

Solving Social Research Problems in Latin America and the Caribbean: Creating Technological and Research Capabilities with Action Research

Lucia Patricia Carrillo Velázquez

Abstract—In order to participate in the global world through designing and proposing the use, appropriation or development of technologies to solve social problems, Latin America and the Caribbean, and Mexico City in particular, require an increased development in scientific and technological capabilities in order to thus enhance opportunities for more and higher quality knowledge representation. Action Research, a knowledge construction process in the context of collective problem solving is linked to Telematics Technology because it makes possible the creation and operation of the necessary virtual context for the researching-teaching-learning interaction process in the transformation process of the action scheme. The action scheme is explained from a constructivist perspective as the theoretical basis for a social science academic group that transforms the capacity to design technological prototype software application during the solution of a research problem. In particular, we describe the TIDI-LAOMS prototype, which is fundamentally our study instrument, designed through Action Research by the analyzed group in Mexico City, and used as a virtual context and interaction means in the knowledge construction process of the same group.

Index Terms—Action research, technology & education; social & telematics research; technological capabilities in latin america and the caribbean.

I. INTRODUCTION

Social transformation triggered by the evolution of science and technology must ensure sustainable development. It must also meet the basic needs and rising aspirations of the inhabitants of a region, and ensure employment availability in the face of technological changes. Latin America and the Caribbean, however, have reported low levels of attention to science and technology.

The region is considered one of the most inequitable regions in the world since the little attention that is given to science and technology focuses on small segments of the population.

Since the academic context is one of the areas that is transforming in contemporary society, strong scientific and technological development is required to help counteract

social inequality. In our case, because at a national level Mexico has lost a major part of its capacity to compete internationally, it needs more than the 16,598 researchers recorded by the National Research System in 2010. Mexico thus needs more than the current annual number of students graduating from PhD degrees. (Figure No. 1)

In general, explaining, discussing and finding solutions to this situation requires a solid education in science and technology that promotes democratic citizen participation aimed at achieving both the common good, and a valuable and fair country.

Knowledge development in particular is required for technology use, appropriation, research and development. In the current situation, however, it is necessary to observe the interrelationships in the social system as a complex system in order to thus promote interdisciplinary studies and generate knowledge from the perspective of action around social phenomena.

For these reasons it is top priority to promote the development of technological capabilities among researchers and faculty members in order to influence the transformation of the current situation in Mexico City and the country as a whole, particularly considering their responsibility for training students and new scientists.

II. ACTION RESEARCH AS AN ACTION SCHEME RECONSTRUCTION PROCESS IN KNOWLEDGE CONSTRUCTION

We understand Action Research (AR) as a perspective to practicing the teaching-learning process. It is characterized by dynamic processes of knowledge creation based on reflective analyses and action transformation aimed at problem solving. [10][15]

“AR is an iterative process involving researchers and practitioners acting together on a particular cycle of activities, including problem diagnosis, action intervention, and reflective learning.”[1] “When the researcher intervenes, the researcher becomes part of the study”.[2] “This paradigm is conceptually and methodologically framed using different related and connected terms, such as action-case research, collaborative research, or interactive research. Common to all AR is that it is focused on design and intervention, and it has been argued to be an ideal approach for the Information Systems field”. [14]

The AR context is characterized as a debate space in which to analyze, create and reformulate knowledge vis-à-vis researchers’ need to generalize conceptual and methodological paradigms.

Manuscript received September 20, 2011; revised September 30, 2011.

Lucia Patricia Carrillo Velázquez is a PhD in Administration Sciences, MA in Computer Engineering. carrillopatricia4@gmail.com Torre II de Humanidades, piso 6, cubículo 619. Ciudad Universitaria, México. D.F. CP 04510.

Unam-ceiich-dgapa-papime/pe304909
Unam-ceiich-dgapa-papiit/in308309 project.

project;

Fig No. 1. Research on Mexico

Year	Total Population	Population (30-39 years)	Registration tag ^[12] (PhD)	Graduating ^[12] (PhD)**	Researchers (National Research System)
2000	97 483 412 ^[11]	25 551 962 ^[11]	8 407		7 466 ^[17]
2005	98 208 532 *	n/d	13 081	1 910 ***	10 904 ^[17]
2010	112 336 538 ^[10]	16 763 785 ^[11]	n/d	n/d	16 598 ^[18]

* Estimated

** Average 5 years to PhD graduating.

*** Data show graduating of registration tag five years after.

n/d: no data

This context is essential to multidisciplinary research. It encourages the usefulness of work among experts from various disciplines, including technology.

