

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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### 3. SUMMARY FOR MIKC PHASE 1

At the beginning of the program “Monterrey: International Knowledge City” (MIKC), important and concise commitments were required in order to detonate an economy that would create, generate, transmit and apply knowledge more effectively and would accelerate the economic and social development of Nuevo Leon’s community. Those commitments are described in this chapter.

After incorporating **MIKC** as a **strategic project** in the **State Plan of Development 2004-2009**, Phase 1 was implemented. It focused primarily on the implementation and institutionalization of a series of promoting actions (described in Chapter 2) that began when the first **State Law for Promoting Knowledge-Based Development** became effective; formalizing the conceptual **Triple Helix model** for the coordinated work between the state government and the academic and productive sectors of Nuevo Leon; the **signed agreement for the promotion of MIKC**, and finally the **creation of the Innovation and Technology Transfer Institute (I<sup>2</sup>T<sup>2</sup>)** as the entity in charge of promoting and coordinating this program .

The actions that were implemented during Phase 1 were directed towards a central objective: **the transformation of Nuevo Leon into a Knowledge society, region and economy. The General Director of the National Council of Science and Technology (CONACYT), Mr. Juan Carlos Romero Hicks, emphasized in April 2008 that: “.... these accomplishments of Nuevo Leon have to do particularly with the foundation of institutions, legislation, the State Council, the Institute for Innovation, the great achievements of the Park, the Knowledge City, the Universal Forum of Cultures, among others.....”<sup>1</sup>.**

The most distinguished actions that had a greater impact during Phase 1 of the MIKC Program are described below in detail. They are identified by the work team of the *Tecnologico de Monterrey* based on the information obtained from different sources of the state government, other public organizations, institutions that participate in the program, and from their own research.

#### 3.1 *Human Capital Education and Development*

The strategy to stimulate technological development and the establishment of knowledge enterprises by strengthening the educational institutions at all levels in order to increase the labor demand in the new areas of knowledge was proposed in the **State Development Plan 2004-2009**.

In addition, strengthening the scientific and technological research areas of the productive sector and of the public and private universities of Nuevo Leon was proposed. It also proposed to train educators that would respond to new challenges

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

and eventually sign agreements with the federal government to design and establish educational programs centered on a knowledge society.

The use of Information and Communication Technologies (ICT's) to develop students' competencies and abilities that are required in today's competitive setting, ever more demanded, was also promoted, while at the same time, supporting those groups of the population that are more marginalized or those from rural areas of the State of Nuevo Leon.

With this conviction in mind, the MIKC Program has promoted quality in education from the basic (compulsory) level to the under-graduate level based on the conceptual model of the Triple Helix. During Phase 1, different programs and actions have been implemented, such as: promoting children's interest and learning of science (including the whole family's participation); increasing the investment in school infrastructure and equipment (especially at the elementary level); the use and application of information and communication technologies (ICT's) in teaching; establishing alliances to guide the curricula of undergraduate schools towards the needs of the new labor market and enterprises, among others.

**Infrastructure and Equipment Investment  
Compulsory Education  
Nuevo Leon  
2004-2007**

Year	Number of Works	Investment (Million pesos)
2004	36	100.785
2005	156	537.747
2006	68	339.076
2007	198	418.592
<b>Total</b>	<b>458</b>	<b>\$1,396.200</b>

Source: ITESM. Self-elaboration with data from State Governance Reports. State Development Plan 2004-2009.

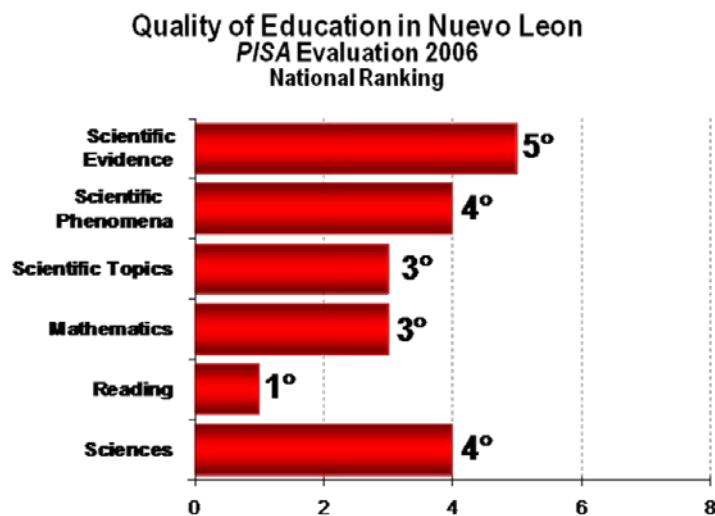
On the other hand, with the **Strategic Educational Agenda 2007-2009**, which was introduced by the state government through its State Ministry of Education (Feb.2007), but with the active participation of the private sector and the educational sector of Nuevo Leon (Triple Helix), the goal was set to **position Nuevo Leon among the first three places nationwide in terms of the main indicators of educational development and among the ten best educational systems in the world<sup>2</sup>**. During the presentation of this agenda, Mr. Jose Natividad Gonzalez Paras maintained that **".....the Agenda, with its goals, general policies and its actions to improve the access and the quality of educational services in Nuevo Leon, represents the insight of what we want**

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

***to be in a short and mid term, as well as what we want to be in the future, in the long term scenario, in 15 or 20 years... ”<sup>3</sup>.***

The **Strategic Educational Agenda 2007-2009** also considers, among its actions, the following: to increase the number of hours students in school dedicate to reading and writing; applying mathematics to solve problems in all fields; the development of comprehension and the use of natural and social sciences methods; stimulating critical and strategic thinking<sup>4</sup>, in order that these actions together represent a detonator for the development and consolidation of the “Monterrey: International Knowledge City” program.

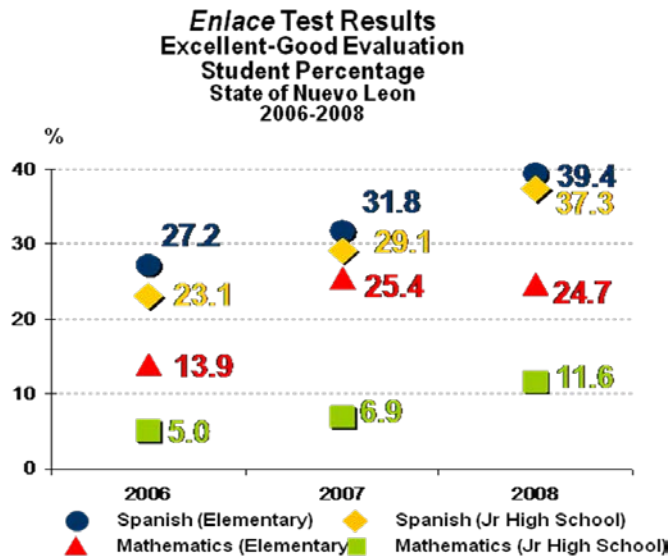
The level in the state educational system has been progressively improving in quality and relevance. This is reflected mainly in the different national and international evaluations which have been recently applied to the students of the State of Nuevo Leon. The results of the PISA test 2006 places local education in the first places nationwide in the subjects of: Science (4<sup>th</sup>); Reading (1<sup>st</sup>); Mathematics (3<sup>rd</sup>); Scientific Topics (3<sup>rd</sup>); Scientific Phenomena (4<sup>th</sup>) and Scientific Evidence (5<sup>th</sup>).



Source: ITESM. Self-elaboration with data from the National Education Evaluation Institute (INEE).

The results of the *Enlace* test 2008 also placed the State of Nuevo Leon in the first places nationwide for those students who obtained an excellent or good grade in Spanish as well as in Mathematics at elementary and Jr. High levels. Considering that the percentage of students who were evaluated by these rubrics has increased since 2006, there are still areas that require improvement in the educational system of Nuevo Leon, such as in the teaching of Mathematics, since these represent the bases for the areas of technology and innovation. At the same time, Nuevo Leon needs to improve its international position in terms of education.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2



What follows are the most important initiatives and advances achieved for the strengthening of education and development of human capital; these actions were carried out during Phase 1 of the MIKC Program or supported by the same.

## SCIENCE AND TECHNOLOGY

### INNOVEC

Under the guideline of building links between science and the elementary level of education, the **Innovation in Science Teaching Initiative (INNOVEC)** was implemented in Nuevo Leon in order to teach basic sciences in real world situations and, at the same time, promote interest in sciences and innovation among children of these school levels.

**INNOVEC** is a Civil Association which is integrated by academicians, businessmen/women and members of the educational system. Its main purpose is centered on the training of advisors and the resource management actions before national and international organizations, as well as before the federal and state governments, in order to finance the **Science and Technology Program for Children** at kindergarten, elementary and Jr. High levels<sup>5</sup>.

For the administration of the financial resources negotiated by INNOVEC, an agreement was signed in August 2006. The purpose of this agreement was to create a trust fund that stated that the contributions made by the Ministry of Education (federal government) and by the government of the State of Nuevo Leon would be equal. In July 2007, a trust fund was created with an initial deposit of \$20 million pesos for the initial operation of this program<sup>6</sup>.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

## Science and Technology Program for Children

**INNOVEC Nuevo Leon** negotiated the use of didactic units created in the United States that were endorsed by the National Scientific Resources Center, the National Academy of Sciences, and by the Smithsonian Institute. These units were to be used in the **Science and Technology Program for Children** in order for the children of Nuevo Leon to learn that science is applicable to many aspects of daily life. This was to be obtained by using the methodology of Hands-on Inquiry Centered Science Education Systems (SEVIC in Spanish)<sup>7</sup>.

