Regional Triple Helix models: drivers, dynamics, public policy

Technology Park as a promoter of Triple Helix ecosystems to make strategic partner to contribute to the regional development

Author:

Polyana TARGINO – Porto Digital - Rua do Apolo, n.181, Bairro do Recife, Recife - Pernambuco – Brazil, CEP: 50.030-220 - polyana@portodigital.org

Graduated in Business Administration at the Sciences Faculty of Pernambuco (FCAP / UPE), 2007 and in Social Communication - Journalism at the Federal University of Pernambuco (UFPE), 2007. As a journalist she worked on University TV (2004-2005) and on Pernambuco.com Journal (2005-2006), Associate Pernambuco portal group. Currently, she works as a Technological Innovation Analyst at Porto Digital and at the Brazil Bank and has 5 paper publications as a result of her work at Porto Digital.

Co-authors:

Cidinha GOUVEIA – Porto Digital - Rua do Apolo, n.181, Bairro do Recife, Recife - Pernambuco – Brazil, CEP: 50.030-220 - cidinha@portodigital.org

Graduated in Civil Engineering at the Federal University of Paraíba (2000), and in Data Processing Technology at the Data Processing Faculty of Paraíba (2002). Master in Software Engineering at the Federal University of Campina Grande (2004). She has experience in Project Management, and Public Policies. As Project Manager, she worked on projects involving countries such as USA, Italy, China, India and Russia, having Motorola as the main client. Currently, she works as Project Manager at Porto Digital and teaches in postgraduate technology courses for four years, with 14 publications.

Emanoel QUERETTE - Porto Digital - Rua do Apolo, n.181, Bairro do Recife, Recife - Pernambuco – Brazil, CEP: 50.030-220 - emanoel@portodigital.org

Graduate in Social Communication - Advertising and Marketing at the Federal University of Pernambuco (2005) and in Business Administration by University of Pernambuco (2009). Master (MBA) in Project Management at the Department of Production Engineering, UFPE (2009). Attending the Masters (MSc) Science andTechnology Policy at the University of Sussex/SPRU, United Kingdom. He has experience in Project Management, Organizational Consulting, Advertising and Marketing. Research topics such as: Identity in Post-modernity, Strategy, Competitiveness, Innovation and Networks.

Francisco SABOYA - Porto Digital - Rua do Apolo, n.181, Bairro do Recife, Recife - Pernambuco – Brazil, CEP: 50.030-220 - saboya@portodigital.org

Degree in economics (1982) and Master in Engineering Production at the Federal University of Pernambuco-UFPE (2006). Professor of Macroeconomics and Systems and Information Technology Management disciplines at the Administrative Sciences Faculty at the University of Pernambuco, UPE, FCAP. He was Economic Development and Tourism Secretary of the Cabo de Santo Agostinho city (1998-1999) and Commercial Director of the Pernambuco Tourism Company (1995-1996). As a business consultant, he operates in the areas of strategic planning, process productive engineering, organizational restructuring, innovation management and knowledge management in the public and private markets. Since August, 2007 he holds the position of Porto Digital's President, a Technology Park based in Recife. He is also a counselor at CESAR - Centre for Advanced Studies and Systems of Recife and at Recife Softex – Brazilian Society for Software's Export Promotion.

Marcelo CLEMENTE - Joy Street S.A. - Rua do Apolo, 81, 3º andar, Bairro do Recife - Pernambuco, Brasil. 50030-220. - marceloclemente@joystreet.com.br

Graduated in Computer Science at Federal University of Pernambuco, 1997; PMP - Project Management Professional Certificated, PMI 2003; Attending the MBA in Corporate Finance,

CEDEPE, 2011. He has 14 years of experience in IT industry, most of them in the game/entertainment industry. Currently, he works as Business Manager at Joy Street S.A. and acts as Project Management consultant at Recife Softex.