Technologists learn social topics and at the same time analyze the development of technological capabilities, while sociologists learn about technology and at the same time analyze social phenomena.

The learning result is visible when the research group acts together to develop an instrument for technological research.

AR considers action as a resource to observe learning processes because acting in relation to an object of reality is the manifestation of a cognitive stage called Action Scheme (AS).

“It seems to be characteristic of practice-based knowledge that it is personally experienced. The corporeality of knowledge means that no action is possible without a body, that there is no divide between the outer and inner worlds, and that self-consciousness is a cornerstone in professional practice.

This concerns all the actors - researchers, practitioners and users - who enter into action.”[15]

Piaget [7] explained the transformation process of this AS in the theory of genetic epistemology. García [8] observed it as a complex system in the theory of constructivist epistemology.

AS is described as an organized whole, the components of which define individual action in relation to objects in the environment in terms of the motor, sensory, perceptive, affective and volitional functions. The organization of a whole is the result of a dynamic interaction, differentiation and successive integration process. [7]

“By continuously reconstructing the concepts, we understand the present and project into the future in order to be able to act. Thought processes make re-conceptualization possible and routines can be a possibility as they are a core feature of the action scheme when it breaks down reflection, and is called into play in order to get the action going again.” [15]

The process of transforming the AS is possible through object assimilation, which is the result of repetitive subject-object interactions.

The AS builds interpretative tools that enable humans to grasp external objects. Those tools adopt an organized structure with linked and coordinated information called significance logics. The interpretations suppose previous constructs, in turn given by previous structures.

Interaction is thus fundamental in knowledge construction processes because it promotes the understanding of the different objects of reality, making it possible to grasp

external concepts as “the other”. Social processes are based on human links built with interactions. Information and Communication Technology (ICT) is thus a fundamental tool as a means of interaction because it makes interactive virtual contexts possible.

Located within this framework and in the context of formal interdisciplinary research, AR is assumed to be the result of a permanent and dynamic open process of restructuring meanings and relationships that emphasize perspectives and actions from other fields of knowledge.

In our case, we are interested in observing technological advantages as means of interaction and virtual context in the AS transformation process when the technological capacity is the AS that we need to transform.

AR as a strategy is assumed to promote the transition of Action Schemes in individual and collective cognitive structures when a group interacts during the search for a solution to a problem. Therefore, the creation and transformation of technological capabilities was studied in an academic group using AR as research methodology.

III. THE SOCIAL SCIENCE RESEARCH PROBLEM

Because social scientists throughout the world have studied events linked with collective action and social movements, it is necessary to study and analyze the ideas guiding the theories and methodologies used to understand and explain these phenomena.[6][9]

Social organizations or collectives have their own objectives, strategies and structures, which is an interesting research topic. The way this topic is taught reveals the professor’s concepts and imaginary.

As established by the functional structure of the Universidad Nacional Autónoma de México, the activities that researchers carry out include the teaching of subjects linked to their scientific field.

For that reason our interest in current social phenomena and the technological context led us to create a multidisciplinary research group to study three parallel dimensions. The first dimension is to grasp the historical process through which social movements and action developed; the second dimension is to get to know the perspective, theory and methodology used for the study and how professors teach the subject to students; and the third dimension is to observe and develop capabilities for technology use, appropriation or development in social research. [5][6]

In this paper we specifically describe the telematics prototype as a preliminary result of the third dimension of our

study.