This methodology (which includes experiments in physics, biology, and chemistry) was adapted to the teaching system for natural Sciences in Mexico by the Mexican-United States Science Foundation (FUMEC) with the support of the Ministry of Public Education (SEP) and the Mexican Science Academy<sup>8</sup>. The purpose of the **Science and Technology Program for Children** is for the teacher to apply the SEVIC methodology in the classroom in order to stimulate the children's curiosity, and that it lead them to investigative learning and application of the scientific method.

This program has been applied systematically since then and, by 2008, it was in operation in 11 municipalities of the State of Nuevo Leon where 16,328 students were participating<sup>9</sup>.

The coverage of this program for the 2008-2009 school term was aimed at engaging the participation of 106,000 students, with the financial support of the trust negotiated by **INNOVEC**<sup>10</sup>.

This process also concerns the academic agenda for Jr. High, High schools, and universities to emphasize five technological and strategic areas defined for the development of Nuevo Leon (Biotechnology, Health Sciences, Nanotechnology, Mechatronics, and Advanced Information Technologies)<sup>11</sup>.

### Science and Technology for Children Program Program Coverage Preschool and Elementary 2007-2008

Level	Schools	Teachers	Students
Preschool	13	32	956
Elementary	54	578	15,372
<b>Total</b>	<b>67</b>	<b>610</b>	<b>16,328</b>

Source: ITESM. Elaborated with data from the State Ministry of Education in Nuevo Leon.

Table: Science and Technology for Children Coverage 2007-2008<sup>12</sup>

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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### **Science and Family Program**

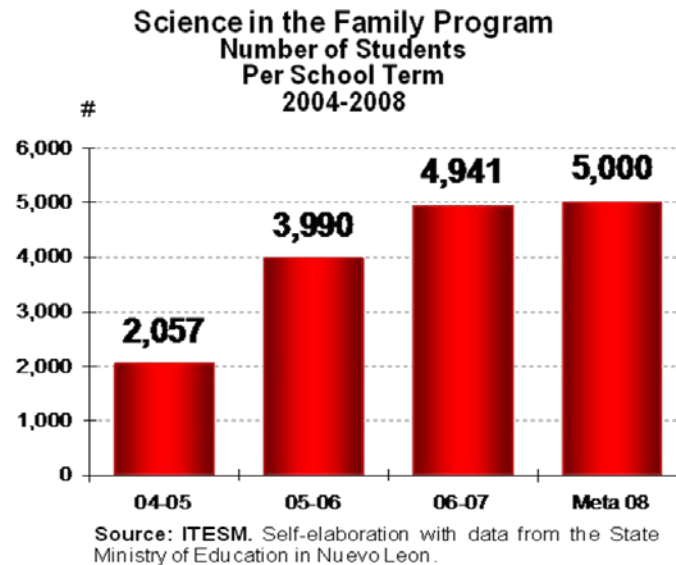
The objective of this program is to encourage the participation of parents and teachers in the scientific formation of students through the application of the SEVIC methodology. It also seeks to generate scientific and investigative aspirations in students. This program was implemented by the Ministry of Education (NL) in collaboration with COCyTE, the UANL, and the School of Scientific and Technological Studies to promote self-learning within the families of Nuevo Leon through which, by means of experimentation at home, the support of the family and assessed by the teacher at school, the students will acquire knowledge and strengthen their attitudes and values through Science<sup>13</sup>.

The **Science and Family Program** has been operating since the 2004-2005 school term, for which 31 schools from five school zones of the Metropolitan Area and 2,054 students participated. In the 2005-2006 school term, the coverage reached 3,990 students, the incorporation of the municipality of Montemorelos and the participation of more than 1000 new families<sup>14</sup>. In the 2006-2007 and 2007-2008 school terms, the program covered seven municipalities and by 2008 it operated in schools of the municipalities of Escobedo, Apodaca, Guadalupe, Santa Catarina, Monterrey, Garcia and Montemorelos. The number of participating students was 4,941 by 2008 and several private schools have been incorporated<sup>15</sup>.

With this program, the students of Nuevo Leon carry out scientific projects in the classrooms and at home, supported by their parents and teachers. The goal of the program was the participation of 5,000 students and 15,000 family members<sup>16</sup>, and the goal was practically met. In addition, agreements and arrangements are being negotiated with other states that have shown interest in implementing the program, including Tamaulipas, Zacatecas and other border states of Mexico that are analyzing the feasibility and pertinence of implementing the program in their educational systems<sup>17</sup>.



Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2



### Science teaching in the CINVESTAV

The Research and Advanced Studies Center (CINVESTAV) of the *Instituto Politecnico Nacional* (IPN) Monterrey Unit promotes the learning of Science in a fun and practical way, working in coordination with the local elementary and Jr. High schools. This center trains human resources and generates knowledge in four areas: exact, natural, and social Sciences, and Engineering<sup>18</sup>.

In April 2008, Director Bruno Escalante Acosta pointed out that the importance of this program is such that it has a Research Laboratory in Science Education, and one of its main lines of action is to promote educational innovation and the development of intelligent systems that will facilitate the Science teaching-learning processes<sup>19</sup>.

In addition to working with children, the researchers at CINVESTAV train elementary and Jr. High teachers, that all together is fundamental in changing the mentality of the society of Nuevo Leon, brought about partially by the MIKC Program<sup>20</sup>.

### Scientific Outreach Workshops

The **Scientific Outreach Workshops**, organized by the COCyTE NL, in collaboration with other government institutions, both private and educational (Triple Helix), promote a scientific and technological culture in the society of Nuevo Leon through conferences, shows, demonstrations, interactive activities and workshops that are presented in an integrated, participative, practical and fun manner<sup>21</sup>. They also help to understand scientific phenomena in order to

## Monterrey, International Knowledge City (MIKC) Summary Phase 1 and Master Plan Proposal Phase 2

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create awareness in the community about the responsible use and management of natural resources and technology<sup>22</sup>. The workshops promote the idea that, through knowledge of the Sciences and their application in daily life, the people of Nuevo Leon will have the opportunity to acquire the tools that will enable the sustainable development of a Knowledge society.

### **Robotics Workshops in your School**

The **Robotics Workshops in your School** integrally approaches different disciplines (Physics, Mathematics, natural and experimental Sciences; information, communication and technology Sciences) to develop creativity and constructive thinking in Jr. High students, which will give them with a global vision of the world by facing the analysis, design and solution of problems. **By the 2007-2008 school term, this program was provided to 100 schools, 100 teachers and 2,000 students<sup>23</sup>.**

## **INFORMATION AND COMMUNICATION TECHNOLOGIES**

### **Connectivity and Technology**

One of the most important actions in the **Strategic Educational Agenda for Nuevo Leon 2007-2009** has been to implement a program to ensure all schools' connectivity and basic equipment with appropriate information and communication technologies<sup>1</sup>. The use of ICT's in teaching is a basic requirement to improve and democratize education. In the framework of the MIKC Program, there have been great advances in the technological equipment of schools. In Nuevo Leon, 7 out of every 10 elementary schools have Internet access. Phase III (2007) of the Encyclomedia federal program oversaw the installation of computer equipment with Internet connection in 4,106 classrooms from 1,424 schools<sup>24</sup>. Almost 140,000 students and 5,000 teachers have had access to the World-wide Web with these actions<sup>25</sup>.

### **Encyclomedia Program**

The **Encyclomedia Program** is a new high quality learning system with the objective of boosting educational development in Mexico. It was conceived as a complement to the free State textbooks, therefore optimizing the use of educational materials; it also includes several innovative didactic resources, such as fixed and moving images; interactive classes, audios; videos; maps, virtual tours, among others<sup>26</sup>. **This program is being implemented in Nuevo Leon since the 2004-2005 school term in four phases, through which almost**

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<sup>1</sup> Acción de la Agenda Estratégica Educativa 2007-2009 Number 7



Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

**250,000 students have been serviced in elementary and Jr. High at about 3,000 schools<sup>27</sup>** (data from the 2006-2007 school term).

*English Learning through Encyclomedia Program*

Learning the English language plays an important role in the development and consolidation of the MIKC Program. With the purpose of teaching this second language using a technological era tool (Internet), and **Encyclomedia** being a tool that enables a dynamic and attractive access to knowledge, the Ministry of Education of the state of Nuevo Leon launched this program that aims to reach 153,000 elementary 5<sup>th</sup> and 6<sup>th</sup> graders in Nuevo Leon's public schools during the following years<sup>28</sup>.

This program, at 2008 closure, has been in operation in 2,223 elementary schools, in 6,700 groups and with 700 teachers. It will soon be introduced to Jr. High. It also reaches some rural schools and is being reinforced at teacher-training colleges, so that student-teachers may acquire this second language competence and, therefore, on their incorporation to the educational system, they have this ability and may become agents to enable their students' learning of English as a second language<sup>29</sup>.

**Encyclomedia Program in Nuevo Leon  
Equipment and Beneficiaries  
Elementary and Jr High School Levels  
Phase I – Phase IV**

Item	Elementary			Jr High	Total Nuevo Leon
	Phase I	Phase II	Phase III	Phase IV	
	2004-2005	2005-2006	2006-2007	2006-2007	
<b>Equipment</b>					
Establishments	51	368	1,424	269	2,112
Classrooms	102	756	4,106	906	5,870
Schools	102	486	2,033	432	3,053
<b>Beneficiaries</b>					
Students	9,053	28,880	139,984	71,132	249,049
Teachers	331	1,130	4,975	2,082	8,518

Source: ITESM. Self-elaboration with data from the State Ministry of Education in Nuevo Leon.

Table: Encyclomedia Program in Nuevo León<sup>30</sup>

**Educational Software for the teaching of Mathematics and Science**

The state of Nuevo Leon has participated in several federal educational improvement programs, such as the SEP's pilot program **Teaching**

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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**Mathematics through Technology (EMAT)**, implemented in several states around the country with the purpose of improving teaching quality in the Mathematics area, promoting the training of Mathematics teachers in Jr. High and promoting the use of ICT's in the public school classrooms<sup>31</sup>.

