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Student Perception toward Computer in Teaching-Learning Math in Tertiary Education. A Theoretical Construct Validation

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ABSTRACT

Nowadays the process for teaching mathematics has developed principally through information and communications technologies (ICT), especially through the use of computers. The purpose of this study is to show if the theoretical model proposed by Galbraith and Hines adjusts to data provided by students at Universidad Cristóbal Colón. The sample is composed by students in the fields of economics and administration, and used the scale designed by Galbraith and Haines (1998). This scale consists of five sections: mathematics confidence, mathematics motivation, mathematics engagement, computer confidence, and computer and mathematics interaction. The statistical technique used to evaluate the data was Structural Equations. The goodness of fit indices CMIN/DF =1.080, GFI=.993, AGFI= 979, CFI=.995, RMSEA=.016, indicate that the hypothetical model adjusts to the theoretical model proposed by the authors cited above.

Introduction

Students' performance in mathematics is a topic currently under discussion from the theoretical perspective of anxiety, confidence, and other variables associated to this phenomenon. It is also certain that the inclusion of information and communication technologies has had a meaningful impact on mathematics teaching, as shown by studies carried out by Galbraith and Hines, (1998).

In this same vein, in a recent exploratory study, García-Santillán, Escalera-Chávez, Córdova and López (2013) pointed out that students show a clear tendency toward an attitudinal deficiency, and this can be primarily understood as an intolerance toward mathematics. This topic has been discussed in numerous studies. At the same time, these authors highlight the existence of creative students, who see in mathematics a means to solve real-problems. Mathematics provides them with the capacity to seek, ask, inquire, and research problems they want to solve.

Children begin by exploring their world, associating objects and person in an imaginary which only psychology can explain as an instinctive act. Curiosity come to be a determining variable in teaching processes in any discipline, including mathematics, the object of this study. Students are creative in the same measure they are curious; this becomes an essential element in the search for solutions to mathematical problems, as shown in their study by García-Santillán *et al* (2013)

In the same study, García *et al* (2013) make reference to Fey's postulate (1989) about the use of technology in the teaching-learning process of mathematics. In his word's Fey's say:

> *"…it is very difficult to determine the real impact of those ideas and development projects in the daily life of mathematics classrooms, and there is very little solid research evidence validating the nearly boundless optimism of technophiles in our field." (Op cit, 1989)*

What has motivated different studies in regards to the golden trilogy: learner, mathematics, and computer are precisely the question what is the nexus between mathematics and technology. A seminal referent in trying to explain this phenomenon is the study by Galbraith and Haines (1998), *"Disentangling the nexus: Attitudes to mathematics and technology in a computer learning environment".* Here they refer that a distinction must be made between the relationship between mathematics and ICTs, and technology applied to the mathematics teaching-learning process. This relationship is envisioned as two constructs which must be dealt with individually, given that including technology modifies the educational process.

Other arguments, such as those of Kaput and Thompson (1994) have added to this theoretical discussion. In this regard they point out that technological innovations have been developed to solve other types of problems, not necessarily the process of mathematics teaching. What they propose is in contrast to other studies, such as those by Auzmendi (1992), García, Edel and Escalera (2012). It must be considered however, that, though it is true that technology *per se* was not created for the educational process, it has been of great use in the teaching-learning process, and attempts have been made to adapt the mathematics syllabus, as stated by Galbraith and Hines, (1998).

Justification

Knowledge of mathematics is very important in people's lives. Thus, it is necessary to understand and use mathematics correctly in daily life. In the United States, the National Council of Teachers of Mathematics (2004) has indicated that using mathematics had never been as important as it currently is, and that day by day this need is increasing, since mathematics is essential for life, is part of our cultural heritage and is necessary for work.

In the process of teaching and learning mathematics, ICTs have taken on a relevant role. Thus, it becomes indispensable to study them as tools to overcome attitudinal deficiencies and to provide feedback to the principal actors in student learning.

This study, carried out among students at a private university in the Mexican state of Veracruz, offers evidence which allows us to identify if the attitude toward mathematics is influenced by the use of information technologies-specifically, computers- in the teaching and learning process. Thus, the finding of this study will contribute to existing knowledge on the topic, in regards to constraints and scope. The study intends to obtain information and data which will allow us, as much as possible, have sustainable arguments to guide both teachers and students in the better development of the process of teaching and learning mathematics.

Empirical Studies

Attitude represents an emotional reaction toward an object. It is the belief one has in regards to an object, or one's behavior toward this object. Meanwhile, emotion means enthusiasm produced by a stimulus (McLeod, 1989a). These dimensions represent the affective part of the human being, and they can be present in greater degree in an individual, decreasing the cognitive aspect. In other words, passion increases, and knowledge decreases.

Attitude can be seen as the result of emotional reactions which have been interiorized and transformed (McLeod, 1989) to generate feelings of moderate intensity and reasonable

stability. Marshall (1989) has proposed the hypothesis of a mechanism for cognitive development, attitude situated in the concept of network of human memory (Anderson, 1983, 1995). Here, attitude represents the evocation of stored affective memories, which implies a dispassionate response. Attitudes are expressed along a positive-negative continuum (pleasant-unpleasant).

Attitude in mathematics, in the words of Gal and Garfield (1997), is the sum of emotions and feeling experienced throughout time in regards to the learning of mathematics. In this context, it has a more stable understanding over beliefs than over cognition.

Other studies have added to the argument about the growth of technologies and their influence on the educational process of mathematics teaching. The impact has been defined as favorable in the field of mathematics teaching at all levels (Goldenberg, 2003), Moursund (2003), García and Edel (2008), García-Santillán, Escalera and Edel (2011), García-Santillán and Escalera (2011). In this same regard, Gómez-Chacón and Hines (2008), Noss (2002) and Artigue (2002) have demonstrated that technology use in mathematics teaching favors student performance. In fact, some studies highlight the existence of cognitive and affective demands present among the student population in specific programs which include technology (Pierce and Stacey, 2004; Galbraith, 2006; Tofaridou, 2007).

Derived from the above arguments, García-Santillán et al (2013) highlight an important element for scholarly discussion; that is, precisely, the extreme care which should be given to the dialectic aspect, both technical and conceptual, within the process of mathematics teaching. This specifically in the fields where technology must be included, through graphing, calculators or any computer-based resources.

Other research into the topic of attitude toward mathematics and computers, such as Cretchley and Galbraith, (2002) has found evidence on the dimension which integrate this variable: commitment, motivation, confidence, and interaction between mathematic and computers. Other studies suggest there is a weak relationship between mathematics and attitude toward computers, in regards to confidence and motivation, versus the use of technology in the mathematics teaching-learning process (García-Santillán et al, 2013).

On the other hand, other authors, such as Crespo (1997) cited in Poveda and Gamboa (2007) question whether technology is the "magic formula", though it has been propounded as such. Of course, technology per se is not the solution to the problem of an apparent attitude of rejection toward mathematics on the part of the student. It can be, however, an important means for transforming traditional classroom with blackboards, erasers, desks, and other instruments of the old school into interactive classrooms which generate learning spaces mediated by ICTs, as has been referred by Gómez-Meza (2007), cited in Poveda and Gamboa, (2007). This same author mentions that, though technology is not the magic formula, nor the solution to all educational ills, what is true is that technology can by a change agent who promotes mathematics teaching and learning.

Theoretical Foundations

This confirmatory study on the validation of a theoretical model explaining the construct of attitude toward mathematics, is an extension of an exploratory study by García-Santillán et al (2013) carried out among students at the Universidad Politécnica de Aguascalientes, where surveys were applied to 164 students of different fields of study, such as: administration and business, mechatronics engineering, industrial engineering, strategic systems engineering, and mechanical engineering.

Both works are based on the theoretical proposal of Galbraith and Haines (1998) on the component elements of attitude toward mathematics, that is: motivation, confidence, commitment, computer confidence, and mathematics-computer interaction. In addition to this seminal referent, they include the contribution of Cretchley, Harman, Ellerton and Fogarty (2000) on the use of technology in mathematics teaching, and its theoretical reality.

From this theoretical construction stems the aim of the present study, which seeks to demonstrate if the model proposed by Galbraith and Hines fits the data collected during the field work with students at Universidad Cristóbal Colón.

From the above, we derive a preliminary question: Does technology really generate a change in mathematics teaching? In this regard, there have been pronouncements such as those of Karadag and McDougall (2008) who postulate that, regardless of the theoretical and practical implications of all that has proposed about teaching mathematics and the inclusion of technologies in the curriculum, it is clear that a large part of the population uses technology on a daily basis. This is especially true in the case of students, who cannot conceive of life without these indispensable tools- the computer and the internet. It is important to remember that these generations have been born in the information age (the Net generation), and thus they are confident in their use of technology.

Regarding this rationale from Karadag and McDougall (2008), it is interesting to revisit what Galbraith (2006) said about the use of technology. He referred to it as "an extension of one's self". The relationship between student and technology is direct; it becomes part of the identity, and, certainly, it affects the process of teaching and learning mathematics.
Other theoretical arguments have added to this debate. Its postulates refer that students as well as the academic institutions where they are formed professionally, have been capable of using technology in an effective way, as had been foreseen (Lagrange, 1999; Artigue, 2002; Izydorczak, 2003; Moreno-Armella and Santos-Trigo, 2004; Moyer, Niexgoda and Stanley, 2005; Kieran and Drijvers, 2006; Kieran, 2007 and Karadag and McDougall, 2008).

In the same vein of ideas, García-Santillán et al (2013) make reference to Suurtamm and Graves (2007), who mention that the Ontario Ministry of Education has proposed that, in order for students to improve their capacity for research and analysis of mathematics concepts, they should use technological tools such as calculators or computers which allow them to solve problems more rapidly, even those problems which may be impossible to solve with a paper and pencil. With the use of such tools, it becomes possible for students to solve mathematical problems quickly, in the context in which they develop.

These tasks can include doing complex arithmetic operations. In this sense, and continuing with the objective of the study, it is important to explain the particular view of computational mathematics attitudes. Thus, we include an operational definition for each of the five dimensions of attitude toward mathematics described by Galbraith and Hines: mathematics attitude, computer attitude, computer-mathematics interaction, and mathematics commitment.

To better understand the above-mentioned dimensions, and considering that the field of academic motivation could question the conceptual distinction between mathematics "confidence" and mathematics "motivation", it is important to highlight the explicit operational definition for each of these dimensions. Scholarly tradition has given rise to different theories of motivation; as a consequence, a conceptually different series of constructions of motivation has been identified.

Theories of motivation arise from different perspectives, and thus can focus on beliefs, values, or objectives. This field, in general, agrees that to examine a broad concept of "motivation" is not productive, and that research should concentrate on specific construction within motivation.

The scales designed by Galbraith and Haines (1998) were built upon parallel components on the attitude scale of Fennema and Sherman (1976), but designed to make them appropriate for use among undergraduate students. Five constructs make up the scale; in which each section is comprised of eight indicators (see Figure 1). Regarding mathematics confidence and mathematics motivation, Galbraith and Hines, state:

Mathematics confidence: Students with high confidence toward mathematics believe they get value for their effort, do not worry about learning difficult topics, expect to get good results, and feel good about mathematics as a subject. Students with low confidence are nervous about learning new material, expect all mathematics will be difficult, are naturally weak in mathematics, and care more about mathematics than any other subject.

Mathematics motivation: Students with high motivation toward mathematics enjoy doing mathematics problems, persevere until a problem is solved, think about mathematics outside of class, and become absorbed in their mathematical activities. People with low motivation do not enjoy mathematics challenges, are frustrated by having to spend time on problems, prefer to have the answers instead of being left with a problem and cannot understand people who are excited about mathematics "(op. cit, 1998.) Attitudes toward computer use scales were designed to parallel the corresponding mathematics scales.

Confidence toward computers: Students who demonstrate a high degree of confidence in computers believe they can master the necessary software procedures; they also feel more confident in their answers when they do calculations on computer equipment, therefore, they are more confident about solving problems by themselves. On the other hand, students with low computer confidence feel disadvantaged by having to use computers; they feel anxious about using the computer to perform calculations within their learning process. In short, they do not trust computers to produce correct answers, and panic leads them to commit errors when a computer program is used.

Computer Motivation: Students who demonstrate high computer motivation create their own learning activities, as they find it more enjoyable. They have the freedom to experiment and are more likely to spend long hours at a computer to perform a task and enjoy trying new ideas on a computer. Students with low computer motivation avoid using computers; they feel that their freedom is being eroded by the limitations of the program because they think that computers make students mentally lazy.

As to computer-mathematics interaction, the importance of this partnership has been studied by different authors, including the following: Lester, Garofalo and Kroll (1989), McLeod (1985) and McLeod (1989b). These authors have come to the conclusion that when the student is not familiar with the technology, this can cause special difficulties. Given the importance of this interaction, authors such as Reif (1987), Chi, et al (1989) and Anderson (1995) have mentioned that, by interacting with learning materials, such as pencil and paper, or a computer screen, the brain adds a dimension to the cognitive processes in student learning.

In regards to "participation in mathematics learning", we can point out that some studies have contributing to the understanding of this phenomenon. These reveal that student commitment toward learning mathematics yields efficient and valuable results. It has been demonstrated that some experts have effectively used some mechanical concepts in mathematics teaching (Reif, 1987). Likewise, other studies have shown how examples can construct a powerful framework for learning (Reder et al, 1986; LeFavre y Dixon, 1986). Students who learned committed to generating more ideas than students who did not (Chi et al., 1989).

Meanwhile, Swing and Peterson (1988) demonstrated that integration and development processes, such as analysis, definition, and comparison, are related to greater learning. Another study, this one carried out by Reder and Anderson (1980) showed that summaries support effective learning. Anderson (1995) has demonstrated that when these factors are frequently associated to concepts in the learning process, the information received by the student can be more easily recalled. Likewise, if the information is interconnected in a knowledge network, it can lead to better results for the learner.

In sum, it can be said about mathematics commitment: students who got higher scores on this scale prefer to work through examples, than with the given materials, and vice-versa; students with a lower score on the scale prefer to learn with materials than through examples.