IV. TELEMATICS PROTOTYPE TO OPERATE ACTION RESEARCH

“AR encourages researchers to experiment through intervention and to reflect on the effects of their intervention and the implication of their theories.”[1]

We intervened and observed the AS transformation process in a multidisciplinary group in which the researcher-professor and students interact because “the conventional systems analysis approaches, such as structured analysis and data, emphasize the <<hard>> aspects of the

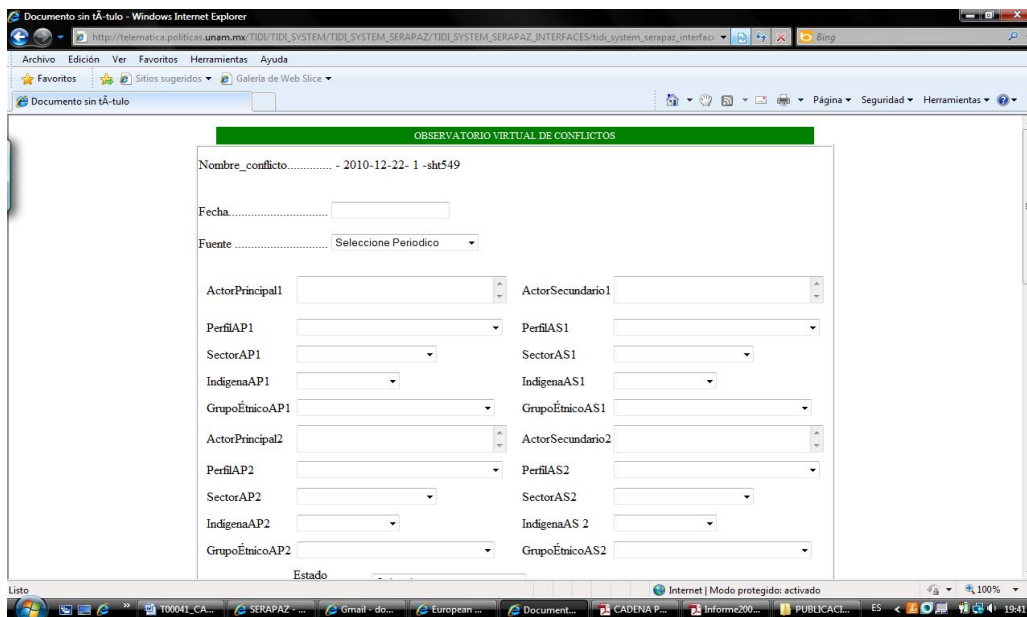
problem domain, but system analysts need to apply their craft to problems that are not well defined.”[1]

With the AR, technological capacity is transformed and at the same time the group solves a theoretical-methodological research problem, that is, their understanding of categories of the activity of Mexican social organizations is transformed as they learn to develop a telematics observatory.

To simultaneously solve this problem, they conduct Research (R) in social and technological topics and they Act (A) to reformulate concepts, theories and methodologies and to design the telematics prototype in order to make them explicit.

Figure No. 2 shows preliminary concepts.

Fig. No.2.Disciplinary Logic of significances and Categories of Analysis Activity of Mexican Social Organizations TIDI-LAOMS. Telematics Platform



Carrillo V., L. Patricia. 2010.

<http://telematica.politicas.unam.mx/LAOMS/laoms.html>

© TIDI-LAOMS. CARRILLO-UNAM, 2010. INDAUTOR:03-2010-061711595400-01

The research group started to use the word “conflict” to express “the open confrontation among two or more organized groups, named social actors because they have different perceptions of a real situation.” [16]

The word was used by a research sub-group representing an AS of a discipline. Other sub-groups proposed that their AS was expressed through the word “collective action”. It means: “social decomposition processes in constitutive elements and their re-composition in new organizations”.[6]

The telematics platform has to be re-developed due to different explicit concepts, but it enables collective observation and analysis around implicit conceptual elements that link the significances on both conceptions: actors find social transformation and use different manifestation types.

Telematics platform design and development is an interactive means to make explicit and transform the significance logics of a discipline, and it results in a multidisciplinary AS because the research group understood a new concept: “social event”. At the same time, it is an