Pedro LIMA – Porto Digital - Rua do Apolo, n.181, Bairro do Recife, Recife - Pernambuco – Brazil, CEP: 50.030-220 - pedro@portodigital.org
Chemical Engineer at the Catolica University of Pernambuco, UNICAP (1995), specialist in Business Administration at the University of California at Berkeley (1997), specialist in Security Information at the Olinda High Education, AESO, (2005), Project Manager Professional (PMP) certified by Project Management Institute PMI (2005). He has experience in Project Management, Public Policies, Information Tecnology infrastructure, ERP and Industrial Processes. Currently, he is working as a Project Manager Consultant for Porto Digital, as a Project Manager Consultant for Rede Globo Nordeste, a branch of one of the biggest television network of the world, and for Ecoplan where he is responsible for creating a controlling mechanism for the expansion of one of the Guarulho's airport runways.

Key Words: Education, Technology, Partnership.

1. INTRODUCTION

The issue of public education in Brazil is a major challenge to the government, who has to deal with problems such as: inadequate infrastructure, lack of qualified teachers and bad teaching indicators (low grades, high rate of abstention, abandonment and reprobation). The situation is not different in Pernambuco, northeast of the country. So, in May 2007, the Department of Education of the State of Pernambuco, in search of an alternative that could change the situation, commissioned NGPD – *Núcleo de Gestão do Porto Digital* (Management Unit of Porto Digital) to seek innovative solutions that could create mechanisms to support the educational activities in order to improve the educational indicators in the state.

To build the required solution, NGPD promoted the interaction between the various components of the ICT cluster in the state. This action has taken into account the mission of technology parks, which is to generate synergy among the various actors, acting as articulation agent in the environment and stimulate innovation. By identifying local and regional vocations, and building the economic and technological feasible alternative, it was possible to establish an innovative partnership strategy aimed at improving the educational indicators of the state and promoting the regional economic development. This strategy resulted in the creation of the OjE – *Olimpíadas de Jogos Digitais e Educação* (Olympics of Digital Games and Education), in which games with educational content is the new strategic tool in the processes of state public education.

OjE is a virtual adventure developed in the form of a digital-game competition, which values the educational content and ability to work together. It is dedicated to students and teachers from public schools in the state, where the game is seen in an educational perspective, thus requires the mediation experience of teachers.

So far, the project has already made three Olympics, one in 2008, another in 2009 and the past was in 2010, and the intention is to maintain the project for at least another four years. In the first year the solution was tested in 20 schools, engaged 1100 students and was assessed by 88 percent of the school managers and 68 percent of students as having increased the interest of students in the studies. The second edition of OjE accounted 1,046 teachers, 18,230 students, 368 schools and 126 municipalities. In 2010 the counting up to the month of September, was of 36,000 students, 669 schools and 165 municipalities of the 185 in the state.

2. STATE-OF-THE-ART

2.1. About Porto Digital

The main breeding ground of knowledge and development of ICT applications in Pernambuco is the Porto Digital (PD). It is a technology park located in the Old Recife Distric, historic centre of Pernambuco. Porto Digital is a result of the innovation environment that was consolidated in the state in recent decades along with the coordinated effort of the university, the productive sector and government, in order to insert the industry of Information Technology and Communication in the economic matrix of the Pernambuco state. Being a sector with high growth potential, ICT is also the basis for increasing regional competitiveness in any contemporary economic development strategy.

Porto Digital is the main component of ICT system in the State of Pernambuco. Its goal is to implement economic development, public policies, urban regeneration, social inclusion, strengthening of the ICT cluster and other arrangements through the use of these technologies. With 10 years of existence, Porto Digital is among the leading technology centre in the country. PD generates to the state 6,000 jobs, attracted 170 institutions among universities, government ministries, research and development centres and technology companies on a national and international level. Companies of all sizes have already settled in PD and are producing innovative solutions and technology products.

As a result of the success of its actions, PD was acknowledged by AT Kearney [1], one of the biggest consulting companies in the world, as the largest technology park in the country in number of companies and sales in 2005. Since 2007, PD was recognized as the Best Technology Park and Habitat for Innovation in Brazil by the National Association of Science Parks and Incubators (Anprotec - *Associação Nacional de Entidades Promotoras de Empreendimentos Inovadores) [2]*.