The above discussion allows us to identify the variables in the object of study, as illustrated in the following construct, where are discussed the variables proposed by Galbraith and Haines (1998) about: mathematics confidence, mathematics motivation, mathematics commitment, computer confidence, and mathematics-computer interaction, all of this within a trilogy: student, computer, and mathematics.

Methods

For the purposes of this study, the sample is non-probabilistic. The selection of the elements does not depend on probability, but on the causes related to the characteristics of the investigation, and, of course, the selected samples obey other research criteria (Hernández, Fernández, Baptista 2006). The study sample is made up of 303 students of Universidad Cristóbal Colón from various fields of study: Economics, Administration, Accounting, Marketing, and Tourism Business Management.

The criteria selection for including the surveyed students were: they had to have completed at least one course on mathematics within their undergraduate program, and, finally, that they were available on the day the survey was applied. The scale used was developed by Galbraith and Haines (1998), and consists of five sections: mathematics confidence (Items 1 to 8), mathematics motivation (Items 9 to 16), mathematics commitment (Items17 to 24), computer confidence (items25 to 32), and mathematics-computer interaction (Items 33 to 40). Each section consists of eight elements evaluated with a Likert scale. The scale ranges from 1 (low) to 5 (very high).

To process the data, the AMOS v 21 program was used. The statistical technique used to prove if the theoretical model proposed by Galbraith and Haines (1998), fits the data was Structural Equations, due to its great potential for broadening the development of a theory (Gefen, Straub and Boudreau (2000). The hypothetical model was evaluated by various goodness of fit measures to assess in what measures the data support the theoretical model. These were the following: statistical likelihood ratio Chi-square (X2) and Mean Squared Residue (RMSEA), GFI (Goodness of Fit Index), AGFI (Adapted Goodness of Fit Index), CFI (Comparative Fit Index) (Hair, et al. 1998).

Hypothesis

If the anxiety toward mathematics model is a five-factor structure: mathematics confidence, mathematics motivation, mathematics commitment, computer confidence, mathematics-computer interaction. Therefore the hypothesis is:

H1: The anxiety toward mathematics could be explained by the structure of a model which integrate five-factor: mathematics confidence, mathematics motivation, mathematics commitment, computer confidence and mathematics-computer interaction.

The graphic representation model is presented in Figure 1:
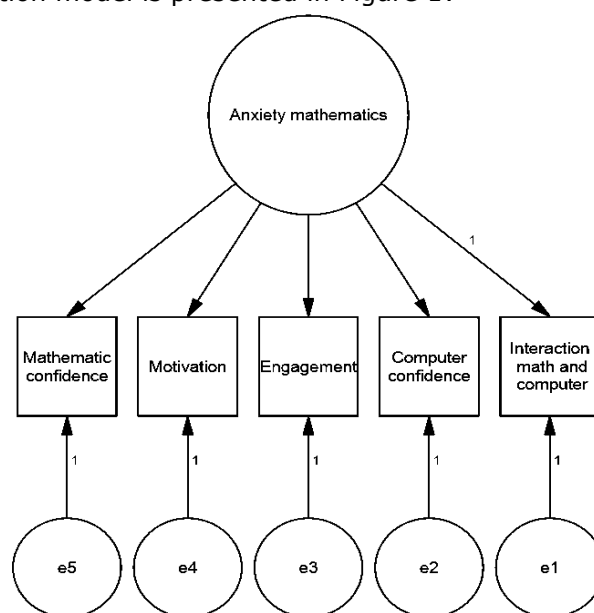
Figure 1: Theoretical model of Galbraith and Haines (1998)

Results

The results are presented in three sections: a) Summary of the Model, b) Variables of the model and parameter c) Evaluation of the model. With respect to the status summary of the model, fifteen elements are registered in the covariance matrix. Of these, ten are estimated parameters with positive degrees of freedom (5= 15-10). This indicates that the model is over-identified and the Chi squared can be estimated (X^2) 5.399 with a level of probability of 0.369, which indicates that the model is significant.

Table 1: Weight, measurement error, reliability and covariance of variables

Variable	Weight	Significance
Interaction	0.513	
Confidence	0.325	3.59
Commitment	0.323	3.58
Motivation	0.597	4.43
Mathematics-Computer Confidence	0.397	4.07

	Indicator measurement error				
	Interaction	Confidence	Commitment	Motivation	Confidence Mathematics
Interaction	0.737				
Confidence	0.000	0.894			
Commitment	0.000	0.000	0.896		
Motivation	0.000	0.000	0.000	0.644	
Confidence Mathematics	0.000	0.000	0.000	0.000	0.842

Reliability = **0.5365**

Variance

	Estimation	S.E.	C.R.	P
F1	3.444	1.065	3.233	.001
e1	9.616	1.109	8.671	***
e2	18.547	1.660	11.175	***
e3	24.193	2.163	11.183	***
e4	7.253	1.055	6.875	***
e5	12.941	1.234	10.486	***

Source: own

The parameters to evaluate the model are ten, which correspond to the regression weights, six variances, which give a total of 16 parameters to estimate. With respect to the variables, it can be seen that there are 11 variables in the model, of which five correspond to the number of observed variables, and six to non-observed variables. In order to estimate if the hypothetical model is a good fit, we evaluated: 1) the estimated parameters, and 2) the complete model.

With respect to the first point, reliability of the parameter of Table 1 was estimated. It was observed that the parameters of the weights and variances are viable, and the value of reliability is 0.5365. There are no negative variances, and all are significant, (greater than 1.96). Furthermore, the table shows the values for measurement error for each indicator, and all are positive. This indicates that the variables are related to their constructs.

Global fit model: Table 2 provides the quality measurement for absolute fit.

Table 2: Measures Goodness of Fit: Revised model and null

Indices	CMIN	CMIN/DF	GFI	AGFI	CFI	RMSEA
Values	5.399	1.080	.993	.979	.995	0.016

Source: Own

The index sample chi square is a satisfactory fit (X2 = 5.399, df = 5, sig = .369). The values of GFI (.993), AGFI (.979), CFI (.995) and RMSEA (0.016) are satisfactory because their values tend to one and are greater than 0.5 (Byrene, 2000).

Upon acceptance of the model (as a whole), the construct in order to check the internal consistency of all indicators to measure the concept was evaluated.

The results in Table 3 indicate the reliability value associated with the construct and this is 0.5365, less than recommended (0.70), indicating that the indicators are not sufficient to represent each of the dimensions.

Table 3: Reliability and Variance Extracted

Indicators	Reliability	Mean Variance Extracted
Ansiedad hacia la mathematics	0.5365	0.350

Source: Own

The table also shows the extracted variance, which must be greater than 0.50. In this case the value is less than 0.5. This means that more than half of the variance indicator is not taken into account for the construct.

Conclusions

The results give evidence that the structure specified in the hypothetical model is significant when applied to students of Universidad Cristóbal Colón. That is, the data fit the proposed model. The results are consistent with those of other authors (García-Santillán, Escalera and Edel 2011, García- Santillán and Escalera, 2011) who show that the presence of technology stimulates mathematics learning. It is also important to point out that the results of the study have a theoretical implication, because they support the theoretical foundation proposed by Galbraith and Haines (1998). Las constructions considered by the authors are of statistical and practical significance in the students who were the object of this study.

Furthermore, the evidence obtained in this study contributes to predict the reality described by the authors in regards to attitude toward mathematics. At the same time, they give light to establish new question in the search for more knowledge. However, it is important to mention that it is necessary to explore additional weightings for the indicators, since the values of variance are low.

At the same time, the practical implications come about because the results are useful for higher education institutions to carry out teaching strategies focused on the use of information technology. It is important to conduct a larger effort by the teachers of the subject, encourage them to use these technological tools in such a way that they increasingly strengthen students' attitude toward mathematics.

References

[1] Anderson, J. R. (1983). *The architecture of cognition*. Cambridge: MA Harvard University Press

[2] Anderson, J. R.: (1995), *Cognitive Psychology and Its Implications*, (4th. ed.), New York: W. H. Freeman and Company.

[3] Chi, M. T. H., Lewis, M. W., Reimann, P. and Glaser, R.: 1989, *'Self explanations: how students study and use examples in learning to solve problems'*, Cognitive Science 13, 145–182.

[4] Cretchley, P. & Galbraith, P. (2002). *Mathematics or computers? Confidence or motivation? How do these relate to achievement?* Proceedings 2nd International Conference on the Teaching of Mathematics (Undergrad), CD and online, Wiley, Crete.

[5] Cretchley, P. & Galbraith, P. (2002). *Mathematics or computers? Confidence or motivation? How do these relate to achievement?* Proceedings 2nd International Conference on the Teaching of Mathematics (Undergrad), ,CD and online, Wiley, Crete.

[6] Fennema, E. & Sherman, J. A. (1976). Fennema-Sherman *Mathematics Attitudes Scales: Instruments designed to measure attitudes toward the learning of mathematics by males and females.* Journal for Research in Mathematics Education, 7, (5), 324-326.

[7] Fey, J. T. (1989) *'Technology and Mathematics Education: A survey of recent developments and important problems'*, Educational Studies in Mathematics 20, 237–272.

[8] Galbraith, P. & Haines, C. (1998). *Disentangling the nexus: Attitudes to mathematics and technology in a computer learning environment*. Educational Studies in Mathematics 36, 275- 290.

[9] Galbraith, P. (2006).*Students, mathematics, and technology: assessing the present challenging the future*, International Journal of Mathematical Education in Science and Technology, 37, (3), 277-290.

[10] Garcia-Santillán, A. & Edel, R. (2008). *Education-learning of the financial mathematics from the computer science platforms (Simulation with ICT). Main Theme: Application of ICT (information and communications technologies), in education-learning process.* Annual Meeting Nova Southeastern University "Beyond the Classroom" Fischler School of Education & Human Service. NOVA EDUC@2008. March 17-19, 2008. Miami Beach, Florida USA.

[11] García-Santillán, A. & Escalera, M. (2011). *IT applications as a didactic tool in the teaching of math's (using of spreadsheet to programming)* Journal of Knowledge Management, Economics and Information Technology, I, (6), 122-138.

[12] García-Santillán, A., Escalera M. & Edel, R. (2011). *Associated variables with the use of ICT as a didactic strategy in teaching-learning process of financial mathematics. An experience from the classroom.* Revista Iberoamericana de Evaluación Educativa, 4 (2), 118-135.

[13] Gómez-Chacón, M. I., & Haines, C. (2008). *Studentes' attitudes to mathematics and technology. Comparative study between the United Kingdom and Spain.* International Congress on Mathematical Education, 1-12.

[14] Izydorczak, A. E. (2003). *A Study of Virtual Manipulatives for Elementary Mathematics*. Unpublished doctoral dissertation, State University of New York, Buffalo, New York.

[15] Kaput, J. J. & Thompson, P. W. (1992). *Technology and Mathematics Education. En D. A. Grows*, Handbook of Research on Mathematics Teaching and Learning (págs. 515-556). New York: Macmillan.

[16] Kaput, J. J. (1994). *Technology in Mathematics Education Research: The first 25 years in the JRME*. Journal of Research into Mathematics Education, 25, (6), 676-684.

[17] Karadag, Z. & McDougall, D. (2008). *Studying mathematical thinking in an online environment: Students voice*. In Figueras, O. & Sepúlveda, A. (Eds.), Proceedings of the Joint Meeting of the 32nd Conference of the International Group for the Psychology of Mathematics Education, and the XXX North American Chapter 1, 350. Morelia, Michoacán, México: PME.

[18] Kieran, C. & Drijvers, P. (2006). *The co-emergence of machine techniques, paper-and-pencil techniques*, and theoretical reflection: A study of CAS use in secondary school algebra. International Journal of Computers from Mathematical Learning, 11, 205-263.

[19] Kieran, C. (2007). *Interpreting and assessing the answers given by the CAS expert: A reaction paper*. The International Journal for Technology in Mathematics Education, 14(2), 103-107.

[20] Lagrange, J. (1999). *Complex calculators in the classroom: Theoretical and practical reflections on teaching pre-calculus.* International Journal of Computers for Mathematical Learning, 4, 51–81.

[21] LeFavre, J., & Dixon, P. (1986). *Do written instructions need examples?* Cognition and Instruction 3 , 1-30.

[22] Lester, F. K., Garofalo, J. and Kroll, D. L.: 1989, *'Self-confidence, interest, beliefs, and metacognition: key influences on problem-solving behavior'*, in D. B. McLeod and V. M. Adams (eds.), Affect and Mathematical Problem Solving: A New Perspective, pp. 75–88, New York: SpringerVerlag.

[23] Marshall, S. P.: 1989, *„Affect in schema knowledge: source and impact"*, in D. B. McLeod and V. M. Adams (eds.), Affect and Mathematical Problem Solving: A New Perspective, pp. 49–58, New York: Springer–Verlag.

[24] McLeod, D. B.: 1985, *'Affective issues in research on teaching mathematical problem solving'*, in E.A.Silver (eds.), Teaching and learning mathematical problem solving: Multiple research perspectives, pp. 267–279, Hillsdale, N. J.: Lawrence Erlbaum Associates.

[25] McLeod, D. B.: 1989a, *'Beliefs, attitudes and emotions: new views of affect in mathematics education'*, in D. B. McLeod and V. M. Adams (eds.), Affect and Mathematical Problem Solving: A New Perspective, pp. 245–258, New York: Springer Verlag

[26] McLeod, D. B.: 1989b, *'The role of affect in mathematical problem solving'*, in D. B. McLeod and V. M. Adams (eds.), Affect and Mathematical Problem Solving: A New Perspective, pp. 20–36, New York: Springer Verlag.

[27] McLeod, D. B.: 1989b, *'The role of affect in mathematical problem solving'*, in D. B. McLeod and V. M. Adams (eds.), Affect and Mathematical Problem Solving: A New Perspective, pp. 20–36, New York: Springer Verlag.

[28] Moreno-Armella, L. & Santos-Trigo, M. (2004). *Student's exploration of powerful mathematical ideas through the use of algebraic calculators*. In D. E. McDougall & J. A. Ross (Eds.), Proceedings of the twenty-sixth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, 1, 135-142. Toronto: OISE/UT.