Currently, seven out of ten Nuevo Leon teachers, in first and second grade of Jr. High, have been trained in workshops, specialized studies and consultancy at their schools for the use of EMAT software in the classroom<sup>32</sup>.

Additionally, Sciences I (Biology) teachers from 39 Nuevo Leon schools were trained to use the **Teaching Science through Technology (ECIT)** software<sup>33</sup>.

On the other hand, at three public Jr. High schools located in marginal sections of Santa Catarina, the students use technology to learn Mathematics. Through the **TI-Navigator System of Texas Instruments**, students work with wireless scientific calculators connected to the teacher's computer, allowing him/her to monitor what each student is doing in real time (individual and group reports are elaborated based on that information). Each school has a classroom equipped with 32 calculators and one computer for the teacher, all of which represents an investment of US \$6,000 dollars per school<sup>34</sup>.

## TEACHING A DIFFERENT WAY

### From Memorization to Analysis Capability

Promoting and enabling an increasing number of hours dedicated to reading, writing and Mathematics application; to developing comprehension and the use of methods in social and natural Sciences; to stimulating critical and strategic thinking; to strengthening attitudes and values for a democratic coexistence, through the dissemination, promotion and adoption of the most successful practices implemented in other states in the country, as well as the identification and best use of international best practices, are actions contemplated in the **Strategic Educational Agenda 2007-2009**<sup>2</sup>.

Under the same light, the implementation of the following initiatives was contemplated in the short term:

- Singapore graphic Method. Problem Solution: This program, currently in operation since the 2008-2009 school term, gives students functional and flexible tools to solve everyday problems and, in the future, problems related to their professional activities. 500 schools are being assisted, the results of which will be measured through the *Enlace* Test, and the aim is to make the methodology available to 150,000 students<sup>35</sup>.
- Entrepreneurial Culture: On 26 April 2008, an agreement point elaborated by the LXXI Congress Legislature of Nuevo Leon was voted; it proposes the

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<sup>2</sup> Acción de la Agenda Estratégica Educativa 2007-2009 Number 5

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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incorporation of programs to encourage the entrepreneurial culture into the state educational programs. Therefore, an official request was presented to the SEP for the inclusion of the subject in the school plans and programs for elementary and Jr. High education; any aggregates or modifications to school programs pertain to the federal office<sup>36</sup>.

### **Bio-Psycho-Social Development**

Another action suggested for the **Strategic Educational Agenda 2007-2009** is related to the program for integrating and strengthening the coordination of activities carried out in the civic formation field, in areas such as Civic education and Ethics, as well as the promotion of values proper to a democratic coexistence<sup>3</sup>.

The **Pisotón** pilot program aims to train teachers, who in exchange will train other teachers (the teachers of other teachers) on subjects regarding the child's integral development and to contribute to training human resource capable of coherently and integrally coordinating and executing the psycho-affective development program. Among the activities this program includes is a specialized course with an 80-hour theoretical segment and a 100-hour practice segment<sup>37</sup>. Additionally, there have been conferences and workshops for teachers, conferences for parents, story-telling for children, which foster insightfulness; psychodramas, table games on stories, life experience tales and integration workshops for parents, teachers and children<sup>38</sup>.

## **EDUCATIONAL EVALUATION**

### **Individualized Attention to the Student**

Another action suggested and currently in operation in the framework of the **Strategic Educational Agenda 2007-2009** is the one related to **establishing an alternative to evaluate learning in schools**<sup>4</sup>, with the purpose of obtaining an individual evaluation for each student, in order to apply adequate teaching strategies to improve the teaching-learning process. Furthermore, the educational programs carried out in the future will more precisely emphasize on consolidating strengths and overcoming weaknesses, in the students' performance as well as the schools' functioning; for this purpose, programs and projects have been developed, among which, the following are listed<sup>39</sup>:

- Pilot project: Bio-Psycho-Pedagogical Diagnostic and Formative Evaluation (BSPP) for second and third grade preschool children. This project evaluates preschool students' individual educational needs by means of an initial and

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<sup>3</sup> Acción de la Agenda Estratégica Educativa 2007-2009 Number 6

<sup>4</sup> Acción de la Agenda Estratégica Educativa 2007-2009 number 10

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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formative test; it provides collective and individual follow up for students and teachers; it provides differential theoretical and pedagogical advisory for teachers and for research results analysis. **By the end of 2008, the pilot project has been applied in 6 schools, where 240 students and 35 teachers have participated.**

- **Intelligence Development through the Arts Program (DIA)**: This program was implemented to foster students' integral development and to look after their individual learning needs. DIA's objectives are: to train mediators with a transcendental vision of education, open to modifying their teaching practices, and boost their learning and development process; to promote integral development of students in four ability areas (cognitive, communicative, affective and social); to create a learning arena that enables dialog and the collective construction of knowledge, in an environment of harmony and respect; and to integrate the arts as a means for human development. **The DIA program's methodology has been implemented, at 2008 closure, in 57 schools, where directors and teachers have received this training.**

### **Intermediate *Enlace* Test**

To strengthen educational evaluation, the Ministry of Education of Nuevo Leon has developed a tool that is applied at mid-school term, called **Intermediate *Enlace*** test. This test is a quantitative measurement, applied by Nuevo Leon, which renders a systematic diagnosis to follow up the advancement toward the strategic goals contemplated in the **Strategic Educational Agenda 2007-2008**<sup>40</sup>.

*"...this type of evaluation is more analytical and helps the teacher have more information on each of his/her students..."* stated Dr. Reyes Tamez Guerra, Minister of Education in Nuevo Leon, in November 2007, and added that *"...this evaluation renders precise information on where the deficiencies lay..."*<sup>41</sup>.

The objectives of the Intermediate *Enlace* are: to evaluate the advancement in the subjects of Spanish and Mathematics, from the beginning of the school term up until the end of the first quarter, for 3rd to 6th grade in elementary school and 3rd grade in Jr. High; it follows up on diagnosed learning problems and improves the quality of basic (compulsory) education; to obtain information from every student, group and school to design and correct educational strategies; and to use the evaluation results to make necessary decisions in the school management project<sup>42</sup>.

### **High Education and Educational Innovation Institute**

Improving education in the state of Nuevo Leon is the main goal of the **High Education and Educational Innovation Institute**, first of its kind in Mexico. The

## Monterrey, International Knowledge City (MIKC) Summary Phase 1 and Master Plan Proposal Phase 2

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creation of the Institute was one of the priorities of the state government (2003-2009 Administration) in educational matters. The Institute is in charge of detonating, not only research in educational areas, but also teaching innovation programs, from the generation of new didactic materials or development of educational software to preparing teaching professionals with a graduate degree (PhD) that may, together with the teacher-training college, have an impact on the quality of education in Nuevo Leon<sup>43</sup>.

The Institute's work will increase educational quality; train and boost teachers' teaching abilities; create research projects on educational techniques and technologies and, consequently, advance rapidly at the regional level in this important chapter that represents education for the Knowledge Societies<sup>44</sup>.

The Institute is the result of a joint and coordinated effort between the Teachers Guild (Syndicate Sections 21 and 50) and the Ministry of Education of Nuevo Leon, who signed a work agreement for the improvement of education in Nuevo Leon. This agreement was signed in June 2007 in the framework of the Strategic Educational Agenda, the State Education Plan and the Memories of the National Education Congress conducted by the National Union of Education Workers in 2007<sup>45</sup>.

This education entity also contemplates, among its objectives, the generation of tools to monitor abilities, capabilities, competences, attitudes and values of the students of Nuevo Leon, aligned to the *Enlace* test evaluations. It also aims to substitute traditional school tests for exams aligned to national and international parameters and develop educational software to improve teaching in reading, writing, Mathematics and Science<sup>46</sup>.

### **HIGH SCHOOL AND HIGHER EDUCATION**

Training professionals with profiles adequate to the knowledge economy, Nuevo Leon has 5 highly recognized Universities (ITESM, UANL, UR, UDEM and *TEC Milenio*) and 2 State Technological Universities (Mariano Escobedo and Santa Catalina), which offer a large array of majors, graduate degrees, specialized courses, virtual education and online courses mainly related and linked to the strategic sectors and technological areas of the MIKC Program. With the joint work of the Triple Helix, some of Nuevo Leon's business leaders have pointed out that the academic sector has been very receptive, in general, to the needs for human resources in the industrial and productive sectors. For example, in the aerospace sector, UANL and ITESM are offering programs aligned to the requirements and certifications of the aerospace industry. In general, the main

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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universities of Nuevo Leon are strongly promoting majors in engineering and science<sup>◇</sup>.

### ***Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM)***

Admitting only students with an average of 80 or higher in a scale of 100 (or its equivalent) is the policy that, since August 2007, is being followed by the **Tecnológico de Monterrey** for the admission of new students. The purpose for this is to “...create higher demands for teachers, students and administrators; improve academic programs; and motivate more challenging dynamics within the classroom...” as expressed by Dr. Alberto Bustani Adem, Dean for the institution’s Metropolitan Area of Monterrey (2008)<sup>47</sup>.

**“...the best, those who commit their soul, those who are diligent, that think in term of the collectivity, those that will enable Tecnológico de Monterrey to become, by 2015, the most recognized academic institution in Latin America for the leadership of its graduates in the public, private and social sectors; for the technological research and development it performs to propel the economy based on Knowledge, generate business management and incubation models, collaborate to the improvement of public administration and public policies; and to create innovative models and systems for the sustainable development of the community...”** was the vision formally introduced by Dr. Rafael Rangel Sostmann, Tecnológico de Monterrey’s Provost, during the XX Reunion of Advisors in February 2004<sup>48</sup>.