2.2. The Real Demand

The State of Pernambuco, in Brazil, provides its population with a large and complex educational network, with about 900,000 students, 29,000 teachers and 1,108 schools. Despite the universality of the offer, the network presents serious problems of performance, as repeatedly demonstrated by the performance of their students in national examinations such as SAEB - Evaluation System of Basic Education and ENEM - National High School Exam and highlighted by BDI – Development Index of Basic Education (Ideb) [3] as the state with the worse assessment of the country, rating 2.4 from the 5th to 8th grade in 2007, a rate below the national average which was 3.2.

In such context, actions aimed at strengthening the diverse forms of teaching and learning must be undertaken, through the assembly of strategic partnerships that have an impact on the network's macroscopic point of view.

Based on this scenario, the Secretariat of Education of the State of Pernambuco asked the Management Unit of Porto Digital (NGPD) to look for innovative solutions that could improve the educational indicators in the state.

3. METHODOLOGY

According to IASP - International Association of Science Parks [4], technology parks are organizations managed by specialized professionals who are supposed to provide their community with the promotion of a culture of innovation and competitiveness of their companies and research institutions. This should stimulate and manage the flow of knowledge and technology among universities, R&D centres, firms and their markets, facilitating the creation and consolidation of technology-based firms (TBEs) through the process of incubation and spin-offs and providing other aggregates such as quality space and infrastructure. Also, public and

private investment are necessary, as well as regional and national strategic partnerships that move the economy and stimulate the development of new business models, promoting the increase and perfect relation of supply and demand and the consequent generation of jobs.

Assuming this role, once contracted by the State Department of Education to build an innovative solution that could contribute to the improvement of educational indicators of Pernambuco, NGPD established a discussion forum between representatives of the State, of Academy and from the private sector to lead the understanding of the state demand and structuring of a proposal for an innovative solution. As a result of the discussions, under the coordination of Porto Digital, the articulation for a strategic partnership was undertaken, which is the formal implementation of the concept of Triple Helix [5]for development of a region, which is the basic framework Porto Digital's activity.

The triple helix model, proposed by Etzkowitz & Leydesdorff, shows that the generation of wealth and local development can be achieved through innovation and knowledge management, combining Academy, Enterprise and Government. This relationship generates a helix up regional development caused the flow of knowledge between universities and enterprises, so that they acquire greater competitiveness through the most dense in knowledge.

In that context, NGPD mediated the demand from the Secretariat, by proposing the creation of a consortium of resident game companies from Porto Digital in order to generate the solution. Since the companies were all small sized firms, they would not have the necessary development capabilities to perform, individually, the project; creating a consortium was an ingenious solution to that first challenge. Additionally, NGPD introduced the Centre of Informatics from Federal University of Pernambuco (CIn/ UFPE) in the project so to support the development of educational content for the games. This conjunction yielded NGPD the Management Contract with the State Government, signed in April 2008 to act as agent for implementation of the solution.

The object of the Management Contract was the scientific and technological development of necessary activities for the creation of educational projects through Porto Digital, making possible to support the Education Department in the formulation, implementation, monitoring and evaluation of a technology based educational game environment aimed to the improvement of educational indicators of the state of Pernambuco.

The consortium of companies, together with teachers from the CIn/ UFPE, is responsible for designing and developing of the following products, among others: (i) Creation and development of an environment based on digital games, (ii) Planning and monitoring of three edition of the Olympics with average duration of five months and (iii) Training of the State's Educational body (teachers, technicians).

Considering the various actors who interact in the ecosystem of a technology park, the governance has a vital role not only in promoting the development of a technology environment as well as creating the necessary synergy to come out with innovative solutions. The management unit of the park, NGPD, is capable of converging actions of various actors and of mediating their strategic relations and interests, contributing to the development of new technologies and implementation of public policies for a common end, developing, thus, the replicable model on strategic partnership capable of fostering socioeconomic growth as a whole.

4. FINDINGS AND INTERPRETATION

4.1. DEFINITION

The Olympics of Digital Games and Education (OJE) is a virtual adventure game developed in the form of a competition of digital games which values learning contents, the ability to work in groups and engagement of all in building the future today.

