Educational Knowledge Transfer in Indigenous Mexican Areas Using Cloud Computing

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Abstract—This work proposes a Cooperation-Competitive (Coopetitive) approach that allows coordinated work among the Secretary of Public Education (SEP), the Autonomous University of Querétaro (UAQ) and government funds from National Council for Science and Technology (CONACYT) or some other international organizations. To work on an overall knowledge transfer strategy with e-learning over the Cloud, where experts in junior high and high school education, working in multidisciplinary teams, perform analysis, evaluation, design, production, validation and knowledge transfer at large scale using a Cloud Computing platform. Allowing teachers and students to have all the information required to ensure a homologated nationally knowledge of topics such as mathematics, statistics, chemistry, history, ethics, civism, etc. This work will start with a pilot test in Spanish and initially in two regional dialects Otomí and Náhuatl. Otomí has more than 285,000 speaking indigenes in Queretaro and Mexico´s central region. Náhuatl is number one indigenous dialect spoken in Mexico with more than 1,550,000 indigenes. The phase one of the project takes into account negotiations with indigenous tribes from different regions, and the Information and Communication technologies to deliver the knowledge to the indigenous schools in their native dialect. The methodology includes the following main milestones: Identification of the indigenous areas where Otomí and Náhuatl are the spoken dialects, research with the SEP the location of actual indigenous schools, analysis and inventory or current schools conditions, negotiation with tribe chiefs, analysis of the technological communication requirements to reach the indigenous communities, identification and inventory of local teachers technology knowledge, selection of a pilot topic, analysis of actual student competence with traditional education system, identification of local translators, design of the e-learning platform, design of the multimedia resources and storage strategy for "Cloud Computing", translation of the topic to both dialects, Indigenous teachers training, pilot test, course release, project follow up, analysis of student requirements for the new technological platform, definition of a new and improved proposal with greater reach in topics and regions. Importance of phase one of the project is multiple, it includes the proposal of a working technological scheme, focusing in the cultural impact in Mexico so that indigenous tribes can improve their knowledge about new forms of crop improvement, home storage technologies, proven home remedies for common diseases, ways of preparing foods containing major nutrients, disclose strengths and weaknesses of each region, communicating through cloud computing platforms offering regional products and opening communication spaces for inter-indigenous cultural exchange.

Keywords—Mexicans indigenous tribes, education, knowledge transfer, cloud computing, Otomí, Náhuatl, language.

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I. INTRODUCTION

MEXICO has more than 125 million inhabitants, making it the 11th most populated country in the world, with 81.72 million people between 14 and 65 years of age, who are potentially active in the generation of Mexican wealth. The Educational System has the challenge of generating 1.4 million well prepare professionals each year. Furthermore the effort must reach all and every corner of the country. [1]

Among the factors that hinder the growth of developing countries, one of the most critical is the disparity in education from basic to high school with consequences of extreme poverty and high crime rate. Now if you have more than 13 million Indigenous which counts for 10.4% of the Mexican population [2], [3], where they speak native languages, predominantly Náhuatl with 1.54 million, and in particular in the center of Mexico in an area known as "Bajio" with almost 285,000 Otomí Indigenous who rarely have access to formal education, first by not having sufficient basic infrastructure, and an appropriate strategy for such education, and by having a language barrier.

TABLE I
THE SEVEN MOST SPOKEN INDIGENOUS LANGUAGES IN MEXICO

Indigenous Languages	Total	Men	Women
Náhuatl	1,544,968	754,321	790,647
Maya	786,113	405,504	380,609
Mixteco	471,710	221,655	250,055
Tzeltal (Tseltal)	445,856	221,464	224,392
Zapoteco	425,123	203,126	221,997
Tzotzil (Tsotsil)	404,704	198,507	206,197
Otomí	284,992	137,779	147,213

On several occasions there have been efforts to penetrate massively basic education in all regions, but this has failed due to poor infrastructure and the logistics of training teachers and staff who has followed the program; therefore, it is required that universities and government work hand in hand with the goal of providing a sustainable strategy that will transfer the knowledge in a step by step fashion to the different actors.