From its beginnings, the institution has sustainably grown in the field of research, technological development and innovation (R+D+i). Currently, ITESM includes 59 research Chairs which are groups of experienced professors, young professors and students dedicated to a specific research line with applications for the productive sector, enabling the development of mid-term projects and stimulating the training of young researchers with an entrepreneurial vision.

Furthermore, a strategy is being implemented to take the knowledge and practice acquired in the R+D+i areas of ITESM beyond the research groups, by applying them both to rural and urban communities.

Noteworthy is that these actions are the basis for the strategies that are contemplated in ITESM’s 2015 vision and mission, which are complemented by the development of incubation models and the creation of business accelerator networks and technology, innovation and knowledge transfer centers.

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<sup>◇</sup> Testimonials gathered from interviews with international experts and key actors in the state of Nuevo Leon for the elaboration of Monterrey International Knowledge City Master Plan Phase 2 (MIKC) (April-June 2008)



### ***Universidad Autónoma de Nuevo Leon (UANL)***

With 75 years offering higher education in the state, the ***Universidad Autónoma of Nuevo Leon*** has also bet on research and development (R+D+i) with a very clear commitment and goals, for example, 500 UANL professors belong to the National Researchers System (SNI), or the creation of several new research centers (both goals are part of UANL's 2012 vision).

According to data from UANL's Rector, Jose Antonio Gonzalez Treviño (2008), UANL includes 306 professors registered in the SIN and several young men/women are in training to become researchers.

Some of UANL's emblematic projects, linked to the MIKC Program and materialized in 2008, include:

- The **Engineering and Technology Research, Innovation and Development Center (CIIDIT)**, located at PIIT<sup>6</sup>.
- Another project is the Agricultural Sciences Campus, where were built the Schools of Agronomy and Veterinarian Medicine. Additionally, there is a specialized library in agricultural and biological sciences.

These installations “***...have the objective to foster new graduate programs that will serve the research lines in the agro industrial area...***”, as stated in September 2007 by UANL's Rector, during an interview for an important local newspaper<sup>49</sup>.

Parallel to this, both UDEM and UR have installed and implemented R+D+i centers and programs under the Triple Helix model, linked to the development and consolidation of a knowledge society in Nuevo Leon; these universities are described below.

### ***Universidad Regiomontana (UR)***

*Universidad Regiomontana* participates in the MIKC Program by focusing its education and professional training and connecting traditional business activities to those related to new technologies, through the development guidelines established by the state government of Nuevo Leon (PED 2004-2009). The UR embodies the premise that through knowledge, research, innovation and application of science, wealth can be generated, as well as forming entrepreneurs and developing technology to produce social well-being by improving competitiveness, productivity and the ways to operate in the present<sup>50</sup>.

Through this transversal approach, the UR is intensely promoting the incorporation of a group more representative of society to the knowledge

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<sup>6</sup> Technological Innovation and Research Park

## Monterrey, International Knowledge City (MIKC) Summary Phase 1 and Master Plan Proposal Phase 2

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economy, and the integration of SME's to the knowledge and information society, by developing entrepreneurs and professionals<sup>51</sup>.

### ***Universidad de Monterrey (UDEM)***

UDEM offers a personal formation plan for the development of its students' talents through experiencing the values, the leadership practice for the common good and the interaction within a multicultural learning community, enriched by an experienced faculty with a high human quality that promotes research for the benefit of society. This personal formation plan, aligned to the needs of a knowledge region/economy, contemplates academic excellence, the formation in values, their transcendence through servicing others and the development of leadership abilities<sup>52</sup>.

Furthermore, UDEM has 9 R+D+i centers, among which we may highlight: the Interdisciplinary Research Center on Quality in Education and Overcoming Poverty; the Technological Innovation Center (GENERA); the Tribology Research, Development and Innovation Center; the Product, Container and Packaging Innovation Center (located at PIIT) and the Business Incubation and Development Center, which all have research lines aligned to the MIKC Program and place UDEM as a relevant actor for the consolidation of a knowledge society in Nuevo Leon<sup>53</sup>.

### **State Technological Universities of Nuevo Leon (UTE)**

Taking into account the analysis of successful educational models from countries such as France, Japan, the United States, Great Britain and Germany, the federal SEP decided to create a new higher education option, to train professionals according to the requirements of the productive sector. This system is under the responsibility of the General Coordination of Technological Universities for the same federal entity<sup>54-55</sup>.

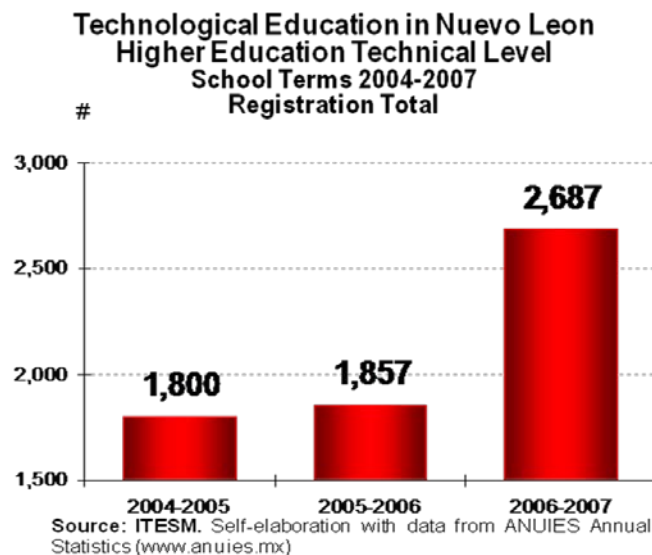
During the last years, great efforts have been made to incorporate this network of universities (UTE) to state pedagogical systems, due to its modern didactic models; equipment and laboratories with the latest technologies; and academic plans relevant to the economic activities of the region. This enables the incorporation of thousands of youngsters (and adults) to the globalized and competitive world, where the medium and large national and international enterprises demand, not only specialized manpower, but also mind-power and intellectual capital focused on the areas of innovation and high technology<sup>56</sup>.

The **State Technological Universities of Nuevo Leon** are public decentralized organizations (OPD in Spanish) that attend to the needs of higher technical education in the state, especially the requirements from the strategic sectors and the technological areas in the MIKC Program. Currently, the UT Mariano

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

Escobedo and the UT Santa Catarina are in operation; their function is to teach technological knowledge and abilities to graduate students from High school and establish agreements with other national and foreign institutions, with the purpose of fulfilling its educational objectives<sup>57-58</sup>.

This educational option, added to investment and other actions at this level of instruction and education, have enabled the school population in technical majors in Nuevo Leon (University Higher Technical level) to increase its registration by almost 50% from 2004 to 2007. It is very important to point out that the strategic agreements between the academy, the scientific and technological community and the governments (Triple Helix Model) have been a decisive factor in promoting the formation of human capital for the knowledge areas of the MIKC Program.



## THE FACULTY

### The best teachers through contest

To fulfill the goals established in the **Strategic Educational Agenda 2007-2009**, the Ministry of Education of Nuevo Leon and the National Union of Education Workers (SNTE) agreed that, beginning 2007, a new plan would be implemented to fill teaching posts through a **Selection Contest open to candidates wishing to join the State Education System in Preschool and Special Education Services**.

This public contest enables the identification of the best prepared candidates to fill 294 posts for teachers of preschool education and 31 for special education<sup>59</sup>. On the other hand, for the first time, the selected teachers were allowed to consider the available schools options so they could, themselves and based on

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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the score obtained, choose the one they preferred to join, offering this as an additional incentive in the contest.

This selection contest contemplates two stages:

- The first consisting of a knowledge evaluation, that is to be satisfactorily approved by the candidates, and
- The second stage, including a psychometric exam designed by the School of Psychology of the *Universidad Autonoma de Nuevo Leon*<sup>60</sup>.

### **College of Scientific and Technological Programs of the state of Nuevo Leon**

To support the integral formation of teachers, academicians and personnel of the education establishments in High school, promoting their abilities, creativity, productivity and under the quality philosophy linked to the local productive and social sectors, the **College of Scientific and Technological Programs of the state of Nuevo Leon (CECyTENL)** was created, **operating by the end of 2008, at 11 technological High schools** located in the municipalities of Apodaca; Garcia, Linares, Marin, Salinas Victoria, Cadereyta Jimenez, Monterrey (Estanzuela), Sabinas Hidalgo, Aramberri, Allende and General Escobedo, and **at 8 general High school establishments** in the municipalities of Lampazos de Naranjo, Mier and Noriega, Iturbide, Los Ramones, Bustamante, Agualeguas, Zaragoza and Rayones<sup>61</sup>.

### **CINVESTAV's Graduate programs**

The MIKC Program requires leaders in the areas of research, teaching, science and technology to increase the intellectual capital in the region, and this is precisely CINVESTAV's mission. This center congregates scientists and educators from different disciplines with an intrinsic interest toward the teaching of Science and the performance of scientific and technological research.

The CINVESTAV has two projects closely linked to MIKC, which are in progress and have had significant advances (at 2008 closure).

The first is a **graduate education program in projects focused on children, in subjects related to Physics, Chemistry and Biology with experiments that may be carried out in the classroom.** The second, another graduate program, is a **medical engineering and physics program, which includes the following research lines:**

- **A technological development to obtain sharper X-Ray images, and**
- **The creation of a shield for certain body parts of patients treated with radiotherapy**<sup>62</sup>.

### **Institute of Research, Innovation and Graduate Programs for Education**

The **Strategic Educational Agenda 2007-2008** is promoting research development to continuously improve the management of the local educational system, the teaching processes and the learning achievements at all types, levels and modalities of education<sup>7</sup>. In this sense, the creation of the **Institute of Research, Innovation and Graduate Programs for Education** was suggested and it is contemplated to begin operations during the 2009-2010 school term, at the latest<sup>63</sup>. The Institute will operate as a Higher Education school, at the graduate level, as well as develop research, innovation and specialized information outreach programs.