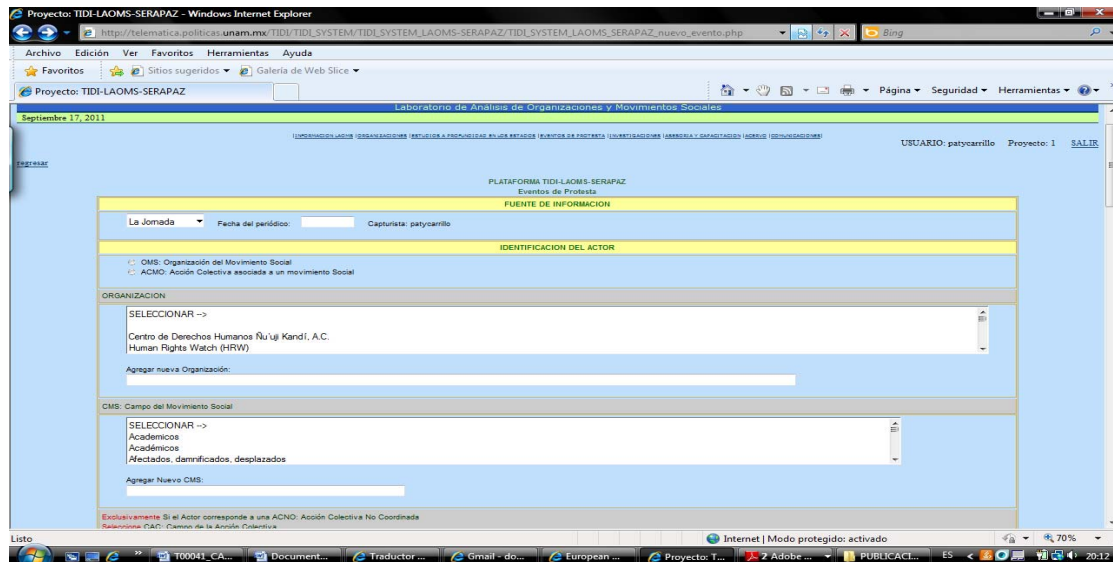
element to qualify social movements and the informatics data on the technological platform.

The qualifying concepts are: social movement organization, (OMS), collective action associated to social movement, (ACMO), and collective action not associated to social movement, (ACNO). (Figure No. 3)

Therefore, “the system represents applied disciplines, and the related research is often justified in terms of its practical implications. AR can address complex real life problems and the immediate concerns of practitioners.” [1]

We emphasize it because the telematics prototype is our instrument to learn and teach social movement topics from a scientific basis and is our instrument to study the social research dimensions because it is an explicit representation of research results. This is due to the fact that the platform was designed in the AR by the analyzed group and at the same time is used as a virtual context and means of interaction to attain knowledge construction in individual and collective cognitive dimensions.

Fig No. 3. Software Application for Social Research TIDI-LAOMS. Telematics Platform



Carrillo V., L. Patricia. 2010.
<http://telematica.politicas.unam.mx/LAOMS/laoms.html>
 © TIDI-LAOMS. CARRILLO-UNAM, 2010. INDAUTOR:03-2010-061711595400-01

We consider that it is a research result because interaction is fundamental in knowledge construction processes, as it promotes the understanding of different objects of reality, making it possible to grasp external concepts and therefore understand them like “the other”, transforming an individual AS into a collective and multidisciplinary AS, thus making it possible to analyze and solve social phenomena from an interdisciplinary perspective. Finally, we are impacting the capacity Mexican students, researchers and professors have to compete in two dimensions: a) they are capable of technology use, appropriation, and design development, and b) they understand that interdisciplinary studies need to study interrelationships in highly complex social systems.

AR is evident from Figure No. 3, which shows a prototype that the group uses as a means of interaction. It is an explicit representation of knowledge created in the social and

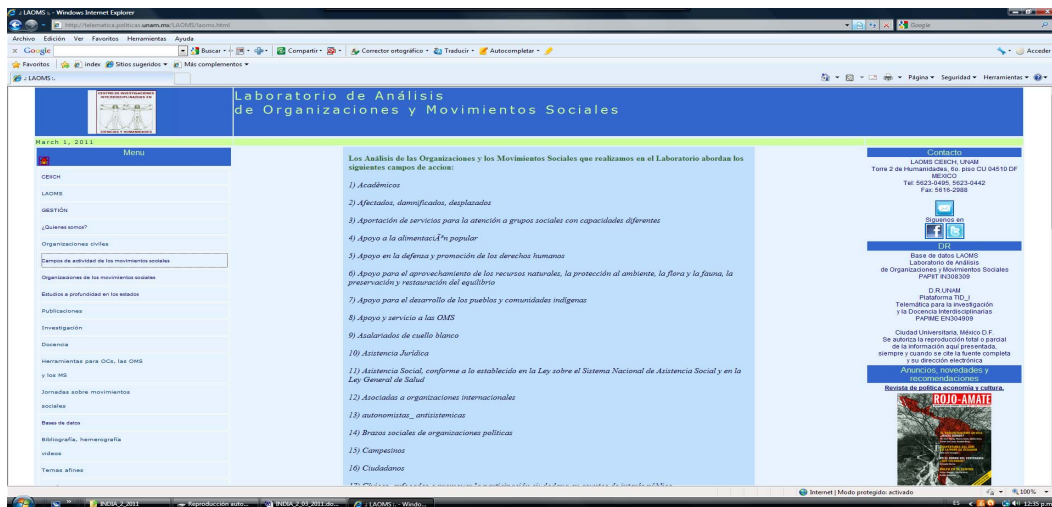
technological dimensions of our study and at the same time it shows the new concepts used as classificatory criteria.