The inclusion of educational games in the educational architecture was a solution to improve educational indicators. The strategy, from the perspective of the actors involved in the process,

makes sense for several reasons and can contribute greatly to the performance of the system as a whole.

The project seeks, through a dynamic competition in a digital environment, the improvement in thinking processes, student's production of meaning and the participants encouragement for collaborative and collective work (involving students and teachers) in order to more appropriately motivate them to the typical school activities and instrumentalise them in a complementary manner to achieve better curricular results. It is a fruitful educational use from digital games.

From the interaction of the gamer with other individuals to the elaborate processes of reasoning and meaning production, electronic games and activities generated by its use encapsulate the entire operation that is typical of information systems that instrumentalize contemporary societies, while representing one of the best examples available of attracting young people to the digital culture. However, on the one hand, the "educational software/ game" is generally very unattractive for the young; on the other hand, common electronic games (of "action/adventure") almost never deal directly with school's interest of conceptual domains (and perhaps that is why they are so attractive to kids). The original proposal from the consortium, therefore, was to combine the best of two worlds (education and adventure/ games), offering students and educators a set of consistent and innovative possibilities from an educational point of view, as illustrated in Figure 1.

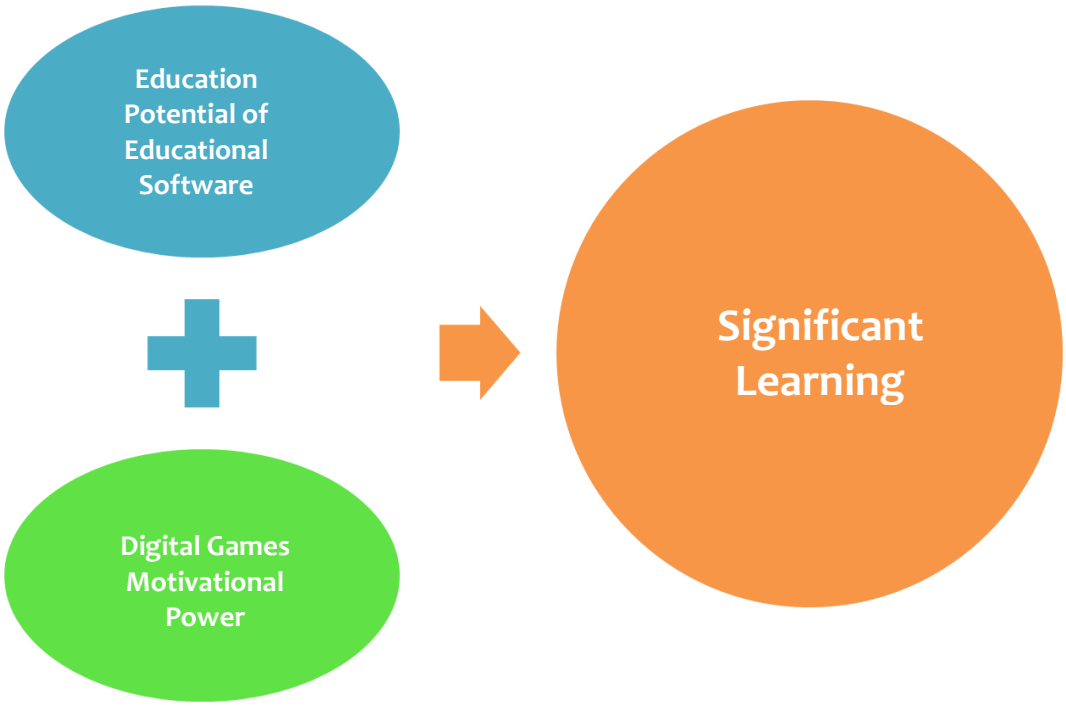


Figure 1 – The Proposal

For this, the following products and services were developed:

- An Environment Based on Digital Games consisting of:
  - 01 Master Game;
  - 10 Mini-games;
  - 02 Mini-Games for students with special needs;
  - Front-end application (initial process stage);
  - Back-end application (final process stage).