Mexican Indigenous population, for centuries, has been forgotten and they have taken actions. They have migrated to large cities in Mexico and in other countries, causing serious problems in their regions and in those cities. The search for better opportunities and a better standard of living has caused families to explode or disintegrate, mainly because men are the first to migrate and often times they don't return leaving back homeless families in rural communities.

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The project of knowledge transfer proposes a gradual but sustainable strategy for members of those families, which could offer them better tools, methods, forms of work, even from childhood, and ways that could be used for the growth of their tribes or communities, creating access to effective communication between them without losing their roots, ways of living, and detonating synergy through the transfer of successful work, thereby improving living standards in the region. For example, the Otomí are one of the largest indigenous peoples in the country, as they are around 285,000 inhabitants, living in two regions of Mexico. The first is the area through the states of Mexico, Hidalgo and Queretaro; the second is smaller and less defined, including the Huasteca Area, north of Puebla and part of Tlaxcala. The most studied region is the first, which is the Mezquital Valley. Their forms of government vary from region to region. And it consists of two main forms civil and religious positions. In Puebla, the supreme authority of the Otomí tribe is the mayor, whose assistant are a civil judge and several "topiles" (police). In Veracruz, with smaller populations, the supreme authority is the local agent, who is appointed by the mayor. In Hidalgo, the supreme authority is the assistant judge, and the judge conciliator. Access to this hierarchy starts with the office of messenger, whose duty is to convey to the people the policies of the municipal authorities.

In the religious hierarchy, there is a "stewardship" and the "captaincy". The stewards dealing with feast of the patron saint and the captains deal with the Carnival. The system has a pyramidal structure: the below are the most and with whom you can have greater access. At the top of the pyramid is the "guardian of the temple", which is usually the oldest man in the village and has gone through all the rungs of the hierarchy and age gives him the power to be the mediator between men and saints.

Knowing all of this you can highlight the importance of reconciling the transfer of knowledge in different cultures both civil and religious; it is very difficult if you do not have the consent of the leaders of the community.

Coupling this with what was said by the UNICEF; Mexico "still faces greater challenges. More than half of children in the country live in poverty. More than six millions of children and teenagers are out of school and three million work". UNICEF will not end its work in Mexico to ensure that all children and adolescents without exception have guaranteed all their rights. But this will only be possible with the combined efforts of all sectors of society." [4].

II. Procedure

This paper is based in a non-experimental, transactional, exploratory – descriptive [5] research where a strategy allows involvement of all actors, taking gradual achievements in less than 10 years, working with children from 10 years until 15 years of ego, emphasizing 13 years old kids they may provide substantial knowledge in such important areas as finance, agriculture, marketing and communication. This proposal raises a team for taking a geo - referenced population in order to be able to follow up on the progress of knowledge transfer and the work performed in the productive part of the community.

The strategy to follow is the integration of a tripartite team where researchers from academia, rural teachers and regional commissioners, can establish the real needs of the community, giving rise to the definition of what knowledge must be transferred from the university to the local trainers and then to young Indigenous.
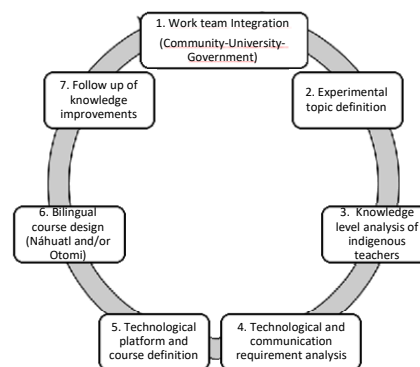