The Institute's goals, within the next twelve years, are<sup>64</sup>:

- To operate programs for the training of educational professionals, at the graduate level, to be recognized (the programs) nationally and internationally, as desirable models of articulation of evidence analysis and a more updated systematic knowledge application, with the concrete improvement of educational practices in the schools.
- To develop alternative trajectories for training in-service teachers and other professionals in basic (compulsory) education, which will allow them to improve their levels of preparation; social, academic and specialized competencies recognition, similar to the best educational systems in the world.
- To become a national and international reference for its contributions to the development of research and innovation processes directly linked to the functioning of schools.
- To become a consolidated source of the most prestigious information on specific educational subjects, mainly those related to a systematic improvement of pedagogical practices in the schools and other educational institutions.
- To evaluate its prestige based on the documented development of its work and on internal and external periodic evaluations.

### **VOCATIONAL TRAINING INFORMATION SYSTEMS**

#### **Research: Professional and technician requirements in Nuevo Leon. Trends and perspectives**

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<sup>7</sup> Strategic Agenda 2007-2009. Chapter VII. Transformation of the State Educational System's management structure and procedures



In the new economic model of Nuevo Leon, where knowledge is the most important asset, it is fundamental to count on information systems that appropriately and strategically guide human capital training towards the innovation sectors and areas with the most employability and entrepreneurship opportunities.

The research **Professional and technician requirements in Nuevo Leon. Trends and perspectives**, elaborated by the Labor Relations and Productivity Council in coordination with the private sector and several local universities (Triple Helix model) allows us to know the needs of professional and technical personnel required by the productive sector in Nuevo Leon, as well as by the priority sectors of MIKC, during the period of 2008-2013<sup>65</sup>. This summary has the additional purpose of identifying the labor competences and formulating recommendations for educational institutes to update their academic programs. Furthermore, it includes the occupational trends and registration of a group of professional courses and technical specialties related to MIKC; and it presents the occupations with the highest demand in the strategic sectors of the local economy, along with the labor competence units for each specialty<sup>66</sup>.

### **Educational Options Inquiry System<sup>67</sup>**

Another tool that the Ministry of Education of Nuevo Leon makes available to all the people involved in the local educational system, and aligned to the educational orientation and relevance for a Knowledge Society, is the **Educational Options Inquiry System**, through which all the technical and professional courses of the state can be found, as well as the scholarships that can finance those studies. In addition, a vocational training exam that uses the Herrera-Montes tool can be taken at the website: [www.nl.gob.mx/scoe](http://www.nl.gob.mx/scoe).

## **LABOR COMPETENCES**

### **Technical Education and Training Modernization Project (PMETyC)**

This project is realized with the collaboration of the federal SEP, the Ministry of Labor and Social Security (STPyS) and the Labor Competency Standardization and Certification Council (CONOCER). The PMETyC has five components:

- Labor competency standardization system.
- Labor competency certification system.
- Formative and training supply transformation.
- Training and certification demand incentives.
- Information, evaluation and research<sup>68</sup>.



The first two components constitute the action framework for CONOCER, the entity responsible for operating the Labor Competency Standardization and Certification Systems in Mexico. The fundamental purpose of this system is to promote the construction of Labor Competency Technical Standards (NTCL), instruments that are defined in terms of the group of knowledge, abilities, techniques and skills that are required for the performance of a productive function based on the quality expectations of the productive sector<sup>69</sup>.

In Nuevo Leon, the teachers of technical high schools have participated in an NTCL certification process in the areas of: computer tools, strategic planning, course development and training course teaching. Throughout the years of 2003 to 2007, 951 college, technical high school and labor training teachers have been certified<sup>70</sup>.

### **WorkKeys: Knowledge and Skills**

**WorkKeys** makes use of the job position description and the skills definitions and evaluation tools based on the WorkKeys methodology of the American College Testing, Inc. (ACT). The application of this methodology was carried out with the collaboration of the State Higher Education Planning Commission (COEPES), the State Ministry of Education and Economic Development, the Labor Relations and Productivity Council (CRTyP), the Mexican Employer's Confederation of Nuevo Leon (COPARMEX), the National Transformation Industry Chamber (CAINTRA), the National Chamber of Commerce (CANACO), the American Chamber of Commerce of Mexico and the Assembly Plant Association of Nuevo Leon, with the financing of the Mixed Fund for Promoting Scientific and Technological Research CONACYT<sup>71</sup>.

**WorkKeys** was implemented in two stages; the first (late 2003) consisted of a diagnosis in which 4,315 technical high school students in their last semester participated, resulting in the profiles for the 100 most important occupations in 10 strategic sectors of the state<sup>72</sup>.

In 2003, **WorkKeys** identified the critical skills and abilities for the jobs that the productive sector of Nuevo Leon demands. The job profiles, accompanied by the corresponding position description, were grouped in the following sectors: Aerospace, Automotive, Biotechnology, Metal-Mechanic, Plastic, Commerce, Construction, Education, Trades, Household Appliances, Software, Telecommunications, Management and Accounting Services, Medical Services, Domestic Services, Stylist, Real Estate, Quality Control, Human Resources, Tourism and Logistics<sup>73</sup>.

From this study (in which several technological high schools participated), specific action recommendations were made to educators, employers, parents, public servants, educational institutions, teachers and students in order to reduce the required skills deficit in the labor pool of the state<sup>74</sup>.

In the second stage of **WorkKeys** (2008), a comparative study was performed to observe the results of the recommendations made in the first stage, as well as to identify successful practices for documentation and publication<sup>75</sup>.

### **World Interactive Network (WIN)**

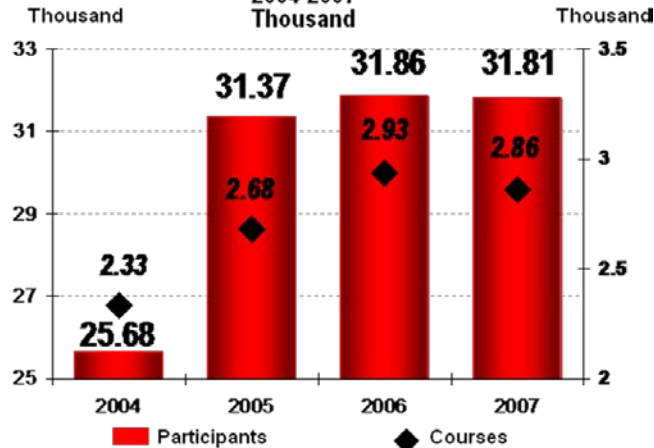
**WIN** is a computer program of the Learning Management System (LMS) which is designed to manage the training programs for the labor pool and it began operations in Nuevo Leon since the 2008-2009 school term<sup>76</sup>.

**WIN** internationally legitimizes users through the certification of their curricular studies and supplies future employers with the grades in **WorkKeys**, as well as their interpretation. The **WIN** certification is composed of four modules<sup>77</sup>:

- **Professional Preparation Certificate**, consists of 41 levels of software and education (aligned with and reinforcing the **ACT WorkKeys** in basic education); databases of the occupational profiles of **WorkKeys** with career exploration components; tools for the elaboration of a curriculum vitae, as well as the construction of **WIN** portfolios and the inclusion of skills, all of this through the website.
- **WIN Portfolio**, is an e-learning follow-up and management system used for storing and use of learning contents.
- **WorkKeys** is an evaluation of the **ACT WorkKeys**, which includes three measurement periods of the fundamental skills for work: informative reading, information search, mathematics and applied technology.
- **Management System**, includes e-mail addresses with information from the labor market, personnel accounts, access and privileged groups accounts.

In addition to the actions previously described, the job of the **Training and Education Institute of Nuevo Leon (ICET)** regarding training and education for work has translated, during the 2004-2007 period, into nearly 10,800 training courses for the development of labor skills in which more than 120,000 people have participated.

Labor Training and Education  
ICET Nuevo Leon  
Participants/Courses  
2004-2007



Source: ITESM. Self-elaboration with data from State Government Reports. State Development Plan 2004-2009.

## HUMAN TALENT DEVELOPMENT

### Talent Development Institute in Nuevo Leon

The advanced information technology industry (software) belongs to one of the strategic sectors and areas of the MIKC Program. Because of that, its development has been a priority issue for the present state administration (PED 2004-2009). Since 2007, universities, companies and government (Triple Helix model), grouped in the **Council for the Development of the Software Industry in Nuevo Leon (CSOFTMTY)**, began placing information technology majors as the best educational and professional option for the young people of Nuevo Leon. In the beginnings of 2008, the **Institute for the Development of Talents in Information Technologies (IDETI)** began operations; its objective is to prepare and train, in a fast way (6 months), software developers with the skills to fulfill the needs of the local and international markets,<sup>78</sup>.

*“... the state of Nuevo Leon has the great opportunity to transform into a global supplier of ITC services...”* according to the vision of Blanca Trevino de Vega, Softtek CEO and President of the Council for the Development of the Software Industry in Nuevo Leon in 2008, which generates jobs and a demand for professionals for the next years.

In February 2008, Carlos Bernardo Garza, Postgraduate Academic Coordinator and Coordinator of the Information Technology Enterprise Incubator in FIME-UANL, stated that *“... there is no unemployment in this activity (software development)...”* and concluded that *“...this institute (IDETI) is a cornerstone in*

*the commitment to make Nuevo Leon a hub for the development of human capital and software...<sup>79</sup>.*

The development of talented professionals capable of promoting the software industry in Nuevo Leon is the main purpose of IDETI, which is based on the model used by **Infosys Technologies** at its training facility in India<sup>80</sup>.

At IDETI (which has a strong approach initiative between the industry and the academy), courses are taught to standardize and train the students of different universities and local technical schools, in addition to training engineers in information technologies and updating the personnel of the software enterprises installed in Nuevo Leon<sup>81</sup>.