[29] Moursund, David (s/f). Editorial: *The Spreadsheet*. Revista Learning £Leading with Technology, 26 (5) disponible en http://www.iste.org/LL/

[30] Moyer, P.S., Niexgoda, D., & Stanley, J. (2005). *Young Children's Use of Virtual Manipulates and Other Forms of Mathematical Representations*. In W. J. Masalski & P. C. Elliot (Eds.), Technology-Supported Mathematics Learning Environment. Reston, VA: The National Council of Teachers of Mathematics.

[31] Noss, R. (2002). *For a learnable mathematics in the digital culture*. Educational Studies in Mathematics, 48, 21-46.

[32] Pierce, R & Stacey, K. (2004). *A Framework for Monitoring Progress and Planning Teaching towards the Effective Use of Computer Algebra Systems*. International Journal of Computers for Mathematical Learning, 9, (1), 59-93.

[33] Poveda, R. y Gamboa R. (2007). *Consideraciones, características, limitaciones y clasificación de una clase basada en talleres*. UNA Costa Rica. Recuperado de: http://cimm.ucr.ac.cr/cuadernos/cuaderno3.php.

[34] Reder, L. M. and Anderson, J. R.: 1980, *'A comparison of texts and their summaries: Memorial consequences'*, Journal of Verbal Learning and Verbal Behaviour 19, 121–134.

[35] Reder, L.M., Charney, D.H., and Morgan, K.I.: 1986, *"The role of elaboration in learnig a skill from an instrucrtional text"*, Memory and Cognition 14, 64-78.

[36] Reif, F.: 1987, *'Interpretation of scientific or mathematical concepts: Cognitive issues and instrumental implications'*, Cognitive Science 11, 395–416.

[37] Suurtamm, C. & Graves, B. (2007). *Curriculum implementation in intermediate math (CIIM):* Research report. Canada: Faculty of Education, University of Ottawa. Retrieved April 15, 2008, from http://www.edu.gov.on.ca/eng/studentsuccess/lms/

[38] Swing, J. and Peterson, P.: 1988, *'Elaborative and Integrative Thought Processes in Mathematics Learning'*, Journal of Educational Psychology 80(1), 54–66.

[39] Tofaridou, I.(2007). *Learning Styles and Technology Environments in mathematics. Education*, Ph.D. Thesis, City University, London, 286

Social and Environmental Responsibility of the Organization in the Context of Sustainable Development

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ABSTRACT

The attitude of companies on the environment fits into a broader sector such as that of social responsibility. Social responsibility includes topics such as child labor exploitation, safety and quality or environmental impact of companies. They now receive more attention from the media, because they lead to the development of new legislation, causing some of the responses consumers through demand and are considered by investors for setting up the portfolio. The debate services that companies must provide society that forms at a time the market and how society influences the behavior of companies imposing them or punishing certain behaviors remain open and highly complex.

As a conclusion we can highlight that in the growing social concern to strive towards development models based on sustainability, the company is trying to redefine its role to adapt to these environmental changes. In this regard, there is a concern increasingly more important role it has to play in the overall strategy of sustainable development as the basic unit of production and thus generating considerable impacts for both economic and social and environmental.

Introduction

Attitude companies, about the environment, fit into a broader sector such as that of social responsibility. Social responsibility includes topics such as child labor exploitation, safety and quality or environmental impact of companies. They now receive more attention from the media, because they lead to the development of new legislation, causing some of the responses consumers through demand and are considered by investors for setting up the portfolio. The debate services that companies must provide society that forms at a time the market and how society influences the behavior of companies imposing them or punishing certain behaviors remain open and highly complex.

Impact of Social Organization

Being an open system, the company interacts with the environment in which it operates, which involves the following effects:

a. The organization is affected by its environment, both directly and through efforts to succeed in adapting to the environment.

b. Organizations affect the environment, because business decisions affect the environment and, in particular, affect the interest groups that relate to organizations. This is advantageous influence on the environment in many cases, but may be harmful.

Cannon (1994) states that the industrial revolution, the attention was focused on corporate responsibility; given the power they had new industrial processes for restructuring the relations of the old regime. The industrial revolution brought fundamental changes in relations between individuals and groups of society. Wealth owners and their company size, gave the suspect on power, their motivations and methods and, moreover, led to the questioning of values defining ethical behavior and operated.

Meanwhile, as the growing impact of industrialization on the natural environment or altered values issue has become a matter of concern and debate. Already in the 70s, social activism exploded on four fronts: environmental protection, national defense, consumer association to self-protection and civil rights.

Ever since then, the social environment has become more demanding as regards the allocation of social responsibilities, companies assume an advantage over the average, more vigilant and intolerant on environmentally harmful repercussions in certain moments come from corporate activity.

As I mentioned, the company has positive and negative influences on the environment, but that some and others are likely separation. Thus, on the positive influences can be distinguished two types of social responsibilities that must face economic organizations and limit the positive impact that the organization exerts on the social environment.
 a. First, influences derived from the work itself, in terms of contribution to multiple elements that form the "common good" of society. The common good is understood all the circumstances that allow full development of individuals. It's so called domestic responsibilities that the entire organization must address. Gallo (1985), analyzing the company's business continuity requirement highlights the following:
 1. Discovering the generation and distribution of products and services useful means to provide company products subject company activity. This responsibility is directly related to placing the company in an economic system and its contribution to economic functions that the system must meet.
 2. Develop people. Being human institutions, companies fulfill their social responsibility when providing and preserving jobs, when people put out of reach of measures to maintain and update training so that people can have a job that fits their capabilities and preferences, typically an intelligent man and useful to all.
 3. Generation and distribution of added value. The company creates wealth (added value) and social responsibility that the organization makes distribution between workers (wages and other social charges), public administration (taxes), depreciation fund etc., refers both to the generation of added value, as and the balance that must exist between the value added generated and distributed and equity required by the distribution. When the organization does not maintain this balance, distributes an amount that results in harm to a group (for example, serving customers with products whose quality is not consistent with the price, order employees to take disproportionate yields and work program, failure to pay tax and social obligations thereby establishing unfair competition).
 b. Secondly, there is the so-called external responsibility that an organization must take. On the one hand, must respect the laws and other rules governing cohabitation and on the other hand, the organization operates a network of higher and intermediate institutions which pursue the common good (public administration, universities, companies, associations, unions). Therefore auxiliary organization has the responsibility to respond collaboration for solving various damage to the common good.

In terms of negative influences, one can say that they occur when business activity, far from being harmless, cause damage to the environment, which means that business activity is the cause degradation common good instead protect it. Such negative influences can be classified according Castoman and Porto in the following three groups:

- Negative influences on company personnel. Refers to both the threats to security and human health, and social discrimination on grounds of sex, race, religion, disability, age, nationality, etc.
- Threats on consumers and users. Here are meeting practices such as:
  - Sales of products adulterated or defective products initially negligible;
  - Provide unsafe and toxic products and services;
  - The sale of expired products;
  - Incorrect labeling and packaging (which generate misinterpretations, with or without intent);
  - Failure guarantees provided or after-sale services;
  - Advertising that induces false expectations.
- Ecological deterioration, as pollution (water, air, earth), consumption of non-renewable resources (carbon, oil and minerals in general), over-exploitation of renewable resources (fisheries, forests), threats to biodiversity of flora and fauna etc. lead to accelerated deterioration of basic systems to support humanity finite land space (see Table 1.1.).

We enumerate downside, potential environmental organization:

Table: 1.1

-	Noise	-	Deposits of water
-	Emissions	-	Accidents
-	Vibration	-	Toxic Spills
-	Leakage	-	Water pollution
-	Radiation	-	Air pollution
-	Extractions and excavations		
-	Movements earth		

Social and Environmental Responsibility of the Organization

Given that the organization influences on the environment are bounded various aspects of social responsibility of the company. Thus, Williamson (1988) distinguishes three levels of social responsibility:

a. legal responsibility imposed by law (can be divided into civil, administrative and criminal).

b. The responsibility imposed on the profession ethical society members (professional ethics) or the organization (corporate culture) as can legal responsibilities and insufficient.

c. Moral responsibility imposed on the individuals themselves, understood by all rules and moral principles that drive the behavior of an individual or a community and proposed a certain doctrine or own an era or culture.

If the first level decision makers can rely on law enforcement and in the second level on generally accepted principles promulgated or professional associations and the companies themselves in the third tier individual values prevail. For all levels the problem is to determine what is "right" every dilemma is presented to decision makers.

In line with the levels set out above, (Carroll, 1994) highlights the following four components of the social responsibility of the company:

- Economic responsibility: organizations are set up with the aim of providing goods and services for a price, so the economic nature is evident with the goal of maximizing the benefit derived from their work;
- Legal responsibility: companies are expected to act according to laws and regulations governing the operation of the market and society to which they belong;
- Ethics responsibility: it does not reflect the formal written codes, norms and values of society implicit derivative that go beyond strictly legal and that can be highly ambiguous compromise as soon as specified;
- Philanthropic responsibility: society as a whole wants the companies to act as good citizens and undermines much of their resources to improve everyone's welfare state. This desire does not imply strict obligations on companies, and if nothing is done in this regard, his behavior would not necessarily be criticized as unethical;

Regarding social issues, (Carroll, 1994) defines an organization's activity on that land reactive, defensive and proactive accommodative. As summarizes Clarkson (1995), each category is characterized by a determined posture and action, as shown in Table 1.2.

Table 1.2: Scale reactive - defensive - accommodative – Proactive

Category	Posture or strategy	Action
Reactive	Denial of responsibility	Make less than what is required
Defensive	The admission of responsibility but the fight against it	Make the minimum required
Accommodative	Accepting responsibility	Make all that is required
Proactive	Anticipation responsibility	Make more than required

When defining the social responsibility of companies, the environment is an issue that undoubtedly directly affect can be influenced in any of its components. The philanthropic interest could be the one that makes the firm to take measures to benefit the environment without apparently at least in the short term, to have any right to legislative and social gain or pressure. On the other hand, those organizations, even when they are recognized as being harmful to the environment, will sooner or later penalized by the market and their survival will be jeopardized if it was breached one of the principles moral prevalent in today's society. In addition, public powers impose through legislation respect to certain environmental values. Ultimately the responsibility or irresponsibility in the face of environmental issues can have important economic consequences and effects on costs derived from market share.

Conclusions

As a conclusion we can highlight that in the growing social concern to strive towards development models based on sustainability, the company is trying to redefine its role to adapt to these environmental changes. In this regard, there is a concern increasingly more important role it has to play in the overall strategy of sustainable development as the basic unit of production and thus generating considerable impacts for both economic and social and environmental.

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References

[40] Cannon, T. (1994), *La responsabilidad de la empresa*, Editiones Folio, Barcelona
[41] Gallo, M.A. (1985), Estrategia y sociedad: Responsabilidades socials, Enciclopedia Practica de Economia, Vol 5, Ediciones Orbis, Barcelona.
[42] Castoman L. J; Porto N., (1999), *La responsabilidad social de la empresa: Impacto social, comportamento empresarial e informacion publica*, Congreso AEDEM . Logroño.
[43] Williamson O. E. (1988), *Corporate Finance and Corporate Governance*, The Journal of Finance, Vol. 43, No. 3, Papers and Proceedings of the Forty-Seventh Annual Meeting of the American Finance Association, Chicago, Illinois, December 28-30, 1987 (Jul., 1988);
[44] Carroll, A. B. (1994). *Social issues in management research: Experts'views, analysis andcommentary*. Business & Society, 33;
[45] Clarkson, M.B.E. 1995. *A stakeholder framework for analyzing and evaluating corporate social performance*. Academy of Management Review, 20;

The Importance of Data-Bases in the Process of Knowledge Sharing Inside of an Eco-Bio-Economic Cluster

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ABSTRACT

The term „database" refers to a structured collection of data, used to model aspects of reality in a way that allows useful information to be extracted. In order for the data resource to be well defined and documented, easily administered and interrogated, derives the need to use a proper database management system. A Database Management System (DBMS) is an interface between users and the database and is designed to store data in an organized manner and to provide full software support for the development of databases IT-apps. A DBMS must ensure the minimizing the data processing cost, reduce response time, the IT apps flexibility and, of course the data protection. Within a cluster-type strategic alliance, an important part in the knowledge-sharing process returns to the database, which is organized in distinct areas of interest, using methods set by After Action Review, or SMART, or other methods organized under complex procedures. The Knowledge Economy Index Report represents an independent review of databases in different countries, based on innovation, creativity, increased production / sustainable consumption and exports.

Introduction

An essential step in the process of accumulating knowledge in a cluster-type strategic alliance is carried throughout databases, produced by its members.

In this paper we shall briefly present databases made by students of pre-university education institutions, members of an eco-bio-economic cluster, in the context of voluntary activities held during school holidays.

Among the advantages of using database management systems data, we can include:
Data redundancy control; Data coherence; Data sharing; Database integrity; Increased security; Correct applying of the standards; Scale Economics; The right balance between the conflicting requirements; Improving data accessibility and response capacities.

The Role of DBMS in the Success of Strategic Alliances

Many DBMS provide tools to simplify the development of database-related IT-apps. This results in an increased productivity of the programmer in charge, and a reduced time of programming (with a corresponding reduction in costs). The DBMS cost varies depending of the environment and the functionality offered. For example, a single user DBMS on a single machine can cost around $ 100, while a multiuser, mainframe DBMS, which serves hundreds of users, can be extremely expensive and may even reach 750,000 $.. Regular annual maintenance expenses may be added, which usually represent a percentage of the displayed price.

Additional costs for hardware: DBMS disk storage requirements alongside with the database may require purchasing an additional storage space. And then, in order to obtain the required performance the purchase of a larger computer, perhaps one destined to running the databases management system could be necessary. The procurement of additional hardware elements leads to increased costs.

The conversion cost: the implementing of a new DBMS system and / or of a new hardware configuration, the conversion cost of the existing IT-apps, so that they can work in the new DBMS and new hardware configuration may lead to significantly higher costs than those required by the acquisition of any new hardware [13].

These costs may include training of the staff to use the new systems and the possible hiring of specialized staff to assist in converting and functioning of the system. The high costs value is one of the main reasons why some organizations do not want to give up existing systems and cannot move to most fashionable technology databases.