- Pernambucos's of Olympics Digital Games and Education Planning and Monitoring, including:
  - Realization of an Olympiad test to validate concepts and models;
  - Realization of two Olympics;
  - Elaboration and implementation of Marketing Plan for each Olympics;
  - Operation and Monitoring of Software Infrastructure.

- Workforce Training and capacity, including:
  - 03 Training for multipliers;
  - 03 Technology training
  - 03 Technical and pedagogical seminars.

The Master Game is a platform of entertainment created for the OjE. The platform provides support to the various activities of competition among the teams participating in the Olympics.

The digital activities are guided through the challenges surrounding digital games (mini games), and questions of the content experienced in the classroom by the student, the puzzles.

On one hand, the mini games are casual games that are meant to provide fun and, consequently, the incentive for users to actively participate in the educational activities of the Olympics. The puzzles, on the other hand, are purely educational in order to encourage the search of knowledge of participants. Thus, the challenges are both a means of fun and learning without any of the parties is compromised trying to achieve different goals.

The platform developed has several gameplay innovative features without giving up the pedagogical aspects, namely:

- Mix of games of pure entertainment with questions related to the topics covered in the classroom;
- More than 70 lines of progress in the game, with more than 350 challenges;
- More than 1000 puzzles with questions from the students' school subjects;
- Ranking by teams and two methods of individual ranking;
- Collaborative gameplay, combining RPG (Role-playing game) and adventure, where the score of the team encourages integration among;
- System of rewards that highlights the best teams.

The dynamics of OJE configures itself in organizing the students into teams (6-10 members), which will develop a collaborative, creating game strategies and coordinating activities in problem solving, that all participating in a virtual adventure that will take the best teams to a final competition running for special prizes related to digital culture.

We also emphasize that the project's intention is not to replace the schools, but to be an additional tool for the teaching of school subjects, and also to make fun the main ingredient for motivating students. Teachers closely monitor the entire creation and development of the project to ensure the educational effectiveness of it. The Olympics is completely free and the games can be accessed from any computer with internet.

The proposal therefore is to create an environment that works both in school and outside it. Besides teaching unit, students can access the game from where he wants and prefer, since it has a computer with internet connection. For this, we developed a format that approximates the social arrangement present in Internet Cafes, allowing the student to remain engaged with the studies without losing the social relation offered by the Cafes environment frequented by this

audience. Thus, the project provides a change of this social arrangement, not only in technology.

4.2. BENEFITS

With OJE students have an opportunity to use the internet positively and the electronic games environment, promoting integration and collaboration through teamwork, healthy competitiveness and the incentive to search for relevant content. In addition, students and teachers earn special awards as game consoles, laptops, TVs, among others.

Participating schools gain by engaging students and teachers in a differentiated project, with high impact and visibility, enhancing the relationship between faculty and students. Teachers, in turn, benefit because the project enables them to coordinate young people in a properly way, approaching the students in their own digital media - generally about which neither the school nor the family has the necessary controls.

4.3. CONCEPTUAL BASIS

The concept of knowledge in the selection and organization of the OJE's contents is based on collaboration, complementarity and integration between the subjects present in the school curriculum proposed.

The contents include the student in cognitive development stage corresponding to the elementary and middle school and considers as references the text of the Law of Directives and Bases of National Education (LDB 9394/96) and the National Curricular Parameters (PCN).

From the general skills, the content relation built provides an indication of what is to enhance in this Olympics, serving as guidance for the development of questions (puzzles) from different fields of knowledge. The intention is to see how the knowledge constructed by the participant may be effected trough the demonstration of their: judgment autonomy, attitudes, values and procedures before problem situations that are as close as possible the actual conditions of social life and of individual and collective work.

4.4. OPERATION

OJE mechanics are very simple. In the beginning of the academic year, students and teachers work together in order to form into teams e apply for the competition in the site of the Project. Each team must have from four to six members, one of them being the captain (Who Will be on charge of receiving e-mails from OjE and helping with the administration and integration of the group), and an "allied teacher".