Among the multiple advantages this program offers are: minimal investment in physical infrastructure; flexibility to create customized short-term and low-cost programs; encouragement of the collaboration between government, enterprise and educational institutions; and the best use of human resources and academic institution materials<sup>82</sup>.

IDETI has witnessed the graduation of 1,000 engineers every year; it also offers a **Transfer Training Course** for universities and enterprises with the objective of promoting the software industry of Nuevo Leon in the short-term, and later on, in the whole country<sup>83</sup>.

In short, the IDETI aims to be the best option for the generation and development of knowledge based on the information and software development technology industry, as well as to prepare the people that take a job in this industry. Furthermore, the IDETI seeks to create a model that is self-sustainable, that generates value and to create an asset for MIKC by means of qualified mind-power<sup>84-85</sup>.

### **Expert Investigation Institute and Professional Training Institute for the Attorney General Office of Nuevo Leon**

One of the main challenges of the region is to build, through society-government, a safe Nuevo Leon and with justice for all<sup>86</sup>. There is no indicator regarding safety that could be persuasive enough if the population feels unsafe. Because of that, three of the actions that have been taken to improve justice procurement and the environment of public safety and Law enforcement in the state of Nuevo Leon, based on the judgment of Luis Carlos Trevino Berchelmann, Attorney General (2008) were created by:

- The **Expert Investigation Institute**.
- The **Professional Training Institute**.



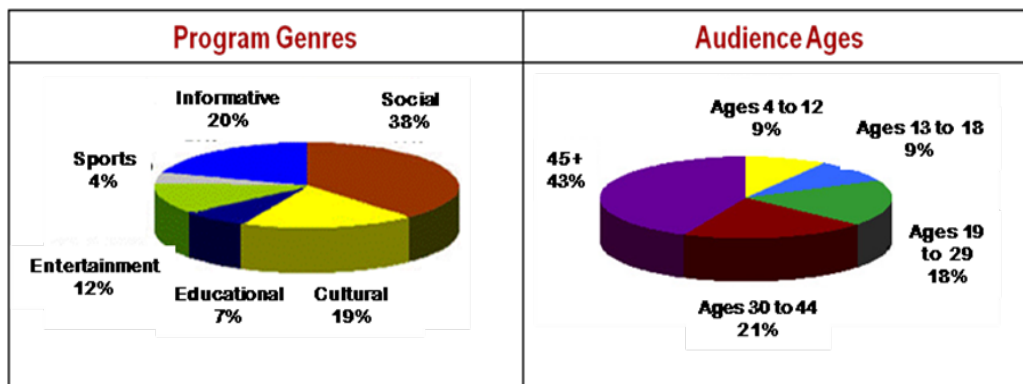
- The **State Bureau of Investigations**, as a direct dependency of the Attorney General<sup>◊</sup>.

## COMUNICATION, CULTURE AND THE ARTS

### Messages and contents related to the Knowledge City

The state of Nuevo Leon has, through the **Radio and Television Stations of Nuevo Leon**, a wide-range resource to broadcast messages and contents that can enrich the life of the citizens and promote the values and principles that characterize a Knowledge city or region. These stations currently offer a good array of entertainment options that collaborate with the education and quality of life of the citizens. TV NL and Radio NL have developed an intense labor of values promotion and outreach that increase the quality of life of the inhabitants and encourage the principals of civic responsibility, social morale, human dignity and family bonds, among others.

TV Programming Nuevo Leon  
Audience Composition  
State of Nuevo Leon  
2006



Source: ITESM. Self-elaboration with data from the State Television Board (TVNL).  
Webpage: [http://www.nl.gob.mx/?P=sgg\\_d\\_television\\_composicion\\_audi](http://www.nl.gob.mx/?P=sgg_d_television_composicion_audi)

Currently, some of the messages and contents transmitted by both stations are related to the “Monterrey: International Knowledge City” program and there is an awareness to continue building a process of efficient communication, with emphasis on social themes, that generates synergies between the community of Nuevo Leon so that it recognizes and spreads **cultural, regional, national and universal values, that are necessary elements to promote the integral development of a knowledge society and economy**<sup>87</sup>.

<sup>◊</sup> Compilation of testimonials from interviews performed by international experts and key actors of the state of Nuevo Leon for the elaboration of the Master Plan Phase 2 of Monterrey, International Knowledge City (MKIC) (April-Junio 2008)





## Culture and the Arts

In Nuevo Leon, there are people who work continuously and relentlessly in the strengthening of culture and the arts through multiple events, programs, the building of infrastructure, a numerous and varied artistic offer, national and international festivals, contests, scholarships, the opening of new spaces and encouragement of the creative activity<sup>88</sup>.

In order to achieve a cultural policy of broad citizen participation, which is democratic and oriented to satisfy the artistic and cultural needs of the community, as well as to offer a reassessment of these aspects in Nuevo Leon, essential goals in this field have been defined: decentralization of the cultural and artistic activities towards the municipalities, support the community of creators for the development of art disciplines, the establishment of special programs to reach all the social sectors as well as groups with particular characteristics and the promotion of the different manifestations of popular culture<sup>89</sup>.

### ***3.2 Science and technology, knowledge and intellectual capital.***

An essential requirement to successfully evolve into the new knowledge economy is the **development of a society strongly attached to science and technology**. Since the Phase 1 of the MIKC Program, science and technology have been positioned as important and fundamental detonators for development, especially in the universities and the business sector.

In order to encourage development based on knowledge, as a part of MIKC, organizations that propose, coordinate and regulate the activities in favor of science and technology in the state of Nuevo Leon were established (for more information see Chapter 2), among which are noteworthy: the **Science and Technology Coordination (COCyTE)** and the **Science and Technology Council (COCyTE)**.

Efforts have also been made to create an environment that stimulates the spreading of information in this regard by means of knowledge programs and international events, in order that, little by little, society can learn the topics of science and technology and their application in daily life.

### **Knowledge Managers: Science and Technology Council (COCyTE)**

Contributing ideas, making proposals for new projects and revealing the opinions of other communities of Knowledge are all part of the functions of the **Science and Technology Council**, created in May 2004.

**COCyTE** has been fundamental to the development and spreading of science and technology in the state of Nuevo Leon and for the MIKC Program. Among its main accomplishments are<sup>90</sup>:





- Family Science Program, which gathers elementary school children participating in the Science Week, to display their experiments (developed at home, with their family) and small research projects to all the parents.
- Knowledge, Science and Technology Magazine, a magazine that publishes articles and news of scientific and technologic character, and how they participate and relate to people's daily lives.
- System of Information and Interaction between Scientists and Technologists of Nuevo Leon, which is a website that concentrates information from scientists, technologists, inventors and companies of the state of Nuevo Leon so that institutions, organizations and companies can satisfy their needs of technology and information development.
- Biographical Dictionary Publication of Scientists and Technologists of Nuevo Leon, which contains more than 400 biographies of scientists, medical doctors, engineers, biologists and personalities that have contributed with their work to humanity and the local community.
- Bio-Monterrey (Annual International Congress), for the promotion of ideas and collaborations in biotechnology.

### Universal Forum of Cultures 2007

Without a doubt, one of the most transcendental events related to Knowledge has been the **Universal Forum of Cultures 2007** (inaugurated September 20<sup>th</sup> of the same year). For 80 days the **2007 Forum** turned Monterrey into an assorted place in which citizens, tourists, experts, intellectuals, leaders of opinion, artists and other participants had the opportunity to explore, reflect and propose about humanity concerns through dialogs, exhibitions and expressions<sup>91</sup>.

Most of the activities in the **2007 Forum** took place at **Fundidora Park** around four central themes: **Cultural Diversity, Sustainability, Knowledge and Peace**.

**It included three participation formats: dialogs, exhibitions and cultural expressions, together with an emblematic spectacle that was presented on a daily basis**<sup>92</sup>. In the dialogs framework there were also workshops, special events and various worldwide encounters. Some of the results of the **2007 Forum** are summarized below:

- **Dialogs: The dialogs and worldwide encounters, that added up to 510 events with 865 speakers, were visited by more than 168,000 people**<sup>93</sup>. These were carried out during eight weeks, through conferences, roundtables, debates, seminars, workshops, dialogs, NGO forums and sessions, promoting interaction, dialog and by them encouraging the citizen comprehension and participation. During the events, the themes addressed included: **Knowledge-**

**based Development;** Education, Science and Technology; Health Culture and Quality of Life; Cities and Population, Natural Resources; Governance and Participation; Human Rights and Justice; Identity and Diversity; Cultural Policies and Communication<sup>94</sup>.

- **Exhibitions, Cultural Expressions and Emblematic Spectacle:** To generate multisensory and dynamic learning that accentuate the message of the great themes of the **2007 Forum**, exhibitions were presented that gave the audience the opportunity to interact with works of graphical and audiovisual media, creation of atmospheres and transformation of spaces, to multiply their communication and meaning possibilities<sup>95</sup>. **Almost 1.9 million people attended the 18 exhibitions presented, with 142 national and international artists**<sup>96</sup>.

Inside *Fundidora* Park, top quality cultural expression events were realized simultaneously, for all tastes and all audiences. Many artists gave the attendants a wide array of options they could participate in, which led them through joy, reflection, questioning and criticism. **More than 1.5 million attendants enjoyed the cultural exhibitions of this grand event that involved the collaboration of 77 countries, more than 450 groups and 2,102 functions starring 3,454 artists**<sup>97</sup>.

As a legacy of the **2007 Forum**, beginning in 2008, the **Santa Lucia International Festival** has become an annual event. Beginning the last week of September to the last week of October, dialogs, exhibitions, cultural expressions and a multidisciplinary emblematic spectacle are presented. A grand exhibition of different cultures will also be presented annually.