Fig. 1 Knowledge Transfer Strategy for Rural Communities

III. Development

Within the geographical Latin-Iberoamerican, there are 7 different categories of entities, Major Metropolises, with more than 1,000,000 people, Metropolis 100,001 to 1,000,000 inhabitants, cities of 10,001 to 100,000 inhabitants, Villas of 1,501 to 10,000 inhabitants, towns from 151 to 1,500 people, villages and hamlets of 15-150 people, isolated farms and isolated houses [6]. In towns, villages and farms is where you can find native Indigenous of the region that have not been influenced by colonialism, with a very particular social structure under schemes of customs, and controlled by the commissioners or village chiefs. This causes a certain secrecy in these communities in all aspects, both in knowledge and culture, by not allowing the introduction of technologies, new ideas or successful ideas in nearby communities. Then the challenge is to be able to integrate this indigenous population to work with historical paradigms in order to be invited by them to transfer then new knowledge, thereby allowing work on areas that would improve its economy, highlighting the cooperation between communities, transferring best practices, tools and methodologies of the community or acquired with the program proposed in this paper.

The purpose of this research is to work in seven coordinated and cyclic areas.

A. Team Formation (Community-University-Government)

Towns, villages and farms have a close structure society that is why it is imperative to be an excellent negotiation with the tribe leaders, whom would allow the integration of knowledge transfer, for this it is vital to form a multidisciplinary team with staff from the community, state government and university. This step is critical and without it the project cannot go forward. Because the acceptance of

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conformity for the transfer of new knowledge through the usual methods, must be sold very well justify the advantages of having this and also being very specific in what will be deliverable and what will this bring to the community. There will need for interpreters of academic background so that it would be easy to translate to the local language of the town, being very precise in terms.

Something important is to establish a single channel for dialogue between the external team of the university, the government and, the indigenous members of the region supporting hierarchies and establishing a better and greater participation and responsibility of the indigenous leader.

B. Definition of Experimental Field

There are several types of organizations where there are indigenous people in Mexico and some are more hermetic than others depending on the geographical area and the depths of the forests and jungle; the southern region is characterized by a very dense vegetation where it is physically impossible to enter without knowledge of the region, in contrast to the north of the country the vegetation is different, and there are great plains, deserts and wooded areas which allows getting familiar with the regions of different communities. These two poles have similarities in their societies as already noted, both organizational and religious. The latter has a very strong weight in the decisions of the community and the first in all matters relating to uses and customs. In most of the cases their customs are different form parameters and strategy of the federal government.

It is proposed to start this program in areas near metropolis, so that the implementation team could acquire experience, correct concepts and forms over time, so that little by little we would find the way to work with populations with greater cultural roots, where greater difficulty for negotiating and paradigm shift is expect. It is important to follow this method as having success stories with less hermetic populations can be taken as an example for other more distant and hermetic.

Fig. 2 Indigenous girls in the Chiapaneca jungle

C. Analysis of the State of Knowledge of Indigenous Trainers

Although there have been great efforts in Mexico in the training of all indigenous people under the Special Program for Indigenous Peoples 2014-2018 [3], we need to identify indigenous trained staff that has knowledge of the native language and Spanish as well as teaching, computing, and be able to establish effective negotiations for knowledge transfer.