In the structure of a DBMS we can delineate the following main components: hardware, software, data, procedures and people.

The hardware component is the physical support for the DBMS and can be formed by a single personal computer or a mainframe computer, or even an entire network of computers.
Some DBMS may require some certain type of hardware or operating system, while others could work using a variety of hardware devices and platforms

The software component includes programs forming a DBMS, application programs, the local operating system, and also the network software where the DBMS is used inside a computer network. Application programs are designed not only to manage data to present information in specific terms through an interface application

The Data Component is the most important component of a DBMS environment in terms of the end user, and includes operational data and also, the meta-data. The data acts as a bridge between the human and the machine components. The system's user activity and that of the personnel that manages the database are performed according to documented usage procedures and operation of the system.

These instructions concern the opening and closing of a work session, the use of DBMS features and of the software applications, the DBMS activation and deactivation, data archiving, use of backup copies, the proper handling of hardware and software failures, the database recovery in case of incident, changing and reorganizing of the database.

In the DBMS environment we can identify four distinct types of people involved: the data and database administrators, logical and physical database designers, IT-app programmers and the end users.

The data administrator handles the data management, being responsible for conceptual and logical design of the database and database planning, the realization and maintenance of standards, database policies and procedures. Its role is to develop the database in the direct support of the organization's overall goals. It sets out the organization's requirements on data, being responsible for conceptual and logical design of the database, developing the general data model line within the idea of information technology and business progress,

creates standards for data collection, sets the needs and establishes data access protection, ensuring a complete documentation for end users.

The database administrator is responsible for designing, implementing and the physical realization of database security and integrity control, the maintenance of the entire system. He monitors system performance and reorganizes the database, when appropriate, defines security integrity and constraints, and is also responsible for selecting the DBMS and database project implementation, user training and making of backups, must know in detail the used DBMS and operating systems environment. The designer of logical database handles data identification, the relations between them and the constraints on data to be stored in the database. He must have a thorough and complete knowledge of the organization's data and its business rules. The physical database designer takes the logical data pattern and establishes how this will be physically done. This involves transposing the logical data pattern into a set of tables and data integrity constraints; selecting specific storage structures and access methods to ensure getting the best data performances in the database activities; establishment of some necessary designing and data security measures [14]. The physical database designer must know the DBMS's functionality, the advantages and disadvantages in respect of each alternative, corresponding to a particular implementation. Application Programmers are meant to implement application programs which provide the required functionality by end users. In most cases, programmers develop after a documentation realized by system analysts. Application programs contain instructions through which the DBMS performs various database operations such as extraction, insertion, updating and deleting data. End users are "clients" for which the database was designed and implemented and for which the database must be maintained to satisfy their informational needs. After the way the system is being used, end users can be:

Simple users: they usually don't know the DBMS and access the database through simplified application programs, using simple commands or menu options, don't need information on the database or the DBMS used.

Sophisticated users: These types of users are familiar with database structure and DBMS facilities and may use a high-level query language such as SQL to perform the operations necessary to the DBMS. Some of them, depending on their needs, have the skills necessary to write application programs for themselves.

Comparisons between the Main DBMS Types

At present, the market has a very large offer of database management systems, starting from systems that can be used for free (unlicensed or with public license), to high-performance systems, for the use of which buying the licenses is required. The most popular DBMS- type software are:
- **Oracle,** produced by the Oracle Corporation is a very powerful multi-user database management system with implementations on all platforms (Windows, Linux, Unix) that offers both high execution performance and a high degree of protection and data security
- **DB2** is an IBM database management system. This system ensures data integrity, provides enhanced data security, and has a graphical interface for database management. It comes, just like Microsoft SQL Server and Oracle, with the possibility of creating stored procedures, these being some procedures running on the server, providing a higher response speed
- **Microsoft SQL** is the multi-user relational database management system developed by Microsoft for Windows-operating systems.
- **PostgreSQ**L open-source DBMS- type software
- **MySQL open-source DBMS- type software**

MySQL - is the most popular database-server, widely known. It is a rich-feature product that supplies a lot of websites and online applications. The working mode is relatively easy; MySQL developers have access to a massive range of information regarding the database on the Internet. Given the popularity of the product, there are plenty of third-party applications, integrated tools and libraries that make working with the DBMS much easier. Although not

intended to fully implement the complete SQL standard, MySQL offers users great functionality. [11]

MySQL Supported Data Types

TINYINT - a very small integer; SMALLINT - a small integer; MEDIUMINT - a medium-sized integer ; INT or INTEGER - a normal-sized integer; BIGINT - a big-sized integer; FLOAT - a real number; DOUBLE, PRECISION DOUBLE, REAL - a real number(with double precision) ; DECIMAL, NUMERIC - a real decimal number; DATE –date; DATETIME - a date and time combination; TIMESTAMP - time period; TIME - hour, minutes and seconds- time format; YEAR - 2 or 4 digits year (default is 4 digits); CHAR - a fixed-length string of characters; VARCHAR - a variable-length string; TINYBLOB, TINYTEXT - BLOB or TEXT column with a maximum length of 255 characters; BLOB, TEXT - BLOB or TEXT column with a maximum length of 65535 characters; MEDIUMBLOB, MEDIUMTEXT - BLOB or TEXT column with a maximum length of 16777215 characters; LONGBLOB, LONGTEXT - BLOB or TEXT column with a maximum length of 4294967295 characters; ENUM - an enumeration; SET - a set.

MySQL can be easily installed and has the third-party tools, including visuals (eg GUI), that make the database work extremely easy; **facility offered**: MySQL supports a lot of DBMS characteristically SQL features, - either directly or indirectly; **Security**: a lot of security features, some of them quite advanced; **scalability and power**: MySQL can handle a lot of data and may additionally be used " at scale" when needed; **speed**: giving up some standards enables very efficient work, which leads to better speeds. Certain functionalities administered by MySQL (eg, references, transaction auditing, etc.), employs him as less reliable than other RDBMS; **stagnation of the development process**: although MySQL is an open-source product, there are complaints about the development process from the purchase moment. However, it should be noted that there are some completely integrated MySQL databases that come with added value over the standard offered on installing MySQL.

PostgreSQL is the most advanced relational open source database management system that aims mainly to respect the standards and to have the property of being expandable.
PostgreSQL, or Postgres, is trying to adopt the ANSI / ISO SQL standards.

Compared to other RDBMS, PostgreSQL is distinguished by its high demands concerning the object-oriented relational and / or integrated database functionality, such as full support that it provides in the field of reliable transactions, ex. atomicity, consistency, isolation, durability (ACID): **atomicity** (all or nothing) = transaction is atomic, it performs all its activities in a single step, or isn't running them at all; **consistency** (integrity constraints not violated) = transaction must maintain the DB consistency after the execution (the programmer's responsibility to write correct programs); **isolation** (concurrent changes are invisible) = transaction is protected from the effects of concurrent planning from other transactions; **durability** (committed updates are persistent) = the effect of a committed transaction must persist even when a failure in the DBMS. Because of its core technology, Postgres is highly capable to effectively manage multiple tasks. Concurrent tasks are obtained without blocking the reading function, thanks to the implementation of a Multiversion Concurrent Control (MVCC), which also ensures compliance with ACID. PostgreSQL is highly programmable and therefore extendable with custom procedures, which are called "storing procedures." These features can be created to simplify the repeated execution, complex, and often required for a database's operations. Although this database management system hasn't got MySQL's popularity, there are many extremely useful tools and libraries provided by third parties, who, despite their strong and complex database features, are designed to facilitate the work with PostgreSQL.

Data types supported by PostgreSQL

BIGINT: 8-byte integer; Boolean: Boolean logic (true / false); Data: calendar date (year, month, day); INET: IPv4 or IPv6 host address; Full: 4 byte integer; Line: infinite line on a plane

MACADDR: MAC address (Media Access Control) ; Real: 4bytes real number; SMALLINT: 2-byte integer; Timestamp: date and time (no time zone); UUID: unique universal identifier..

Core Functions Insured By the DBMS

To achieve the objectives of database management, these have a number of components that allow performing many operations. Depending on their nature and purpose, activities can be grouped into operations, and these in turn can be grouped by function. Given the complexity of management system, facilities offered, the languages used and the type of database to be managed by the DBMS, identification and delineation of functions is not that obvious. These features exist, though some functions with a character of generality can be deduced from all databases management systems.

The data description function: allows defining the database structure using data definition language (LDD). Defining data can be done at a logical level, conceptual and physical attributes by describing the database structure attributes, the linkages between the database's entities or the links between the attributes of the same entity, by defining any criteria for data validation, data access methods, or integrity and confidentiality data related issues. The result of this function is saved as a scheme of the database, which is stored in the internal code in a file that enables the display and updates the database structure at any time. After completing the description function, inside of a DBMS, the database entities already exist as files, but do not contain the actual data, only the database scheme. Data manipulation function: it is the most complex function and is performed using data manipulation language (DML). This function realizes the following activities:

- Loading data in the database through various automated operations that contain restrictions of integrity or scheduled operations that provide data validation criteria
- Updating the database, which consists in operations of adding, modifying, deleting records in the database? The operations of adding and amending are only made under authorization, achieved only by ensuring adequate protection of data and using the same validation criteria that were used to data loading activity.
- Data processing is performed by selection operations, ordering, inter-classifying (composition) performed over the database entities, operations which are preparatory activity of the data retrieval. Many of the processing operations are conducted with operators from the data model implemented by DBMS.
- The data retrieval (query) is performed using data visualization operations (on-screen, printing on paper). Output statements can be found on various information technology supports (i.e. Screen, paper, magnetic, optical) and in various forms (lists, reports, graphs, images, sound, and video) [8]. For the activity of data retrieval there are specialized query languages that can be included in LMD or exist as such, languages that have simple and friendly data retrieval facilities, close to the human way of working and thinking (e.g. SQL).

Data manipulation languages can be found in the form of host languages or even their own languages. Those who use host languages are developed to adapt to universal programming languages and combine the power of such a universal language with data retrieval needs (eg Oracle PL-SQL language using). Those with their own language are developed through a specific language that conveys the power of the procedures to retrieve data from a particular type of database (e.g. Visual FoxPro's own language).

The data usage function: is the set of interfaces needed to communicate with the database of all users. To achieve this function, the management of the database should provide various facilities for several categories of the database's users:

- For "free" users, those representing the category of beneficiaries (end users), DBMS software offers non-procedural languages and various query facilities of the database in a simple and interactive form: suggestive options menus, windows, templates in

different forms, Wizard type assistance[5], documentation (help sites, explanatory messages / windows). These users do not need to know the database structure, nor any programming for users with programming skills, who create the structure of the database and perform complex operations on the database; the DBMS gives the description language, data manipulation language and universal language interfaces [6]. In order to achieve the database, DBMS provides specialist and CASE -type elements (Computer Aided Software Engineering), to help in various activities that may interfere IN the design stages of the database.

- For users with database management skills, which play a decisive role in the optimal functioning of the entire system, the DBMS has created a distinct function in this regard.

The function of database management: it is a complex function that can be handled by the database administrator. He has a rich experience in analysis, designing and programming, organizing and administrating of the database. Thus he organizes the database according to a specific methodology, performs conceptual plan of the database, and coordinates the database design.

For all these, DBMS provides a wide range of items such as CASE-type elements and a number of specialized utilities. For operating the database, the administrator is to authorize the data access (creating accounts, passwords, etc.) to restore the database in case of incidents (through journaling, copies), to efficiently use internal and external memory (by organization, or routines optimization), to make a series of statistical analyzes in the database (number of accesses, updates, users, etc.).

For each of these activities DBMS provides various tools and techniques, ensuring protection of the database. For working with the computer network with distributed database, in which data is distributed on network computers and users are of all types, and in large numbers, therefore very complex databases, DBMS has greatly developed components for the administrator (e.g. Oracle RAC - Real Application Clusters).

The use of Databases in the Regional Sustainable Development

Classification of databases used internationally in the integrated smart sustainable development

Latest European socio-economic research in the areas of Knowledge Economy, Welfare, Demography, Sustainable Development and Impact Assessment, highlighted the need for new databases, instruments and indicators. Classification them to the European Commission, is presented as follows:
- Knowledge economy databases, tools and indicators;
- Social databases, labour markets and indicators;
- Demographic and migration databases and statistics;
- Impact assessment, modelling and sustainable development.

The development and the implementation of new databases is a key part of the Socio-economic Sciences and Humanities (SSH) programme.

The development of new databases (needed throughout the economy as a whole), started from a set of questions, as well as After Action Review and SMART knowledge sharing methods, each based on a set of 6 (six) questions.[1]

The main questions addressed by the European project are: What are the features of European firms that successfully compete in international markets? To what extent do they contribute to productivity and employment? Does access to foreign market enhance firm performance through a learning process? Why are some countries more successful in international trade and foreign direct investment (FDI)? What are the policies that can improve a nation's foreign trade performance? Does integration within the Single Market foster productivity improvements? Has the euro led to a wider participation of firms in crossborder business? What policies can promote the participation of other European firms

that are currently excluded from international markets? What are the gains and the adjustments involved in reducing barriers to trade and (FDI)? What policies can best maximise gains and smooth adjustments?[7]

The Knowledge Economy Index Report is a collection of relevant databases (at international level) which reveals the upward trend of the knowledge- based economy and the recommendations / measures to be taken in this respect, until 2030.

Carrying out a specific methodology

The clustering phenomenon, analyzed in the context of using and sharing of databases, refers to some servers' ability to simultaneously connect to a particular database (in the case, belonging to a eco-bio-economic cluster).

The first step in the methodology process consists in determining the composition of the eco-bio-economic cluster, depending on its objectives and the SWOT analysis results at county level, focused on a total of ten strategic action areas: Urban And Rural Development; Transport infrastructure and public services; Environment and Energy; Economic development (agricultural and industrial); Education for sustainable development; Main social issues concerning demography; Key issues on health insurance; The main social problems at the county level; Culture, sport and youth; Travel and tourism.

The methodology of calculating the volume and efficiency of the knowledge gained within the member organizations of a cluster, involves first identifying existing systems within a company, using Table 1.