### **Global Knowledge-Based Development Week**

On the road to consolidate the “Monterrey: International Knowledge City” program, **the gates were opened during the 2007 Forum to more than 200 specialists and leaders of 30 countries, in the Summit of Knowledge Cities** and in the **Global Knowledge-Based Development Week**, this last event being coordinated by the Innovation and Technology Transfer Institute (I<sup>2</sup>T<sup>2</sup>) and by the *Tecnologico de Monterrey*<sup>98</sup>. The most important leaders in the world of Knowledge Management participated in this event. Specialists coincided in time, place and space, where they shared their ideas and experiences to debate and create a global agenda of priority issues for the development of more regions and cities that base their development on creation and application of Knowledge<sup>99</sup>.

Countries such as Finland, New Zealand, Australia and Singapore, which have an integral vision of what a Knowledge region has to be, as well as countries of Latin America with interesting experiences including Colombia, Guatemala and Panama, shared their public policies, methods, techniques and experiences for

the understanding, management and evaluation of Knowledge Cities and their development based on innovation and high technology, among them, the search for organizations and community sustainability<sup>100</sup>.

This international encounter also witnessed the interaction among government officials, scholars, financiers, consultants and students in order to achieve a multidisciplinary, inter-institutional and multi-regional dialog. The week included the following activities: the Forum Dialogs, the First Summit of Knowledge Cities, the Annual Gathering of Global Compact's Local Networks, the Fifth Assembly of the Latin-American Community of Knowledge Systems and the first MAKCi Awards Ceremony, and 11 publications about Knowledge-Based Development were presented<sup>101</sup>.

### **Bio-Monterrey: International Congress and Biotechnology Exhibition**

In July 2007, during the Science and Technology Citizen Council of Nuevo Leon Meeting, the state governor (2003-2009) emphasized the special importance of new events to articulate the vision and projection of Knowledge in different aspects. The *Tecnologico de Monterrey*, the Autonomous University of Nuevo Leon and the University of Monterrey, as well as many other local academic institutions, have organized international events.

One of these is **Bio-Monterrey 2006**, where the academic institutions of Nuevo Leon participated and interacted with the academic institutions of the United States and Europe, especially with France and Italy<sup>102</sup>.

For the former President of the Mexican Academy of Science (2008), Dr Juan Pedro Laclette, Bio-Monterrey is: "*...a good strategy to place Nuevo Leon on the world map of Biotechnology, to foster the northeast bio-cluster project, which was just launched, and we hope that, in the next years, it may turn into an important center of regional development next to other important innovative and competitive clusters that are already in operation...*"<sup>103</sup>

After the success of **Bio-Monterrey 2006 (which witnessed the attendance of more than 1,400 people, the online following of 80,000 users and the contribution of 70 speakers from 16 countries of the European Union and the United States)** and which was focused on three pillars: Child Bio-Fair, Industrial Bio-Fair and the Scientific Event<sup>104</sup>, the **Bio-Monterrey 2008** took place, which held its position as one of the main events in biotechnology around the world. For this edition, **Bio-Monterrey** was organized in the three most relevant areas to the state of Nuevo Leon regarding its strategy as a Knowledge region and regional and international cooperation<sup>105</sup>: Biotechnology for Human Health (Medical and Pharmaceutical Biotechnology), Food Biotechnology and Human Nutrition and Bio-remediation, and Biotechnology and Sustainable Development.



**Bio-Monterrey** has not only a high relevance for the social-economic local-national development and for regional and international cooperation, it is also strategic because of the topics approached during the event comprise **the research and development areas of several bio-clusters that are being developed in Mexico with close cooperation from its counterparts in Canada, United States and Europe.**

For example, **the Northeast Bio-Cluster**, which aims to be a center of excellence in life and health science, and which is integrated by the Biotechnology Unit of the *Tecnológico de Monterrey*, the Health Institute of the UANL and its Medical School, has the objective to promote research and development projects supported by COCyTE and the creation of research and development centers in the PIIT<sup>106</sup>.

### **3.3 Innovation and Entrepreneurship Culture**

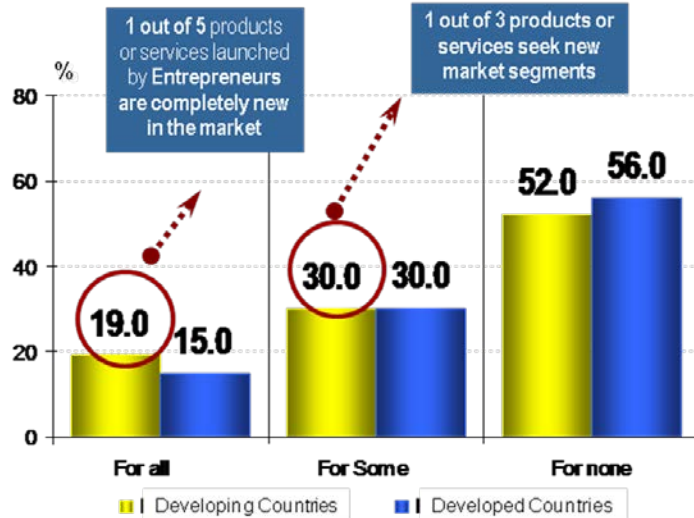
Researchers, businessmen/women, public servants, scholars and members of the civil society all agree on one thing: **innovation is the road to a more successful and sustainable economic and social development.** In a competitive and globalized economy, where knowledge generation is expeditious and technology change is permanent, evolution must be constant, since the market structures are highly dynamic.

One of the most contributing actors in the process of innovation are the entrepreneurs; their new products and services both motivate efficiency improvement and enable their competition in the local and international markets, especially in developing countries.

According to the **2006 Global Entrepreneurship Monitor (GEM)** survey, **one (1) out of each 5 products or services launched into the market by entrepreneurs is totally new, and one (1) out of every 3 products or services seeks new market segments.**

Global Entrepreneurship Monitor (GEM) 2006 Survey  
Entrepreneurs and their relation to Innovation

**For how many consumers is your product/service new?  
New Products/Services Launched into the Market**



Source: ITESM. Self-elaboration with data from the Global Entrepreneurship Monitor 2006 Survey. GEM 2006 Summary Results.

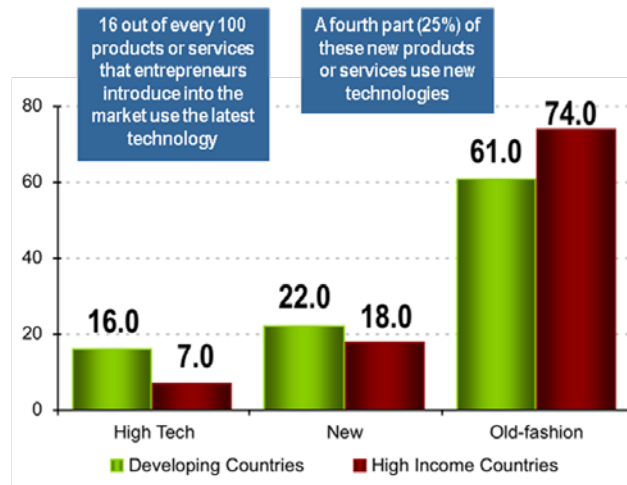
**Entrepreneurs significantly contribute to technological development, especially in developing countries. The 2006 GEM survey also reveals that 16 out of every 100 products or services that entrepreneurs introduce into the market use the latest technology and a fourth part of these new products or services use new technologies.**

On the other hand, in collaboration and synergy with the entrepreneur activity in Nuevo Leon, on the subject of research and development (R+D+i), the MIKC Program began its commitment to the future with the conception and announcement of the first **State Law for Promoting Knowledge-Based Development** (Chapter 2.4); afterwards, another key and strategic project for the conceptual model of the Triple Helix was carried out: the building of the **Technological Research and Innovation Park (PIIT)**, as well as the creation and operation of at least 37 new Technological Research and Development Centers and the institutionalization of the strategic clusters of Nuevo Leon.



**Global Entrepreneurship Monitor (GEM) 2006 Survey**  
**Entrepreneurs and their relationship to Technological Development**

**Technology Application to the New Products/Services**  
**Stage of Technology or the New Processes**



Source: ITESM. Self-elaboration with data from the Global Entrepreneurship Monitor 2006 Survey. GEM 2006 Summary Results.

### Creating the Technological Research and Innovation Park (PIIT)

The PIIT ([www.piit.com.mx](http://www.piit.com.mx)) is one of the fundamental projects and a center piece for the program: “Monterrey, International Knowledge City”. Its launch begins with the signing, in June 2005, of the agreement between the government of Nuevo Leon, CONACYT, CORPES (NL), I<sup>2</sup>T<sup>2</sup>, UANL, ITESM and UDEM<sup>107</sup>.

It can be said that the PIIT is the result of the strategic collaboration, in the framework of the Triple Helix model, between the academic sector (through universities and public research centers), the public sector (state and federal government though CONACYT) and the productive sector.

The PIIT’s mission –the first in its class in the county and Latin America– is to promote technological research and technology transfer between the academic sector and the business sector, as well as the development of intellectual capital for the state of Nuevo Leon. Its vision is to be a world class Technology Park to create value in the society through knowledge transfer based on scientific research<sup>108</sup>.

The main objectives of the PIIT are: to link research and innovation from the academic sector to the local productive sector in order to enable technology transfer; attract international technology-based enterprises; create high value jobs in the region; incubate businesses oriented toward new technologies; and encourage economic development through commercialization of new





technologies<sup>109</sup>, with the purpose of boosting the five strategic technological areas defined in the MIKC Program<sup>110</sup>.

The **PIIT** has a surface of 70 acres; which are destined to the Research and Development Centers (R+D+i) and to the private R+D+i Enterprises and Centers aligned to the objectives of the MIKC Program.