Following to that, they must pick up a character, which will represent the team inside the game. This will give the team Access to the Master Game, called Around the World (*Volta ao Mundo*), that is the main platform, which operation is summarized in Figure 2, where the participants walk through six different countries in order to know and help preserving the local culture, namely: Brazil, USA, England, Egypt, Japan and Australia. In this journey, the students will meet other characters who will offer challenges, consisting in mini-games e quizzes, addressing academic content from all of the school disciplines. To get to the final round, the teams must have solved the greater number of challenges, in all the different levels of complexity.

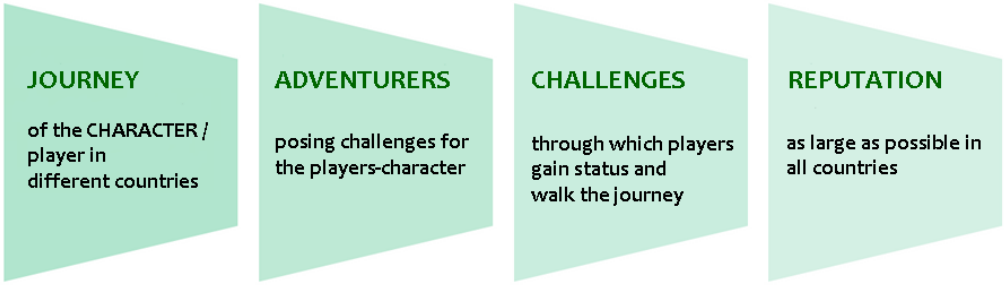


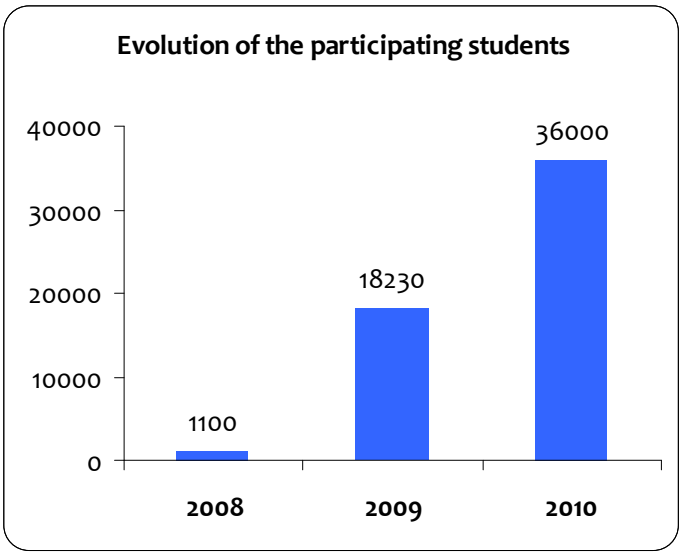
Figure 2 – The Master Game Operation

The intention of OjE's the development team was to create games which are at the same time entertaining and valuable, helping the students to build critical thinking, hypotheses construction skills, narrative construction, problem solving strategies and collaborative working. As an example, one of the fifteen games now available is based on the mechanics of a classical game (River Raid) and is called IMUNO. It addresses content related to the discipline of biology. In the game, he player controls a miniaturized battleship inside the human body which must destroy all the harmful organisms (such as some bacteria and viruses) and preserve healthy cells (such as red blood cells). The student will have to be able to identify different types of cells and organisms inside the various systems within the human body, as well as comprehend health issues, such as disease transmission, healthy nutrition, etc.