Table 1: Identification of existing systems at organizational level

Nr. crt.	Systems' name	Observations
1	**Marketing systems**	They relate specific marketing processes with internal and external organizational environment, thereby linking the organization with the rest of the world [15]
2	**Community patent and trademark systems**	According to Art. 1, paragraph (2) of Regulation EC 40/1994, "Community trade mark has a unitary character. It has the same effect throughout the Community: it shall not be registered, transferred or surrendered, nor subject of a decision revoking the holder's rights or of invalidity and its use may be prohibited only in the Union, in its ensemble "[16]
3	**Business management software systems (ERP)**	The purpose of the software system is to shape static and dynamic aspects of the economic reality more accurately, which requires perfectly suited analysis and design,for both objects and processes.[3]
4	**Production systems**	The design of production systems is based on the concept of optimality which involves that operation of the system takes place under conditions extremizării (minimization or maximization), a function of economic efficiency, for example, minimizing production cost and maximizing profits [4]
5	**Surveillance / alarm systems**	Wireless alarm systems, surveillance systems and video recording equipment, fire detecting equipment, DVRs (Digital Video Recorder), IP cameras, access control systems- time attendance , video intercoms.
6	**Automation systems**	For swing gates, linear gates and barriers
7	**Database Systems**	The database represents one or more collections of data (data sets held by some criteria) in interdependence with descriptions of the data and the relationships between them. Database management system (DBMS) is a software system that enables the definition, development and maintenance of

Nr. crt.	Systems' name	Observations
		databases and controlled access to them.[9]
8	**Copying / computing / communications systems**	Copiers, phones, computers etc.
9	**Operating systems**	It is an organized collection of programs that manage computer resources and achieves an interface between user and computer.[12]
10	**Storage systems**	It can be metallic or non-metallic shelving systems for warehouses, offices, archives, workshops and stores
11	**Heating systems**	It may be unconventional, solar, electric, gas, wood etc.
12	**Location / tracking Systems (*LBS* – Location Based Services & *GPS* – Global Positioning System)**	Permit the construction of geolocation services
13	**Lifting systems**	Mechanical and hydraulic jacks, cable or wire rope winches, hoists, manual and electric lifting strap systems etc.
14	**Transportation systems**	Sustainable transport is a "complex system" to ensure mobility for future generations through social ecological and economic levers through which mankind can develop sustainable transport sector. Transport services are intangible in nature, because their quality can not be determined only by the quality of the technical base (vehicles, infrastructure, vehicle comfort) and the performance effects (comfortable ride without risk, short time etc.)[2]
15	**Specific site organization Systems**	Closure systems / panels / profiles / roof / building / formwork; Infrastructure Systems
16	**Climate control systems**	Air Purifiers, professional systems, ventilation, climate control, removing cigarette smoke, breezair - industrial cooling, air curtains, dehumidifiers, air conditioning etc.

After identifying existing systems within the organization, according to Table 1, it is imperative to identify processes involving these systems, interactions and connections of which are generating knowledge, according to Table 2.[10]

Table 2: Identification of knowledge generating processes

Nr. Crt.	Identification of knowledge generating processes
1	Schooling of the staff for the proper use the systems. Example: Using relational DBMS, client-server architecture etc.
2	Exploitation of the systems. Example: Exploiting of databases through a system of programs.
3	Systems Maintenance. Examples: The maintenance of the database is secured only by its administrator. The "database maintenance" button of the Nexus ERP provides the following operations: database defragmentation, reindexing, defragmenting indexes and updating statistics.
4	Adapting to specific conditions. Example: Adapting databases to certain additional conditions (subject to certain restrictions).
5	Systems interconditionality in complex processes. Examples: A database is an ensemble of data collections that are interdependent, alongside with the descriptions of the data and the links between them. The system database (SBD) is is an ensemble of interconditioned set of elements that contribute to the making and exploitation of databases applications.

6	Implementation of the "4R" (recovery, reuse, refurbishment, recycling) at the end of the systems' lifecycle. Example: ECOTIC - collective organization for waste management; EEE (Electric and Electronic Equipment), IT and Communications (Collective Organisation for IT&C WEEE Management).

The role of pre-university education institutions in the implementation of specific databases

Considering the specific of the strategic alliance – a "Five for All" eco-bio-economic cluster - only educational pre-university establishments with eco-bio-economic activities or related to it, which is in the interest, are of the cluster will be recruited, according to Table No. 3 [10]

Table 3: Pre-university learning institutions

Unit type	Profile / preparatory field	Professional qualification
Technological High School	Services / Economy	Economic activities technician
		Trade activities Technician
		Public Administration Technician
	Natural Resources and Environment Protection / Food Industry	Food industry technician
	Natural Resources and Environment Protection/ Environment Protection	Ecology and Environmental Quality Technician
	Natural Resources and Environment Protection/Agriculture	Horticulturalist Technician
Technological Agricultural High School	Natural Resources and Environment Protection/ Food Industry	Food Products Quality Control Technician
	Technical / Mechanical	Agricultural Mechanic
		Car Mechanic
		Transport Technician
	Natural Resources and Environment Protection	Veterinary Technician
		Agro-Mountain Technician
		Technician in agriculture
Post secondary school	Trading	Assistant Manager

From the time of admission in an educational institutions, each student will be involved in a team of knowledge accumulation and sharing, specific to the study. The team's work will be permanent, functioning differently, depending on context: courses, internships, visiting various organizations, vacation (relatives, friends, etc., that have activities with eco-bio-economic character). Students will be under the effect of voluntary agreements concluded through the school with various firms in the cluster. At the end of high school, they will receive certificates and recommendations that will be useful in the the hiring process.

Creating of databases

Because 80% of the students of these schools live or have relatives in rural areas, they will be involved in the creating of databases that will be later used in the implementation of regional sustainable development strategies through a eco-bio-economic cluster.

The databases fields will be established based on questionnaires that will address the following issues: soil quality (rocky, sandy, groundwater level, etc.); specific elements of different areas, depending on the geographical tupe (plains, hills, mountains, etc.); cultivated plants and plant biomass collection possibilitiesl; fruit trees grown (by acclimation, yield); elements regarding traditional hand-crafting industry and its growth opportunities

(craftsmen, traditional products, etc.); livestock and animal biomass collection possibilities; existence of deforested areas, which should be reforested; problems with landslides; identifying individuals who want to achieve various forms of association; the main forms of pollution identified; existing forms of agritourism and proposals for its development; methods / techniques used in specific fields of work (fruit growing, vegetable growing, viticulture etc.); proposals for the organization of agricultural, cultural meetings, etc.

Another category of databases will refer to the possibility/ impossibility of community involvement in the the development of student exchange, internally (with students from other counties) and internationally.

Annually, will be carried out students' competitions in which the most beautiful pictures made by them will be awarded (landscapes, animals, farming / household, costumes etc.). Databases made on this occasion will be used for the development of cultural, tourist, educational sites, etc., as well as making prints (thus, also contributing to the self-financing of schools). Databases made will be submitted for verification and processing by the "Center for successful knowledge transfer" (KTC), which works in collaboration with the "Centre of Excellence in Entrepreneurship" (AEC) and "Pilot Center For Cooperation And Development Eco-Bio-Economy "(PC), entities that form the core of the cluster (C-C), which will establish and implement future strategies of sustainable development at regional and national level, according to figure 1.
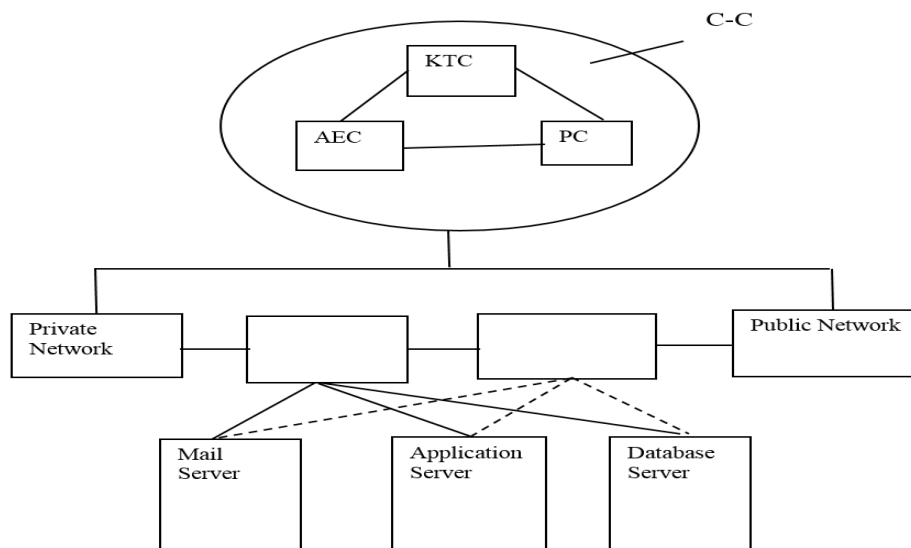
Figure 1: The transfer of databases to / from the core of a cluster

Conclusions

In the context of implementing cluster-type strategic alliances, urgently needed for regional development (in an attempt to alleviate the economic crisis), a new concept has emerged: database clustering, based on the idea that a cluster has at least two servers. In the present paper, since this is an eco-bio-economic cluster implemented at county level, we analyzed databases only made by one category of entities, members of the cluster: educational pre-university establishments whose educational offerings include subjects that match cluster and labor market needs at county level. In a first phase, databases are part of a public network (students, teachers, high school), towards becoming the property of the cluster (belonging to a private network). Cluster management will decide for what purpose and to which entities (individuals and businesses) the databases will be shared. Using and sharing specific databases, depending on the cluster configuration allows users to accommodate both a particular architecture and to the possibility of implementing an effective database management. Combined with the use of Internet service, Web-based Databases IT-apps will lead to the virtual development of the cluster's activities.

References

[46] *** The After Action Review, *Mission-Centered Solutions Inc.*, Colorado, USA, 2008

[47] Basgan, I.I. *Sustainable transport development in Romania, in the context of accession to the European Union*, CNPR, Bucharest 2005

[48] Berar, S. *Conceptual model of a software system for managing virtual SMEs.* Babeş Bolyai University of Cluj-Napoca, The Economical Informatics Journal, nr.3(15)/2000

[49] Brojboiu, M. *Industrial Systems Engineering*, University of Craiova, 2007

[50] Căruțașu, G. Botezatu, C. Ionescu, S. Botezatu, C.P. Joiţa, A. – *Integrated computer management systems*, University Press, Bucharest, 2011, ISBN 978-606-591-106-2, pp.211

[51] Căruțașu, G. Botezatu, C.P. Botezatu, C. – *Business models for extending of 112 emergency call center capabilities with e-call function insertion*, Annals of the University of Oradea, Economic science series, 2010, Tom XIX 2nd issue / december 2010, ISSN – 122569, pp. 1195-1199

[52] European Commission, *Final Report Summary-EFIGE (European Firms in a global economy; Internal policies for external competitiveness*, Bruxelles, Belgium, 2015

[53] Ghencea, A. and Immo, G. (2010): *Database Optimizing Services*. Published in: Database Systems Journal, Vol. 1, No. 2 (20. December 2010): pp. 55-60.

[54] Lupu, V. *Database technology*. Course No. 5. Ştefan cel Mare University of Suceava, 2008

[55] Pîrnău, C. *Contributions On Integration Of Knowledge Management In The Sustainable Development Of Small And Medium - Sized Enterprises*, Ph.D. Thesis, Lucian Blaga University of Sibiu, March 2015

[56] Pîrnău, M. *Web Technologies*, Titu Maiorescu University Publishing House, Bucharest, 2009, ISBN 978-606-8002-23-1/004.55;

[57] Popescu, C. *Operating systems. Introduction*. Course No. 1, University of Oradea, 2009

[58] Popescu, M. *Database Management Systems*, Renaissance Publishing House, ISBN 978-606-8321-56-1, Bucharest, 2010.

[59] Popescu, M. *Relational databases*, Military-Technical Academy Press, ISBN 973-8290-24-4, Bucharest, 2001.

[60] Raboca, H.M. *Marketing Course*. Department of Advertising/CRP. Babeş Bolyai University of Cluj-Napoca, 2011

[61] www.actamarque.ro/marci-comunitare.html (ACTAMARQUE Agency)

Macroprudential policies. The Romanian case.

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ARTICLE INFO

ABSTRACT

Romania was one of many emerging economies that have been affected by the excessive credit growth, the excessive price assets growth driven by the credit growth and by the foreign currency lending. The national macro-prudential tool kit was diverse and used to solve these issues both before and during the latest financial crisis. Analyzing the efficiency of these tools, it can be argued that those designed to prevent the build-up of systemic risks in the expansionary phase did not worked as they should, but this situation is not a country specific one, many other countries facing it, while those tools designed to create countercyclical capital buffers proved to be more efficient than the first ones, ensuring a strong resilience of the banking system in front of financial crisis.

Introduction

Romania was one of the emerging economies that has been affected by the risks identified by the IMF as underpinning the last financial crisis, namely the excessive credit growth, the excessive price assets growth driven by the credit growth, the excessive increase in leverage, the liquidity risk, the volatile capital flows and foreign currency lending. Although the banking system was exposed to significant risks, no banks failure was registered after the beginning of the financial crisis.

The main channel through which the weaknesses of banks' balance sheets affect the real economy is to reduce the supply of credit (Bernanke, 1983). Borio and Lowe (2002, 2004), Drehmann et al. (2010, 2011) and Schularick and Taylor (2012) have shown that indicators of excessive credit growth are very effective in signaling financial crises. Saurina and Jiménez (2006) show that there is a direct connection, albeit delayed, between credit growth and the increase of credit risk, a rapid increase in the loan portfolios being positively associated with an increase in non-performing loans in the future. During expansionary phase both lenders and borrowers are optimistic about investment projects and this translates into low lending standards, while during the crisis, banks suddenly become conservative and restrict the credit policy, which will lead to a credit crunch, leaving the economy without funding. On top of that, in essence, the banks behavior is pro-cyclical whatever regulatory, market or capital requirements.

Macro-prudential policies aim to reduce negative externalities from the financial system to the economy. They are designed to ensure overall stability of financial systems. Macro-prudential

approach considers issues affecting the market as a whole, distinct individual financial institution, problems that cannot be identified at micro-prudential level.