AS transformation is observed in Figure No 4 that shows the designed prototype as a technological development in software application.

Finally, we considered the telematics platform as a research instrument in two different ways: a) for social research, because it makes it possible to observe a social phenomenon, and b) for educational technology, because it makes it possible to observe the learning-teaching process from an Action Research perspective.

We also considered the platform as an intangible resource, because it is an academic and technological product that can be registered as an academic organization’s intellectual capital and as a research group’s intellectual property.

Figure No.4. Interdisciplinary Action Scheme and Categories of Analysis Activity of Mexican Social Organizations TIDI-LAOMS. Telematics Platform



Carrillo V., L. Patricia. 2010.
<http://telematica.politicas.unam.mx/LAOMS/laoms.html>
 © TIDI-LAOMS. CARRILLO-UNAM, 2010. INDAUTOR:03-2010-061711595400-01

REFERENCES

- [1] D. Avison, et al. *Action Research*. Communications of the ACM. Vol. 42. No. 1. January 1999.
- [2] R. Baskerville. *Investigating information systems with action research*. Communications of the Association for Information Systems. Vol. 2. October 1999.
- [3] P. Carrillo. *Sociedad del conocimiento. Academia, complejidad, administración y tecnología*. Mexico. Facultad de Ciencias Políticas, Universidad Nacional Autónoma de México. 2008.
- [4] P. Carrillo. Las publicaciones digitales como medio de interacción durante el proceso de construcción del conocimiento. In: *Revista Digital Universitaria*. Vol. 9 No. 8. UNAM. Mexico. 4to Foro de Edición Digital. <http://www.revista.unam.mx/vol.9/num8/art62/int62.htm> [Accessed: February 2009]
- [5] P. Carrillo. Red multidisciplinaria de aprendizaje colaborativo para la gestión del conocimiento, dirigida a transformar capacidades de análisis de la información de fenómenos sociales, basada en tecnología telemática. Mexico. UNAM-CEIICH-DGAPA-PAPIME/PE304-909 Proyecto. Universidad Nacional Autónoma de México. 2009.
- [6] J. Cadena. *El sector de los movimientos sociales en México, 2000-2011 Características, redes y trayectorias*. Mexico. UNAM-CEIICH-DGAPA-PAPIIT/IN308309 Proyecto. Universidad Nacional Autónoma de México. 2009.
- [7] R. García. *El conocimiento en construcción, de las formulaciones de Jean Piaget a la teoría de sistemas complejos*. Barcelona. Gedisa. 2000.
- [8] R. García. *Sistemas complejos. Conceptos. Método y fundamentación epistemológica de la investigación interdisciplinaria*. Barcelona. Gedisa. 2006.
- [9] A. Melucci. *Acción colectiva, vida cotidiana y democracia*. Mexico. El Colegio de México. 2006. p. 11. Quoted by Jorge Cadena during the Seminar on Social Movement and Collective Action.
- [10] J. *El Cambio Educativo desde la Investigación Acción*. 4th Ed. Madrid: Ediciones Morata. 2005.
- [11] INEGI, Instituto Nacional de Estadística y Geografía. *Censo de población y vivienda. 2010*. México. INEGI. 2010.
- [12] <http://www.censo2010.org.mx/> [Accessed: September 2011]
- [13] INEGI, Instituto Nacional de Estadística y Geografía. *Estadísticas históricas de México. 2009*. Tomo I. Sección 1. Población. Cuadro 1.3. México. INEGI. 2010.
- [14] http://www.inegi.org.mx/prod_serv/contenidos/espanol/bvinegi/productos/integracion/pais/historicas10/Tema19_Ciencia_Tecnologia.pdf [Accessed: September 2011]
- [15] INEGI, Instituto Nacional de Estadística y Geografía. *Estadísticas históricas de México. 2009*. Tomo II. Sección 19. Ciencia y Tecnología. Cuadros 19.35 y 19.37. México. INEGI. 2010.
- [16] http://www.inegi.org.mx/prod_serv/contenidos/espanol/bvinegi/productos/integracion/pais/historicas10/Tema19_Ciencia_Tecnologia.pdf [Accessed: September 2011]
- [17] I. Julkunen, Knowledge-Production Processes in Practice Research – Outcomes and Critical Elements. On *Social Work & Society*, Volume 9, Issue 1, 2011.
- [18] https://www.socwork.net/2011/1/julkunen/si_julkujul.pdf [Accessed: September 2011]
- [19] K. Lewin. Action Research and Minority Problems. *Journal of Social Issues*, Vol. 2, Issue 4, pp. 34-46, November 1946.
- [20] SERAPAZ, Servicios y Asesoría para la Paz. *Informe de la conflictividad en México. Enero-diciembre de 2006*. México. 2006.
- [21] SIICYT, Sistema Integrado de Información sobre Investigación Científica y Tecnológica. *Estadística Básica, 2010 y 2011*. Mexico. SIICYT.
- [22] <http://geo.virtual.vps-host.net:8080/SIICYT/bienvenido.do?jsessionid=5527F0FDF1F8176A000A7FC712BF596F> [Accessed: September 2011]
- [23] SIICYT, Sistema Integrado de Información sobre Investigación Científica y Tecnológica. *Sistema Nacional de Investigadores*. Mexico. SIICYT.
- [24] <http://www.siicyt.gob.mx/siicyt/buscador/google.do?busqueda=sni> [Accessed: September 2011]