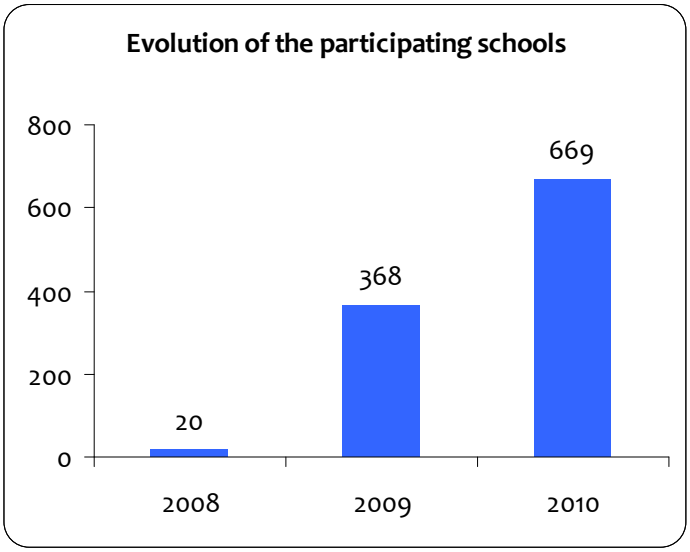
The games were created with the clear purpose of combining the need of gaming skills (dodging objects with the ship, aiming and shooting) and academic skills and knowledge. If the students do not have both types of skills, they may not form a competitive team. However, gaming skills alone are not enough to make the team acquire higher scores. The specific content-related knowledge required both in the action game (identifying the proper type of cells, for example) or in the quizzes' questions, is essential to a good performance. The desire to be better in the overall rank and acquires high scores will stimulate and encourage students to study the academic content on order to perform better in the game.
By the end of a period of three to five months, the teams with higher scores among all the schools, separated in categories by level of education (primary, secondary), play the finals. This event can occur online or in person, depending on the decision of the State Education Department.

4.5. RESULTS

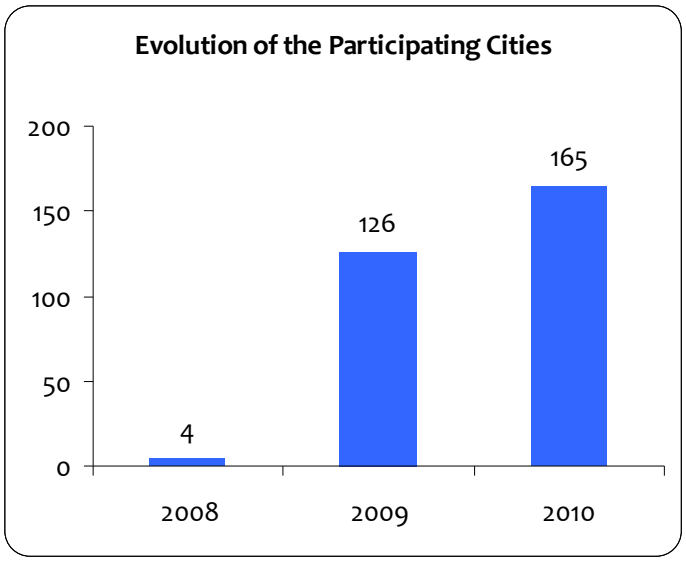
Since when first implemented in 2008, this project is being acknowledge as an innovative benchmark to other states in Brazil, especially because of being easy to replicate in any region of the country, depending only on computers and internet infrastructure. The Graphics bellow shows the degree of participation that increased in the past three years. In 2008, 1000 students from 20 schools in four cities participated in the competition; in 2010, this number boosted to 36 thousand students from 669 schools, spread across 165 cities. Such an exponential growth is not the only evidence of the good outcomes of the initiative. In a telephone survey, people involved in the previous editions stated that they feel more motivated and are putting greater effort in studies after the competition.



Graphic 1 - Students Participation



Graphic 2 - School Participation



Graphic 3 - Cities Participation

Some numbers:

Administrators:
- 88 percent considered OjE an excellent initiative that raised the student's interest in studies;

Teachers:
- 77 percent reckon that OjE stimulated collaboration among students e increased their interest;
- 70 percent discussed the solution of the puzzles with the teams;
- 46 percent increased the time they used computer cluster rooms;
- 41 used OjE's topics in the classroom, during lectures;

Students:
- 68 percent said to have their interest in studies raised;
- 41 percent increased the time they used computer cluster rooms.

4.6. REPLICATION

This look at the educational indexes as something that can be changed for the better with a coordinated effort to create innovative mechanisms that contribute to this growth through the strategy of inclusion of animated educational games for a healthy competition between students was so successful in Pernambuco that drew attention of the state government of Rio de Janeiro.