Research conducted after the onset of the economic crisis reinforced the idea that macro-prudential policies are best placed to control systemic risks mentioned above. Isărescu (2011) believes that macro-prudential policies failed to prevent the accumulation of systemic risks.
Popa (2011) believes that small open economies such as those in emerging Europe are exposed to changes in volume and direction of capital flows yield and authorities should adjust their decisions by taking into account the volatility of external capital. Meanwhile, the recent crisis has shown that financial stability, cost of capital outflows may exceed the benefits (Mihai and Neagu, 2013). Capital flows separately from the benefits it can bring, present pro-cyclical characteristics, which can amplify credit cycles and their sudden reversal creates systemic liquidity risk. In the period 2004 - 2008, Romania has experienced large capital inflows, which were reflected in the substantial increase of external debt of households and companies, especially banks. This growth has created large imbalances by increasing liabilities in foreign currency, unmatched by a corresponding increase in foreign currency assets (Croitoru, 2011).

Objectives

We will try to analyze the main tools of macro-prudential policies applied in Romania and how they have helped to prevent the build-up of systemic risk or enhanced the resilience of the banking system in front of crisis. Data sets collected at national level and studies to date provide limited information on the application of macro-prudential policies in Romania. The toolkit enforced by the National Bank of Romania acted on the banking system, which holds a significant share of financial assets and is comprehensive, including almost all the macro-prudential measures internationally identified. It is thus relevant to analyze how these policies have contributed to the financial stability. We will also examine how monetary policies interacted with macro-prudential policies. Romania has experienced inflows of foreign capital in the period 2004 - 2008, which generated an increase in foreign liabilities of banks from euro 3.8 billion to 24.5 billion. As a result of these capital flows has been registered a gradual reduction in interest rates on deposits and loans and on average interest rate on the interbank market. At the same time, a number of other macroeconomic factors changed significantly (Croitoru, 2011), as follows:
 * private sector external debt increased from 12% to 45.6% of GDP;
 * the economy grew on average by more than 5% per year;
 * current account deteriorated from 8.4% to 12.3% of GDP;
 * the central bank's foreign exchange reserves increased from euro 6.3 billion to 25.9 billion;
 * the domestic currency (RON) appreciated by 24%, from 4.1 RON/EUR in January 2004 to 3.1 RON/EUR in July 2007;
 * financial intermediation increased from 16.6% to 39.3% of GDP;
 * banks have become dependent on external financing and loans to deposits ratio in the banking system increased from 0.72 to 1.37.

Depreciation rate and massive capital inflows led to an accelerated growth of foreign currency lending, but also in domestic currency, while leading to greater imbalances between foreign assets of households and companies and their foreign currency liabilities. Although, during 2004 – 2008, there have been warnings of the risk of exchange rate increase they were ignored by the market, for which the reputation of the central bank acted as an implied warranty, believing that the foreign reserves will be used to avoid substantial loans impairments (Croitoru, 2011). With this implicit guarantee it was optimal for banks, companies and households to expose to the exchange rate risk (Croitoru, 2011).

The rapid credit growth associated with an increase in non-performing loans and the massive financing in foreign currency placed Romania (IMF, 2011) in the category of emerging economies with a higher risk (Figure 1 and 2).

Emerging Europe: NPL levels and past credit growth
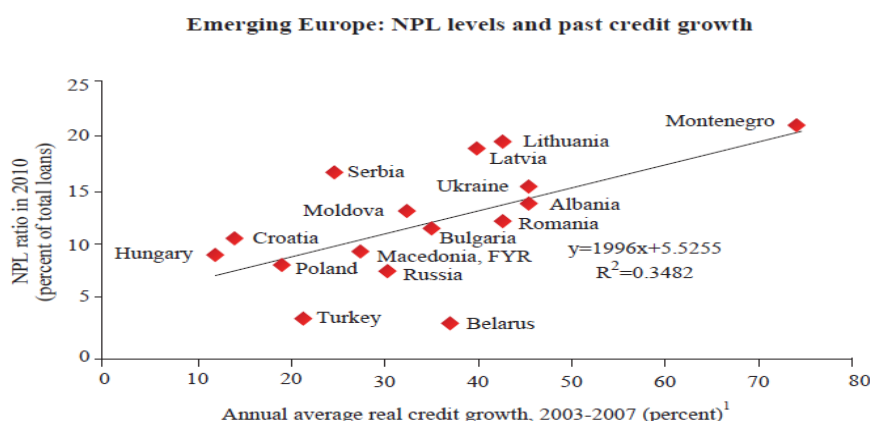
Figure 1: NPL levels and past credit growth

Source: IMF, Choosing macroprudential policies: models, instruments and preliminary empirical findings, Crowley J., Hesse H., 2011. Based on IMF, Regional Economic Outlook: Europe (October 2011)

FX loans: CEEMEA most exposed
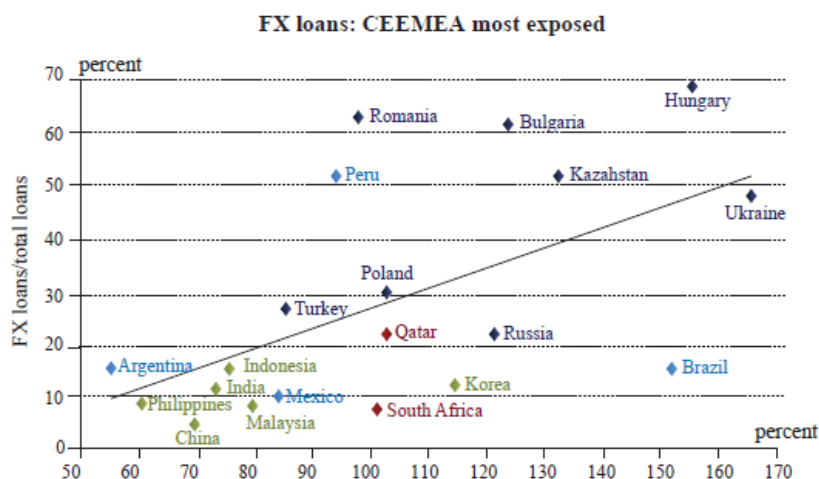
Figure 2: FX loans/total loans

Source: IMF, Choosing macroprudential policies: models, instruments and preliminary empirical findings, Crowley J., Hesse H., 2011. Based on IMF, Regional Economic Outlook: Europe (October 2011)

The interaction of macro-prudential policy with monetary policy

Isărescu (2011) argued that, since the monetary policy rate was the main instrument used to achieve the objective of price stability, the National Bank of Romania did not use it in order to achieve macro-prudential purposes, choosing to responded with a series of macro-prudential measures to imbalances build up in the boom phase of 2004 - 2008. The effectiveness of these measures was relatively limited, because some of macroeconomic policies were pro-cyclical, and especially after the full liberalization of the capital account in September 2006. Isărescu (2011) argued that those measures limited major macro imbalances that could occur in their absence. Crowe, Dell'Ariccia, Igan and Rabanal (IMF 2011) found that monetary policy is an inappropriate tool which can create additional costs to solve the problem of accelerated credit growth and house price driven growth, if it is not linked to a wider process of overheating. Tightening the monetary policy may lead to an undesirable slowdown of economic growth which will not be reflected, with the same intensity, in a reduction of assets prices.

The last financial crisis has shown that there is a major conflict between monetary and financial stability. While monetary stability focuses on consumer prices, financial stability takes into account changes in prices of assets (such as real estate market prices) and aims to reduce the pro-cyclicality of the financial system. The conclusion in economic theory is that, on the long term, there is no conflict between monetary stability and financial stability, the two concepts are mutually supporting, low inflation and stable long-term monetary policy

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aimed at achieving this goal tends to promote financial stability. Cerna (2011) finds that monetary policy pursued by most central banks in the last decade, exclusively oriented towards price stability, facilitated and even fueled credit expansion. The belief that keeping inflation at a low level, so monetary stability, will automatically ensures financial stability has enabled the maintenance of the bubble for years. Cerna (2011) believes that monetary policy strategy (called inflation targeting) neglected the credit capacity to cause financial instability, and suggests to use the interest rate as an instrument of monetary policy in a more flexible way in order to become more sensitive to credit slip and raising prices of financial assets. Thus, it is suggested that the instrument must be filled with specific tools of macro-prudential policy, based on two pillars: countercyclical capital buffers (to prevent systemic risk) and minimum required reserves (to put banks in a position to be able to bear the possible shortage liquidity in the money market).

In the period January 2003 - August 2007, the monetary policy rate decreased from 19.75% to 7%. Since August 2007 taking into consideration the overheating signals and the emergence of inflationary pressures, the central bank has adopted measures to increase the monetary policy rate (from 7% to 10.25% in early August 2008). Tightening monetary policy had undesirable effects, accelerating the foreign currency lending. Even there were some inflationary pressures; the measure did not prove to be effective in reducing excessive credit growth. This effect has been proved by Brzoza, Niedźwiedzińska and Chmielewski (2010), who studied the effects of monetary policy in the presence of developed financial markets in terms of capital flows. They found, based on studies made on Czech Republic, Poland, Hungary and Slovakia, that monetary policy tightening leads to substituting funding in national currency in foreign currency financing. Empirical analyzes confirm this trend for Romania, foreign currency loans accelerating the growth since the domestic currency rate was raised in August 2007 (Figure 3 and 4).
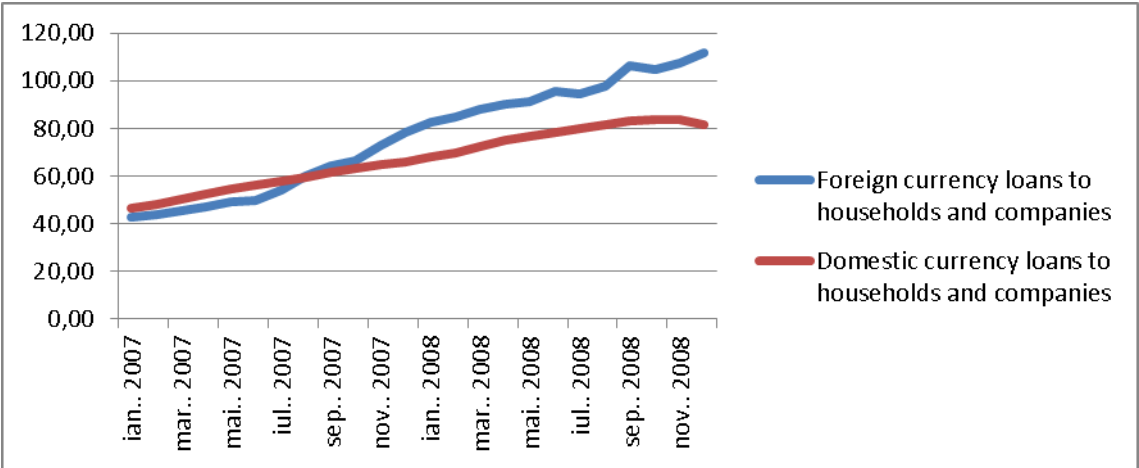
Figure 3: The domestic and foreign currency lending evolution
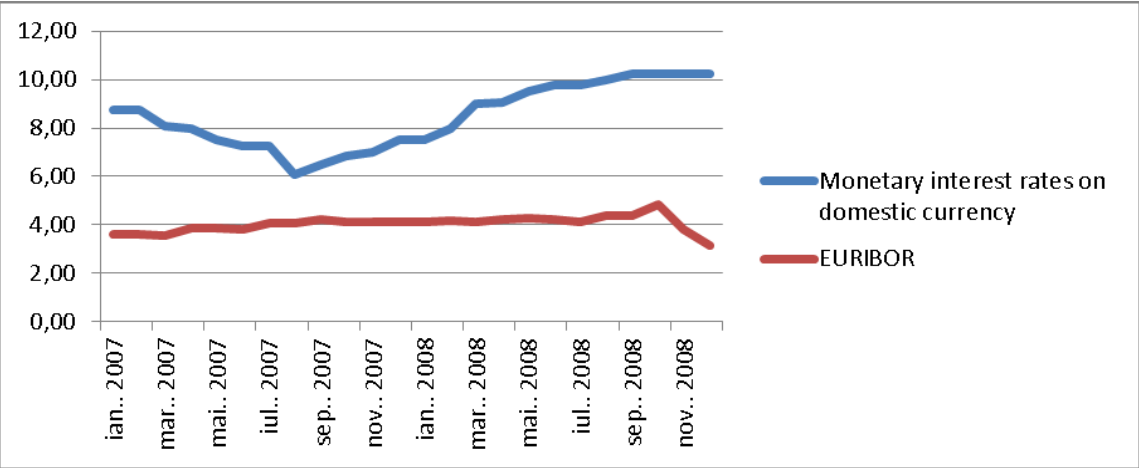
Figure 4: The gaap between the local policy interest rate and Euribor

Brzoza, Kolasa and Makarsky (2013) suggest that macro-prudential policies could at least partially cancel the effect of the loss of monetary policy independence in countries on the periphery of the union, including the fact that the interest rate set by the ECB could not answer to asymmetrical development of the periphery (Greece Ireland, Portugal and Spain) and the central euro area. Using two models for the real estate market and the banking system, they found that the LTV seems to be more effective than the tools of capital adequacy, but to be effective must be implemented at national level. The countries of the periphery accumulated serious imbalances since integration, property prices almost doubled in the period 1996 - 2006, while they stagnated or increased slightly in the rest of the union. This has impacted the accelerated growth of GDP in these countries, and later, when the housing bubble ended in a significant reduction thereof. The accelerated growth of real estate prices has been identified as the main determinant of evolutionary divergence in GDP between periphery and center area. They consider that the main source of asymmetric development was the sharp reduction of interest on the periphery as a result of accession to the euro zone, combined with easier access to cross-border funding.

The situation was not different in the case of Romania, which, although joined the European Union only in 2007, there were optimistic scenarios about productivity and wages growth in the previous period of the integration. These increased the capital inflows in foreign currencies at banks level that relaxed the lending standards. This translated into an increase of the indebtedness at the companies and households level. In Figure 4 can be seen the difference between the domestic policy interest rate and Euribor, that helped increasing cross-border financing and exacerbated the carry trade and the supply push by which the major banking groups with global representation provided cheap funds in different parts of the world.