While in past years the efforts of mi-compu.mx program had the idea to enter relevant, cultural and linguistically contents with intercultural features for children across the country, working on materials in math, science, English and Spanish; this program started in 2014, it has presented some failures especially in the computer equipment, and although it has been given a greater emphasis on equipment than technology transfer, the program still continues in Mexico. Therefore, initially it is required screening and training of personnel in this bilingual Náhuatl and Otomí vs. Spanish language for the initial team, to play both roles as negotiators and multimedia design helpers in both languages.
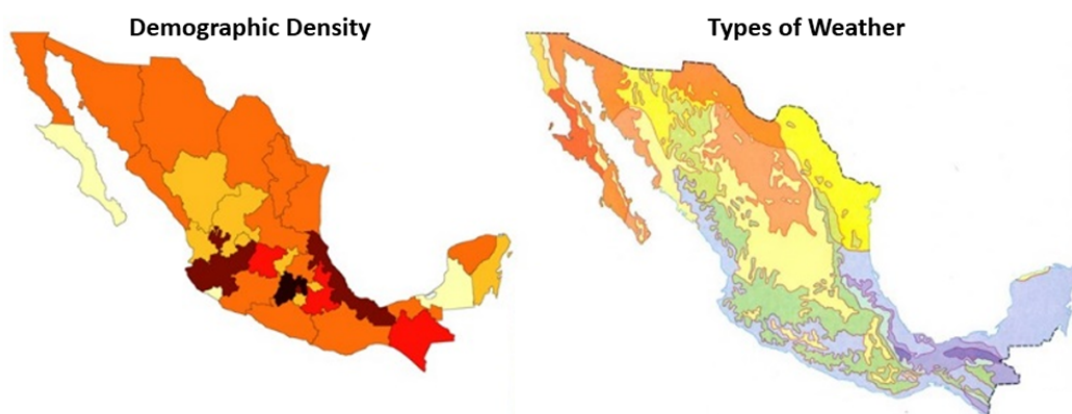

Fig. 3 Mexico´s Population density and Climate

D. Communication and Technology Requirements Analysis

The Mexican territory has 1'964,375 km^2 and 3,149,920 km^2 of sea surface, having its greatest population density in the south-central part with dry and wet areas as seen in the following illustrations, the Mexican Geography / topography is very diverse.

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Mexico´s topography with the steepness of the mountains and the valleys make it particularly difficult for technological access today. It is important to identify geo-position of the different entities in order to establish communication strategies and ensure energy supply and connectivity, as it can be seen in Fig. 4.

Fig. 4 Technological and communication elements for coverage

E. Definition of Courses and Technological Platform

When the first 4 initial stages were solved it is time to define in a multidisciplinary and consensual manner with all the team members, the courses to prepare, so that they have basic knowledge, tools and technological methods to ensure increasing productivity improvements that can be incorporated in the community, and besides all that there is knowledge transfer through work interaction between participants and members of the community out of the training program.

Courses should be prepared by university staff, in conjunction with the indigenous team, and the interpreter, to ensure that the knowledge embodied there is really of interest, and especially useful for the community. The use of technology platforms, such as e-Learning, allows for the course to be replicated and track remotely, so that it can be improved depending on implementation results. The introduction of this strategy will be as discussed, from "easy" communities to remote and more complex regions that are further away from "civilization".

Fig. 5 Technology integration and knowledge transfer

F. Design of Bilingual Courses (Náhuatl and / or Otomí)

The multidisciplinary courses will be bilingual in both Náhuatl and Otomí, highlighting the work of idioms, customs and uses, as well as culture and religion in the area, enabling greater empathy of the courses with trained people.

Fig. 6 Náhuatl young father with his family

Importantly, the courses should be made in a way that they actually have use in the community such as: better farming practices, planting and harvesting techniques, financial methods in collaborative work, high performance teams, basic math, Spanish, organization, communications, etc. all without hurting their customs, also the interpreter and the team should be very careful in the course content.

G. Monitoring Knowledge Progress

The university and government team should put special emphasis on program monitoring through performance indicators, such as tests of participant's knowledge, projects developed for and with the community, computing and communications team performance. An important part of the proposal is the intervention of commissioner of the town in order to conduct an analysis for anchoring government resources and with the knowledge gained via the program, performs tasks of global and sustainable improvements in the area; furthermore, over time they can make such improvements together with neighboring communities.
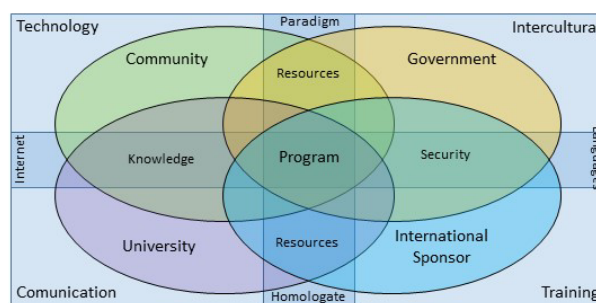

Fig. 7 Proposed interaction of actors in the Model

The interaction between the different actors of the model (program) can be seen in the illustration below, where the cooperation that exists between them is an important element in the program.