Through the Secretary of State for Culture (SEC), the government of Rio de Janeiro has partnered with the Education Secretariat of Pernambuco (SEEDUC) and the Porto Digital to enable the realization of OjE in the state. The first edition of the competition occurred in 2010 and had 24 schools and 2000 students' participating. Thus, the Recife and Rio de Janeiro's Olympics, together, involved 98.000 students and 4.000 teachers.

4.7. THE JOYSTREET – A STRATEGIC PARTNER MODEL

Joy Street, specialized company in educational technologies, founded in January 2010, was the natural fruit of a partnership initiated in 2008 by a group of gaming companies in the subcluster of Porto Digital. This group of companies has organized a consortium to design, develop and operate the OJE.

In 2008, after signing a management contract with the Department of Education of Pernambuco, NGPD promoted an intense articulation of ICT cluster, more specifically between the companies of the games sub-cluster, which originated a selection process to elect the company or group of companies better able to design, develop and operate innovative solutions requested by the management contract.

The winning consortium of companies was formed by four companies: (i) Meantime Mobile Creation, specialized in development of games for mobile platforms, (ii) Jynx Playware, specialized in the development of serious games and advergames, (iv) Manifesto Game Studio, which is specialized in casual web games, and (4) C.E.S.A.R. – *Centro de Estudos e Sistemas Avançados do Recife* (Centre for Advanced Studies and Systems of Recife), a renowned institute of research and innovation.

The success of this innovative educational proposal, and the identification of new business opportunities has led companies to transform the consortium into a new company dedicated to exploring all the expertise developed by the consortium and that inherited, beyond all the human capital involved in the original project, a set of processes, technologies, tools and content that make OJE and its platform an innovative product without equivalent in the world. Thus, the performance of Porto Digital was decisive in forming a new partnership model that provides acceleration of growth in high technology companies.

5. CONCLUSIONS

Considering the various actors who interact in the ecosystem of a technology park, the figure of governance is vital not only in promoting the development of environmental technology, but in the growth of high technology companies and in the region as a whole. The management unit of the park, as NGPD, is capable of converging actions of various actors and of mediating their strategic relations of interest, contributing to the implementation of public policies for a common well. That was the object of this article. Through building a model of strategic partnerships involving actors from various kinds conducted by an organization dedicated to the implementation of public policies, various projects for development of a region tend to success.

6. POLICY IMPLICATIONS AND DIRECTIONS FOR FURTHER RESEARCH

The educational looks indexes as something that can be changed for the better with a coordinated effort to create innovative mechanisms that contribute to the growth of a determined region.

This strategy can serve as an example that can be replicated to attend diverse objectives from the Government where the technology can help. In most of the cases the Academy should be an important partner to map these objectives with the best scientific information available and the state-of-the-art in the area of work. As the technology is transversal to the most kind of existent sectors, it should be easier to apply technological innovation to help the Government to achieve their goals, either in education, health, safety, economy or any other sector of interest.

7. REFERENCES

[1] AT KEARNEY. Desenvolvimento de uma Agenda Estratégica para o Setor de “IT Off-shore Outsourcing”. Brasília, 2005.

[2] ASSOCIAÇÃO NACIONAL DE ENTIDADES PROMOTORAS DE EMPREENDIMENTOS INOVADORES. Panorama de Incubadora de Empresas e Parques Tecnológicos 2006. Brasília, ANPROTEC, 2005. Available at < http://www.anprotec.org.br/ArquivosDin/Panorama_2005_pdf_11.pdf> Accessed June 29, 2009. 15:32:57

[3] INSTITUTO NACIONAL DE ESTUDOS E PESQUISAS EDUCACIONAIS ANÍSIO TEIXEIRA. at http://sistemasideb.inep.gov.br/resultado/ Accessed on December 10, 2009.

[4] WIKPEDIA. Parque Tecnológico. Available at <http://pt.wikipedia.org/wiki/Parque_Tecnol%C3%B3gico>. Accessed on August 10, 2009. 10:11:57 AM

[5] ETZKOWITZ, H.; LEYDESDORFF, L. (1996). The Triple Helix University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development. Amsterdam/New York. New York. USA