The macro-prudential policy instruments applied in Romania

Depending on the type of instrument macro-prudential measures can be divided into instruments designed to prevent building up of systemic risks and tools designed to increase the banking system resilience in front of crisis. National Bank of Romania adopted both types of tools, some of them being considered also for micro-prudential purposes.

Tools designed to prevent building up of systemic risks

i) introducing the *liquidity ratio*, since 2001, the last and most important changes being made in 2009 and 2011 (a more restrictive calculation, imposing qualitative requirements on liquidity risk management e.g. alternative financing agreements under crisis conditions, definition of liquidity reserves in crisis scenarios etc.);

ii) limiting the net open currency position, since 1992, the maximum being set to 10% of own funds individually for any currency and 20% for total foreign currency position;

iii) introducing the loan-to-value ratio (LTV), since 2003. The initial cap was set at 75%, generating a coverage ratio of 133% of loans. The inarticulate legislative framework (the possibility to buy properties without proving the existence of the down payment, over valuated guarantees in the context of accelerated rise in property prices, lack of national indicators on the real estate market evolution etc.) affected the efficiency of this instrument. In addition, the pressure of capital flows and competition for volumes and market share generated from 2007 launching offers with higher LTVs, even 100% (in some cases the residual risk was covered by insurance policies which activate if the guarantee did not repaid in full the loan). Obviously, during the crisis, these hedging mechanisms have not worked.
In my opinion, it could be useful to use different LTVs depending on the location and type of property. This can be seen in the context of unbalanced economic development between regions, cities etc. or based on property specific conditions (plots of land without utilities etc.). Perhaps the lack of relevant data series would have not allowed anyway such type of analyzes.

Subsequent to the crisis development, amid housing market crash, the LTV was significantly reduced for foreign currency loans (75% for euro denominated loans and 60% for Swiss

francs denominated loans) to ensure an adequate level of guarantee coverage in a crisis situation, and to limit in the same time the foreign currency lending;

iv) introducing the debt-to-income ratio (DTI), since 2003. The debt ceilings was initially set at 30% of the debtor revenues for consumer loans and at 35% of income for mortgage loans; the income was considered at the family level, net of other liabilities, and the maximum degree for the total debt was set at 40% of revenues. This tool worked efficiently for a while, but since 2007, following integration into the European Union and on external capital inflows pressure, the DTIs efficiency was affected, banks being able to substantiate, based on internal data, their own DTI ratios. Since the boom began in 2003, historical data could only indicate a very good performance of the loan portfolios. This trend was considered by the banking industry to be maintained in the future, even under increased indebtedness.

The move led in practice to a raise of the DTI ratio up to 70 - 75% of the net income of the households, leading to over-indebtedness of individuals. In adopting that measure contributed some macroeconomic policies that gave false signals about the sustainability and long-term trend in revenue growth, both banks and borrowers underestimating the risks (Isărescu, 2011). In practice, these signals caused granting loans with promotional interest rate, that rise after a period (usually 2 years), and also considering as eligible incomes some revenues streams which proved to be volatile during crisis (commissions, incentives, bonuses, incomes not subject to taxation etc.). Most of the non-performing loans were granted during the period 2007 - 2008, characterized by high credit growth rates and low lending standards (high rates on LTV's and DTI's). The phenomenon is not unique; the IMF (2011) noted that the crisis in the US was generated by borrowers with high rates of LTV's. It was found, that the higher was the LTV before the crisis, the greater was the nonperforming loans rate after.

Later onset of the crisis, the National Bank of Romania adopted measures to reduce indebtedness, especially on unheeded borrowers, by incorporating the results of some predefined stress tests when calculating the DTI ratio. The maximum degree of indebtedness is considered now putting in assumptions about currency risk, interest rate risk and adjustment of revenues. Stress testing hypothesis are based on a depreciation of the local currency by 35.5% compared to euro, by 52.6% compared to CHF and 40,9% compared to USD, on a shock to the interest rate risk of 0.6% and on o reduced disposable income by 6%. From 2012, a shock on the exchange rate also applies to non-financial companies.

v) limiting the banks' exposure in foreign currency loans granted to unheeded borrowers to currency risk, from 2005 to 2006, up to 300% of the own funds of each credit institution. Mechanism to limit foreign currency lending has been effective for a period, until banks have found alternatives to continue expand the foreign currency lending. The main channel was originate and distribute model, banks transferring the foreign currency exposures to parent banks or to special purpose vehicles (assignments, funded or unfunded risk participation, securitization etc.). Some of these transactions (especially swap operations, through which banks funded the foreign currency lending) were not covered by the regulation regarding the minimum requirement reserves for foreign currency liabilities, generating an increase in the short-term wholesale funding.

Another instrument used to cover the risks implied by the foreign currency lending to unheeded borrowers was to set supplementary capital requirements for foreign currency exposures, through Internal Capital Adequacy Assessment Process - ICAAP. The measure was adopted in circumstances in which, following the significant depreciation of the national currency (end of 2008), the central bank imposed, starting with April 2009, a stricter provisioning policy for exposures granted to unheeded borrowers;

vi) the central bank gradually increased the minimum required reserve ratio for foreign currency liabilities with maturities of up to two years, from 25% to 40% in the period 2004 - 2006. The measure was relatively efficient, managing to reduce for a while the growth pace of foreign currency loans. At the same time, excluding from the minimum reserve mechanism the liabilities with maturities of over 2 years stimulated attracting long term external resources. Thus, in 2008, part of the wholesale funding was over two year's maturity, and were not recorded significant outflows immediately after the onset of the financial crisis. A

similar approach can be considered the one introduced later in 2010 in Korea. Since 2010 Korea has implemented a set of tools that targeted the liabilities of banks, and thus the pattern of funding. Korea was affected by the liquidity withdrawal of foreign banks in the domestic market, given that in previous periods was recorded an accelerated growth of credit unsupported equally by domestic savings.

The aim was to reduce pro-cyclicality in banking system by reducing the short term wholesale funding, namely the cross border interbank liabilities (the non-core funding). The Korean authorities introduced a non-core liabilities levy to limit non-core liabilities of banks, applied to the amount of foreign currency debt of the banking system.

After the levy implementation, Bruno and Shin (2013) examined the evolution of the Korean banking system, compared with a group of five large countries in the region (Indonesia, Malaysia, Philippines, Thailand and Vietnam), demonstrating the positive effect of applying the non-core liabilities levy, Korea' vulnerability to crisis being reduced.

vii) with the purposes of preventing rapid reversal of capital flows, National Bank of Romania has also used another unconventional instrument which consisted in signing by this, in April 2009, under the auspices of the International Monetary Fund and the European Commission, the Vienna Agreement, with the parent banks of the nine largest foreign-owned credit institutions operating in Romania, covering about 70% of banking assets. This agreement had three components, namely:
- maintaining the total exposure in Romania of the nine credit institutions;
- increase the capitalization of subsidiaries in Romania over 10%;
- restrictions on the payment of dividends in the years of economic crisis, on a case by case basis;

In the period 2009 - 2011 commitments have been met, and the agreement has proved to be efficient. Although in recent years there has been a contraction of funding from parent banks to Romanian branches, it has been gradually accommodated by an increase in the domestic savings. In my opinion, in Romania could be effective applying a mix of instruments such as that adopted by India, namely different risk weighting ratios in the calculation of capital requirements combined with a specific provisioning policy for certain types of exposures, which were growing faster than the average loan portfolios (real estate, construction, etc.). India applied this mix in accordance with the monetary interest rate changes. The lack of relevant data series makes almost impossible to determine, at the national level, the real contribution in credit and GDP of these sectors since a significant portion of these types of exposures were given to real estate developers who had other NACE codes than real estate developers, and thus the exposures were consolidated under the NACE coding.

As IMF identified (Lim et al. 2011) the exchange rate regime appears to have a role in choosing macro-prudential instruments. In countries with fixed or administered exchange rate regime tend to be used more macro-prudential policy instruments since the exchange rate regime limits the impact of monetary policy rate.

In Romania, credit growth was associated with an increase in capital flows since it was an implied warranty on exchange rate, which functioned as an incentive for financial institutions to increase credit supply through external funding. Thus National Bank of Romania used more tools for credit risk (e.g. LTV's limit, limits on credit growth) to manage the increasing volumes of loans, while using the interest rate was ineffective. Also have been used liquidity measures (e.g. limits on foreign currency lending, limits on net open foreign currency position) to manage the risks arising from foreign currency financing. The phenomenon is not specific to the Romanian market, none of the emerging economies succeeding in effectively control volatile capital flows that generated an excessive credit growth.

Regarding **macro-prudential policies** to build-up **countercyclical capital buffers**, designed to increase the resilience of the banking system, it can be argued that although were not implemented strictly such instruments, National Bank of Romania applied to the banking system similar mechanisms that have proven to be effective.

The dynamic provisioning policy applied by Spain has become a reference model. Spain has a dynamic provisioning mechanism since 2000, which is similar to setting up countercyclical capital requirements. Methodology for determining the dynamic provisions was different from setting up provisions for losses identified in the bank's portfolios. The methodology takes into account a latent loss existing in total loans in the banking system (statistically estimated) although they are not individually identified, leading to the build-up of provisions stocks during periods of expansion, which will be used in downturns.

The formula for calculating dynamic provisions summarizes *i)* specific provisions determined for non-performing loans to a certain date; *ii)* determined proportion of general provisions on loan portfolio growth; and *iii)* a general provision based on a comparison of the average cyclical provisions recorded in the last credit cycle (at system level) with specific provisions determined at the time of calculation, for each bank.

This comparison is one that is the countercyclical element in times of expansion, when the level of non-performing loans is low, the specific provisions is reduced compared with the average provisioning on a cycle, the difference is positive and dynamic provisions fund is established. During a recession period, the trend is reversed, specific provisions increase due to a rise of non-performing loans, the countercyclical component becomes negative and the stock of dynamic provisions is used.

National Bank of Romania has pursued a specific provisioning policy since 2002. All loans were provisioned except for those of borrowers who recorded simultaneously the highest financial performance and arrears of up to 15 days. This methodology is different than the one specified in the International Financial Reporting Standards – IFRS, which is based on testing for impairment only if there are some depreciation signs, which can lead to a reduction of the asset value. In addition, there were fully provisioned all the loans with over 90 days past due. This provisioning policy has contributed to the establishment of loan loss reserves both pre-crisis and thereafter.

Some of them have been used in 2009, when the central bank allowed the deduction of up to 25% of the eligible collateral for exposures with more than 90 days past due, which led to releasing a part of the provisions established for the non-performing loans, and thus strengthening the bank's own funds.

The approach taken since 2009 can be also considered to be a dynamic provisioning. Starting with 2009, there was provisioned all foreign currency loans granted to unheeded borrowers, regardless of the credit quality (starting with 7% for the *Standard* category). This methodology considers the existence of a latent risk for all foreign currency exposures, without any impairment signs at the level of individual exposures. Starting with 2012, the national banking system adopted the IFRS. At that moment the stock of specific provisions was significantly higher (in some banks even double) than that which would have be established under the new accounting standards. Therefore, National Bank of Romania decided to maintain information on the specific provisions (RAS), along with reflecting into the accounting the new loan loss provisions, determined under the IFRS. It was decided that the prudential indicators will be calculated by taking into account the net exposures, determined as the difference of gross exposure and the maximum between RAS and IFRS provisions, while the positive difference between the total of the two types of provisions constituting into a prudential filter. This filter was deducted from the own funds. Consequently, the level of own funds have not been positively affected by the transition to new accounting standards, which implied a low level of loan loss provisions than previous one. The prudential filter was decided to be released gradually, and starting with 2014 the central bank decided to gradually release the prudential filters (20% annually, until the filter is removed entirely), which translates in a release of countercyclical capital, increasing the own funds at the banking system level.

The methodology has common features with that applied in Spain, which is taken as internationally benchmark for both academia and by regulators in respect of the formation of countercyclical capital buffers. Looking at the moments when the central bank allowed the deduction of 25% of the collateral in calculating specific provisions for non-performing

exposures and the release of 20% of prudential filters, it can be seen a large positive effect of establishing ex-ante loan loss provisions. Also, analyzing the non-performing loans coverage ratio with specific provisions could be seen that during the period 2003 – 2014 this exceeded 100%, while the difference between the specific provisions and the impairment adjustments forms solid prudential filters.

Conclusions

Macro-prudential policy tools can be helpful, but their effects are still far from being fully understood, systemic risk is multidimensional and difficult to measure, and transmission mechanisms are not yet fully known (Isărescu, 2011). In addition, macro-prudential policies are not a substitute for traditional solid micro or macroeconomic policies, monetary and fiscal policies should remain effective against distortions and macroeconomic imbalances (Isărescu, 2011).

It can be concluded that, according to national specificities, the most effective tools that can reduce accelerated credit growth without inducing distortions remain LTV and DTI ratios, especially when the effects of monetary policy are limited. Lambertini et al. (2013), in a model analyzing real estate market, consider that a countercyclical LTV based on credit growth may stabilize the economy better than the interest rate. At the same time, limiting foreign currency lending may be effective in the accumulation of risks.

Regarding the tools to increase capital reserves, dynamic provisioning model has proven to be efficient so can be used depending on the historical development of national financial systems. At the national level this tool proved its efficiency. This can lead to a better coverage of risks than using the countercyclical indicator introduced by Basel III.

In conclusion, the traditional instruments of macro-prudential policy continue to be effective at national level in order to control systemic risks, if they are used in a proper way.

Acknowledgements

References

[62] Bernanke, Ben S., 1983, *Nonmonetary effects of the financial crisis in the propagation of the great depression*, American Economic Review 73, 257-276.

[63] Borio C, Lowe P. 2002. '*Asset prices, financial and monetary stability: exploring the nexus'*, BIS Working Paper No. 114.

[64] Borio, C., and P. Lowe (2004). "*Assessing the risk of banking crises"*, BIS Quarterly Review, December 2004. Securing sustainable price stability. Should credit come back from the wilderness, BIS Working Papers, no.157.

