consequence of the enhanced creativity of the educational act. In this scientific paper, through the presented issues, in a documented and validated manner, were presented the interactions between ON-LINE and OFF-LINE in a knowledge-based economy, especially in the modern European educational environment.

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