IV. RESULTS

The results should be expected in stages, which is why the strategy of the 7 steps is very timely and should be done tactfully and agreed by all the commissioners of the population.
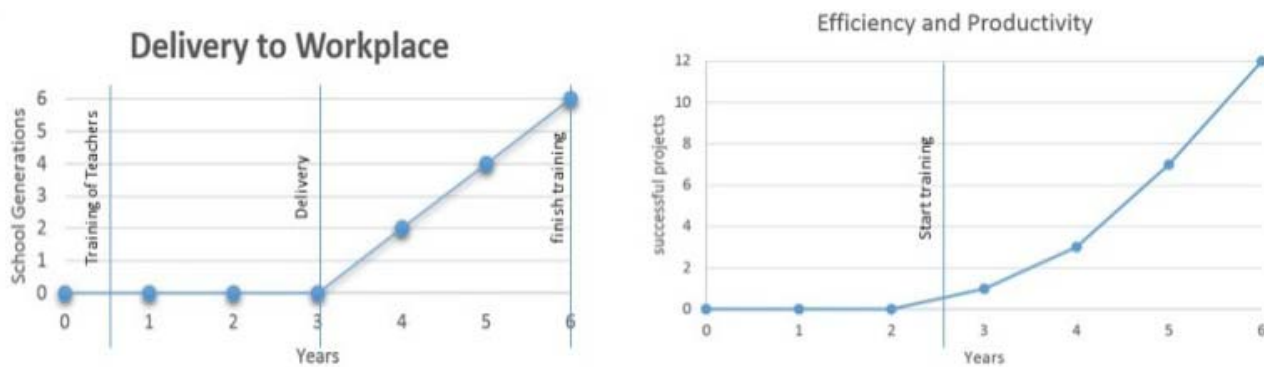
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Fig. 8 Release the workforce and expected increase in efficiency and productivity

TABLE II
RELEASE STRATEGY ON THE FIELD

		2	4	6	Generation into workplace
	Years	1	2	3	
Training of teachers	0	Years old students			
	1	10			
	2	11	10		
	3	12	11	10	Start project with teacher
Pre delivery to workplace	4	13	12	11	
	5	14	13	12	
	6	15	14	13	Delivery to workplace

The expected results in number of generations released to the workforce with new knowledge goes from the fourth year of the project, since the first year is to train teachers and implementation of technological systems and communications in the area, after two and a half years, students together with their teacher may take some projects required in the community in order to experiment with the student generations and new knowledge. We must remember that these projects are not only 100% school, and projects should always involve the community in general. After six years, students are released and may carry out such projects without help from the teacher, but always advised by the government agency sponsoring the program, and this must be sponsored by an international organization like UNICEF, OECD or another to ensure continuity.

V. CONCLUSION

In Mexico, it is urgent to have education at all levels: a large population of homeless Indigenous people is immersed in a nation with major structural problems, but with great encouragement to succeed. This is a proposal to introduce new technologies in their own work of indigenous communities. This cause these communities to increase their efficiency and productivity with their own hands, aided by regional, state, federal and international entities and advised by a university to guarantee approval, transfer and bicultural understanding of knowledge. This model requires to ensure its permanence so a robust implementation of technological and communication elements should be done as well as a timely monitoring of progress in the program's achievements, such as number of students, permanence in the program but mainly projects successes within the community and many projects later transferred to sister communities. It is important to highlight that due to the unique characteristics of indigenous people in Latin America, it is a key pre-requisite to have consensus among members of the working group, to achieve real and sustainable objectives in the community.

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