[65] Bruno V., Hyun Song Shin Working Paper 19084, *Assessing Macroprudential Policies: Case Of Korea*, National Bureau Of Economic Research 1050, May 2013.

[66] Brzoza Brzezina Michal, Marcin Kolasa, Krzysztof Makarsky.Working Paper Series no 1589/September 2013. *Macroprudential Policy instruments and economic imbalances in the euro area*.

[67] Brzoza Brzezina Michal, Joanna Niedźwiedzińska, Tomasz Chmielewski, *Substitution between Domestic and Foreign Currency Loans in Central Europe. Do Central Banks Matter?* ECB Working Paper No. 1187, 2010.

[68] Cerna S., *Tintirea inflatiei: un bilant provizoriu, Studii Financiare*, Anul XIV – Serie noua– Vol.2 (48)/2010; Criza si redefinirea rolului bancilor centrale, Oeconomica, 4, 2010. Politica monetară în epoca postcriză.

[69] Crowe, C. W., G. Dell'Ariccia, D. Igan, and P. Rabanal. 2011. "*How to Deal with Real Estate Booms: Lessons from Country Experiences."* Working Paper 11/91, International Monetary Fund, Washington, DC.

[70] Drehmann M, Borio C, Gambacorta L, Jimenez G, Trucharte C. 2010. *'Countercyclical capital buffers: exploring options'*, BIS Working Paper 317.

[71] Drehmann M, Borio C, Tsatsaronis K. 2011. *'Anchoring countercyclical capital buffers: the role of credit aggregates'*, BIS Working Paper.

[72] Drehmann, M., C. Borio, and K. Tsatsaronis (2011). *Characterising the financial cycle: don't lose sight of the medium term!*, BIS Working Paper no. 380, June.

[73] IMF, *Choosing macroprudential policies: models, instruments and preliminary empirical findings*, Crowley J., Hesse H., 2011.

[74] Isarescu M., *Macroprudentialitatea. Reglementarea, crizele financiare si politica monetara,* Dizertatie cu ocazia decernarii titlului de Doctor Honoris Causa al Universitatii Romano-Americane, 30 iunie 2011.

[75] Jiménez, G., and J. Saurina (2006). *"Credit Cycles, Credit Risk, and Prudential Regulation"*, International Journal of Central Banking, 2 (2).

[76] Lambertini, Luisa, Caterina Mendicino, and Maria Teresa Punzi (2013) *'Leaning against boom-bust cycles in credit and housing prices'* Journal of Economic Dynamics and Control 37(8).

[77] Lim, C., Columba F., A. Costa, P. Kongsamut, A. Otani, M. Saiyid, T. Wezel, and X. Wu, October 2011, *Macroprudential Policy: What Instruments and How to Use Them? Lessons from Country Experiences*, IMF Working Paper WP/11/238.

[78] Neagu, Florian and Irina Mihai, *Working Paper Series no.1591/September 2013 Sudden Stop of capital flows and the consequences for the banking sector and the real economy.*

[79] Popa, C., 2011. *Monetary policy challenges in the CESEE region the case of Romania, Post- Crisis Growth and Integration in Europe*. Catching-up Strategies in CESEE Economies, pp. 167-170, Edward Edgar Publishing Ltd.

[80] Schularick, Moritz, and Alan M. Taylor, 2012, *Credit Booms Gone Bust: Monetary Policy*, Leverage Cycles, and Financial Crises, 1870–2008, American Economic Review 102.

Environmental Costs from the Perspective of Environmental Accounting

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ABSTRACT

Short life of man strikingly contrasts with the permanence of the earth. For thousands of years, many generations were born and disappeared, but the earth he has consistently demonstrated impressive ability to support life. There is also a reverse of the medal. It is estimated that human activities cause a disturbance of the natural cycles of the earth. The article presents the need to manage environmental issues of economic entities by analyzing concepts such as environment, environmental accounting and environmental costs in terms of environmental accounting. Currently, entities are beginning to consider the environmental variable in the decision-making process by introducing measures to prevent environmental impact of their activities or to correct damage. Thus, the entities supporting the cost resulting from the interaction with the environment, which is called environmental cost. The conclusion is that the determination of the environmental cost that society incurs difficulties, namely: it is difficult to quantify, in physical units, amount of environmental resources consumed and there is no basis in the market for these goods, because the cost seeks monetary quantification resources consumed through price or cash equivalents. Environmental costs can be reduced or avoided through pollution prevention practices such as redesigning products, input materials substitution, practices and improve operational level of maintenance.

Introduction

The term environment has a broad sense, including many aspects, among which would highlight renewable or non-renewable natural resources, air, water, landscapes and ecosystems in general. Environment includes the entire exogenous firm, economic, technical, political, demographic, cultural, scientific, organizational, legal, psycho-sociological, educational and ecological marking the establishment of objectives, obtaining the necessary resources, adoption and application of making decisions them.

Although it has always been present in human activity, concern for conservation not appeared until they had important issues and environmental disasters. The presence in the environment of one or more contaminants or some combination thereof, exceeding the limits tolerated, causing damage to life or environmental impact.

It is said that there are environmental impact when an action or activity causes a change, favorable or unfavorable, on the environment or its components. It should be noted that the term "impact" does not imply negativity because it can be both positive and negative. The difference between the future environmental situations changed, as manifested in

consequence of the project and future state of the environment, as would be performed normally, without such action. I mean, what is recorded as positive or negative net change in environmental quality and quality of human life.

Value, cost and price are three different concepts applied to natural resources such as water element may present a distorted approach. In our country, as in many places, freshwater has a high value because it is a scarce resource and essential for industry, agriculture, public and environmental landscape maintenance, ie for flora, fauna and territory as a whole. On the other hand, requires that the water is suitable for consumption able to reach people through valves installed, bearing a significant cost in the construction and maintenance of tanks, treatment plants and distribution networks, without consideration of costs organic. However, its price is relatively low because it does not reflect all costs and they are covered by the state, therefore, pay the real environmental costs is transferred to future generations or simply not considered.

In the past, economic activity did not take into account the impact that their actions had on the social and physical environment surrounding them, ie, remained detached from the natural environment. Currently, however, the vision of the environment has changed; it is considered that meets transcendental functions such as:

- The fundamental source of resources necessary for production;
- Provides services related to natural beauty, clean air, clean water, etc.
- It acts as a reservoir of waste and residues generated for production and consumption.

These functions are considered economical because exchanged in every market would reach positive economic value. The depletion of resources, obtaining and using them becomes more complex and therefore increase costs.

Environmental Accounting

Macroeconomic and microeconomic arose an interesting concept for analysis, environmental accounting. If the macro perspective is a concept widely used in micro level is not sufficiently treated, being a subject and an important area of analysis and study.

Environmental Accounting can be defined as part of the accounting applied, whose goal is the accounting relationship between an entity and its environment, leading to differences between the macro and micro accounts.

Todea et al., 2011 called environmental accounting as "green accounting" and argues that "it should not be confused with mere reflection of environmental costs in traditional financial statements as it is an efficient information system regarding the degree of degradation of natural elements, determined by the activity of the entities and used in order to reduce these degradations and informing stakeholders".

Environmental Accounting is an important tool to understand the natural role in the national economy. Environmental accounts should provide data that highlights both the contribution of natural resources for economic welfare and costs for contamination or exhausted. Evaluation of natural goods and services is just one element of compilation environment.

Environmental Costs from the Perspective of Environmental Accounting

According to Letmathe and Doost (2000) Environmental cost accounting is "an extension of traditional management accounting as decision support".

In his view Rannou (Henri, 2010), the main problem of environmental management accounting is the lack of a standard definition of environmental costs.

US Environmental Protection Agency defines environmental costs as "the costs of environmental degradation that cannot be easily measured or corrected are difficult to measure and not a legal responsibility".

European Commission (Recommendation no. 453/2001) defines environmental costs as "costs that must prevent, reduce or recover environmental damage caused by the entity or one that is likely to occur as a result of activities they run. These include prevention, elimination or reduction of waste or waste water, carbon, treatment of contaminated soils, landscapes radical change, research and product innovation, cleaner production processes, quality control environment ".

According to Constantin Mindricelu (2002), content consumption cost is related to the rise and factors to be pursued and highlighted expression must have a value. So, the cost is the expression value of all the factors used for producing environmental services and expenses incurred by the producer takes the form of environmental services. In other words, the base cost of manpower and consumption are materialized in terms of value, consumption that takes the form of production and distribution costs borne by the producers of specific environmental services. Not to be confused notions of cost and expense. To be more convincing we can say that the expense is synonymous with a payment, representing a cash flow, and the factor that determines that an expense is a cost element is consumption. Expenditure may be simultaneous or previous conduct further consumption. The distinction between the two indicators is that the "included only the cost of materials and labor consumption for a period (month, year), while financial expenses incurred covering the entire circuit of environmental actions.

According to Bonilla Priego (2000), currently entities begin to consider the environmental variable in the decision-making process by introducing measures to prevent environmental impact of their activities or to correct damage. Thus, the entities supporting the cost resulting from the interaction with the environment, which is called environmental cost.

Fronti Garcia et. al. (1998) believe that the activities undertaken voluntarily and those set by contract or environmental laws and regulations, relating both renewable and non-renewable resource conservation, aiming to prevent, reduce or remedy environmental damage.

To determine the cost of production of a good or service should be considered a set of inputs in the process. Some are valued at a price, while others, such as environmental goods and services, not such a mechanism, their value is less recognized. Many environmental resources are not private property, free access to these goods or services are grounds of abuse in their use because they have a zero cost.

This involves developing an environmental policy that combines market instruments and preventive and restorative, and also requires accounting tools that determines its design and evaluation measures concerning the ecological balance.

Therefore, determining the environmental cost that society supports the following difficulties: it is difficult to quantify, in physical units, amount of environmental resources consumed and there is no basis in the market for these goods, because the cost of resources consumed seeks monetary quantification through price or cash equivalents.

Alternatively, the average cost of the economic entity is determined by the amount of resources consumed over the environmental impact that exercised, having preventive or corrective.

In his view Giani Gradinaru (2003), environmental costs and performance management are under consideration at least the following reasons:
• many environmental costs can be significantly reduced or eliminated by changes at the operational level by investing in clean technologies, by redesigning processes and products;
• environmental costs (and thus potential cost savings) may seem insignificant at a superficial;
• using waste recovery schemes in many enterprises have been brought to light environmental costs and benefits;
• better management of environmental costs can lead to improved environmental performance and significant benefits to human health and the business success;

- correct understanding of the locality environmental costs and benefits associated manufacturing processes and products lead to costs and fixed prices more accurate and can help design company in the future, processes, products and services so that they are more environmentally friendly;
- competitive advantages may result from the demonstration of the environmental guidelines of processes, products and services.

Assessment methods for environmental costs of economic entities used in assessing environmental costs are life cycle assessment, environmental balance, full cost accounting (the three dimensions of sustainable development), total cost accounting and ABC.

Rannou, Henri, 2010, analyzing these methods observed significant differences in terms that not all methods of assessing costs take into account all costs. For example, environmental balance method considers only the consumption of natural resources, ignoring other costs. Another difference is that all these methods cannot assign a numerical value of environmental costs such as life cycle assessment methods, environmental and cost balance completely. For example, life cycle assessment method does not take into account intangible costs, including those resulting from the relationship with stakeholders, but no contingent costs, which cannot be associated with specific phases of a product lifecycle. However, environmental balance method does not provide a numeric equivalent of resource consumption; it can be estimated if required. And the full cost method raises the question of the complexity of determining a monetary value on the cost of externalities.

However, the difficulty of implementing an environmental accounting system does not consist in choosing the method of costing, but to identify all costs derived from environmental compliance. Such costs can be generated by changing requirement of raw materials used with less polluting change will be reflected, most likely in an increase in raw material costs and not the environmental costs (Turturea and Turcu, 2013).

Conclusions

Economic entities should include environmental activities in the accounting system, and especially in the cost, thus facilitating the management entity.

Environmental Accounting is an important tool to understand the natural role in the national economy. Environmental accounts should provide data showing both the contribution of natural resources for economic welfare and costs for contamination or exhausted. Evaluation of natural goods and services is just one element of compilation environment.

The application of management policies for environmental costs lead to a reduction in long-term costs and an increase in the benefit claimed.

In order to achieve correct identification of the costs, the business entity should be an environmental system based on the size and type of production. This work will allow better use of inputs and processes, such as recycling. A cost reduction by incorporating the inputs and processes that enable them to make better use of the surplus that can be recycled will also allow avoiding penalties for infringement.

Environmental costs can be reduced or avoided through pollution prevention practices such as redesigning products, input materials substitution, practices and improve operational level of maintenance.

Romania requires professional accountants who specialize in the technical, environmental conservation and reconstruction, is very important.

It should not concern ourselves only promulgation of national rules on the environment, entities involved in productive activities must comply, this will avoid penalties since there is less chance of non-compliance.

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References

[81] Bonilla Priego, M., *Algunos problemas en la determinación del coste medioambiental en la empresa*, Revista Técnica Contable. Año LII, Num. 615, marzo, 2000;

[82] Fronti de García, L., Wainstein, M., García Fronti, I. y Casal, A., *Contabilidad y auditoría ambiental*, Ediciones Macchi, Buenos Aires, 2000;

[83] Gradinaru Giani, *Discriminarea costurilor de mediu*, Revista Informatică Economică, nr. 1(25)/2003;

[84] Letmathe, P, Doost, R.K., *Environmental cost accounting and auditing*, Managerial Auditing Journal, 15, 2000;

[85] Mândricelu Constantin, *Analiza statistico-economica a protectiei mediului*, Teza de doctorat, Bucuresti, 2001;

[86] Rannou, C., Henri, J.F., *The better way to measure environmental costs*, CMA Management, 2010;

[87] Recomandarea nr. 453/2001 a Comisiei Europene;

[88] Todea, N., Stanciu, I.C., Udrea, A.M., *Accounting policies on environmental costs and their calculation method in the entity*, Annals & Proceedings of DAAAM International, 22(1), 2011;

[89] Turturea M, Turcu D.R., *Designul sistemelor de costuri pentru sustenabilitate*, Economie teoretică şi aplicată, Volumul XX (2013), No. 10(587).