Lucia Patricia Carrillo Velázquez. PhD in Administration Sciences, MA in Organization Management and Computer Engineering. Universidad Nacional Autónoma de México (National Autonomous University of Mexico). Torre II de Humanidades, piso 6, cubículo 619. Cd. Universitaria. D.F. México. 04510. Tel+55 56230442, carrilopatricia4@gmail.com

National System Researcher, research project manager at the Universidad Nacional Autónoma de México, Centro de Investigaciones Interdisciplinarias en Ciencias y Humanidades. (Interdisciplinary Research Center in Sciences and Humanities) Dissertation: Knowledge Management and Telematic Technology in Interdisciplinary Research and Teaching. She researches the process to promote, create and transform the competitive capacity in all kinds of organizations through knowledge representation. She particularly observes these processes from a perspective of complex system theories and genetic epistemology. She designs, develops and uses technology telematics to operate cases of study. She was Academic Sub-directress at the Postgraduate Program in Latin American Studies (2006-2009) and Project Manager and Head of the Computer Department in Centro de Investigaciones Interdisciplinarias en Ciencias y Humanidades (1990-2000) both at Universidad Nacional Autónoma de México.

Dr. Carrillo has published: The Multidisciplinary Development of a Technological Prototype: National Wetlands Inventory. In Proceedings of the International Conference on Advances in Recent Technologies in Communication and Computing 2001. 2001. Bangalore, India. Knowledge Management Process and Technology Capacity in a Social Sciences Network Research. In Ibrahim Güran Yumuşac. (Ed.) Bilgi Ekonomisi. The Knowledge Economy. Istanbul, Turkey. Prime Ministry of Republic of Turkey-Avci Ofset Matbaacilik. 2010. ISBN: 978-9944-0203-8-1 Comercio electrónico en América Latina. In EEDI/ESID, Estudios Económicos de Desarrollo Internacional/Economic Studies of International Development. Vol. 10, Num. 2. July-December 2010. Galicia, Spain. ISSN: 1578-4479. Sociedad del conocimiento. Academia, administración, complejidad y tecnología. SITESA-FCPyS, UNAM. 2008.