**As a whole, the PIIT represents jobs for 3,500 scientists, technologists and highly qualified support personnel<sup>111</sup>.**

As mentioned before, the **PIIT** contemplates the installation of Research and Development Centers (public and private) and software development or high technology and innovation enterprises. 37 of these are listed below, 8 of which are in operation as of April 2009<sup>112-113</sup>.

Technological Research and Innovation Park (PIIT)  
Resident Public and Private Institutions  
April 2009 Status

Universities	R+D+i Centers Public Inst.	R+D+i Centers Enterprises	Services PIIT
UANL ●	Water Institute ●	Motorola ●	Nano Incubator ●
ITESM ●	CINVESTAV ●	Pepsico ●	Bio Incubator ●
IC <sup>2</sup> (U. Texas) ●	CIMAV ●	Sigma Foods ●	Hotel ●
Texas A&M ●	CIDESI ●	IT Cluster ●	Commercial Area ●
Arizona University ●	IIE ●	Metalsa ●	Building for Rent ●
Arizona State U. ●	CIATEJ ●	Johnson Controls ●	Parking Lot ●
UDEM ●	CIMAT ●	Plastic Inst. ●	
UNAM (3 Centers) ●	CICESE ●	Furniture Inst. ●	
	CIAD ●	CYDSA ●	
	LANIA ●	Prolec-GE ●	
		Qualtia ●	
		Viakable ●	
		Ternium ●	
		Cemex ●	
		FICOSA ●	

● In operation ● Under construction 2009/2010 ● Under negotiation

Source: ITESM. Self-elaboration from data supplied by the Innovation and Technology Transfer Institute of Nuevo Leon (I<sup>2</sup>T<sup>2</sup>).

Chart: PIIT Residents<sup>114,115</sup>

1. Innovation, Research and Development in Engineering and Technology Center (**CIIDIT-UANL**) ► *In operation.*
2. Research and Strategic Product Design Center (**CIDEP-ITESM**) ► *In operation.*
3. IC<sup>2</sup> (**Texas University at Austin**) ► *Under construction 2009-2010.*
4. **Texas A&M** University ► *Under construction 2009-2010.*
5. **University of Arizona** ► *Under construction 2009-2010.*



6. **Arizona State University** ► *Under negotiation.*
7. **Product, Container and Packaging Innovation Center (UDEM)** ► *Under construction 2009-2010.*
8. **Three R+D+i Centers of the Autonomous University of Mexico (UNAM)** ► *Under construction 2009-2010.*
11. **Water institute of the State of Nuevo Leon (IANL)** ► *In operation.*
12. **Research and Advanced Studies Center (CINVESTAV)** ► *In operation.*
13. **Advanced Materials Research Center (CIMAV–CONACYT)** ► *In operation.*
14. **Engineering and Industrial Development Center (CIDESI–CONACYT)** ► *In operation.*
15. **Electric Research Institute (IIE)** ► *Under construction 2009-2010.*
16. **Research and Technology and Design Assistance Center of Jalisco (CIATEJ–CONACYT)** ► *Under construction 2009-2010.*
17. **Mathematics Research Center (CIMAT–CONACYT)** ► *Under construction 2009-2010.*
18. **Scientific and Higher Education Research Center of Ensenada (CICESE–CONACYT)** ► *Under negotiation.*
19. **CIAD** ► *Under negotiation.*
20. **National Advanced Computing Laboratory (LANIA)** ► *In operation.*
21. **Motorola Design Center** ► *Under construction 2009-2010.*
22. **International Baking Innovation Center (Pepsico–Gamesa)** ► *Under construction 2009-2010.*
23. **Sigma Food** ► *Under construction 2009-2010.*
24. **Monterrey IT Cluster** ► *In Operation.*
25. **Metalsa** ► *Under construction 2009-2010.*
26. **Johnson Controls** ► *Under construction 2009-2010.*
27. **Plastics Institute** ► *Under construction 2009-2010.*
28. **Furniture Institute** ► *Under construction 2009-2010.*
29. **CYDSA** ► *Under negotiation.*
30. **Prolec-GE** ► *Under construction 2009-2010.*
31. **Qualtia** ► *Under construction 2009-2010.*
32. **Viakable** ► *Under construction 2009-2010.*
33. **Ternium** ► *Under negotiation.*



**34. CEMEX** ► *Under negotiation.*

**35. FICOSA** ► *Under negotiation.*

**36. Nanotechnology Incubator** ► *Under construction 2009-2010.*

**37. Biotechnology Incubator** ► *Under negotiation.*

In addition to these R+D+i Centers, the PIIT will include a 130 room hotel and convention center, a shopping mall, a building for lease and a parking lot<sup>116</sup>.

*Note: Further information available at [www.mtycic.com.mx](http://www.mtycic.com.mx).*

### **Creation and expansion of other Research Centers**<sup>117</sup>

Several Research and Development Centers (R+D+i) have been installed in Nuevo Leon based on the strategic lines of the MIKC Program. The following centers are noteworthy, as of August 2008. **ITESM**: Biotechnology Center; Health Innovation and Transfer Center; Research and Technology Transfer Center; Technology Transfer Center (CT<sup>2</sup>); Technology-based Business Accelerator of the Graduate School of Business Administration and Direction (EGADE). The **UDEM** includes the following centers: Education Quality and Poverty Overcoming Interdisciplinary Studies Center; Technological Innovation Center (GENERA); Tribology Research, Development and Innovation Center and the Business Incubation and Development Center. In turn, the **UANL** has: the Mechatronics Technological Research and Development Center; Industrial Design Research Center; Nanotechnology and Nanoscience Laboratory; Audiovisual Communication Research and Production Center; Foreign Languages Research and Certification Center and the Nutrition and Public Health Research Center. The **UR** includes: the Research Center for Entrepreneur Competitiveness in the Knowledge Society; Professional Competitiveness and Permanent Employability Research Center and the Research Center for Professional Integration, Competitiveness and Development of Special Social Groups<sup>118</sup>.

The local private initiative also consists of very important R+D+i Centers, such as: **Whirlpool Household Appliances Technological Development and Research Center**; **FICOSA North America-Mexico Engineering Center (Catalonian auto-parts company)**; **Biotechnology and Genetics Research Center (Livestock Union)**, among others. Another R+D+i center that stands out is the **Monterrey Central Regional Laboratory (LABMTY)**, with more than 30 years of knowledge and expertise in food and agriculture health and harmlessness, for from its foundation, it has worried about being in the vanguard of knowledge and technology in this field. It works with Biology Science, Veterinary, Earth and Biotechnology Science students that are studying for Bachelor and Graduate Degrees in UANL and/or ITESM. In addition, **LABMTY** performs studies in animal health, genetic improvement and reproduction, food harmlessness and animal nutrition<sup>119</sup>.



## Strategic Clusters Creation

With the purpose of fostering innovation, as well as giving scientific research a sense of economic profitability and accelerate technology transfer to the local productive sector, the state government (2003-2009), promoted the integration of regional strategic clusters, through the Ministry of Economic Development (SEDEC), in the next sectors: Automotive, Household Appliances, Aerospace, Biotechnology, Nanotechnology, Specialized Medical Services, Information Technology (Software) and Agribusiness<sup>120</sup>.

The creation of these clusters, under the responsible and joint collaboration of the productive sector, was an important step for the development and consolidation of Nuevo Leon towards the knowledge economy. These clusters, which aim to work under the new concept of *coopetence* (collaboration in competency)<sup>121</sup>, have been developing synergies and scale economies which, in collaboration with the academic sector and the government, have given a greater impulse to productivity and local competitiveness.

### ***Aerospace Cluster***

Established as one of the priority sectors of the economic development program in Nuevo Leon, the SEDEC has taken the assignment of backing up the Aerospace or Aeronautic companies already established in the state and to attract new enterprises and suppliers for these. Thanks to the joint effort between the government, the educational and the productive sectors (Triple Helix model), Nuevo Leon has a solid Aerospace cluster<sup>122</sup>.

Among the most important companies that strengthen the regional cluster competitiveness are: Frisa-Wyman Gordon, Doncasters, Decraine Aircraft, MD Helicopters, Bodycote and Jaiter, among others<sup>123</sup>. In 2007, industry exports recorded US \$150.6 million dollars.

To meet the Aerospace industry's specialized and certified labor demand, the local educational institutions offer majors in Aeronautic Engineering (UANL), Motor and Airplane Maintenance Technician (CONALEP), and ITESM is already working on the Masters in Aeronautics program.<sup>124</sup>

### ***Aerospace Industry Development Center (CEDIA)***

In the Aerospace cluster's specific case, the *Tecnologico de Monterrey*, in an attempt to collaborate in the industry's regional development, joined forces with the state government in order to create the **Aerospace Industry Development Center (CEDIA)**, which was inaugurated in October 2007, the **efforts** of which **concentrate on developing human capital, designing strategies, evaluating programs and managing projects that seek competitiveness in this sector**<sup>125</sup>.

Mr. Luis Vicente Cabeza Aspiazu, coordinator of the Manufacture Systems Master's Degree of ITESM Monterrey and director of CEDIA (2008), explained that this new research center was born under the MIKC Program context, since it is the most suitable link between academy, government and private initiative "... from here on, (CEDIA) will support Aerospace suppliers so they can get international quality certifications, promote the link between the business, academic and government sectors and foster the existence of more professionals in the field..." stated the ITESM official<sup>126</sup>.



On the other hand, **CEDIA** has the goal of promoting academic development through the thesis of the engineering students and those from similar majors, and the implementation of B.A. and M.A. programs destined to support the Aerospace sector development, not only in the region, but the whole country. Another line of work is the consultancy, specifically through diagnoses of companies in order to facilitate their way to competitiveness through certification processes. Technological development consultancy services are also offered<sup>127</sup>.

Regarding this matter, Luis Vicente Cabeza Aspiazu stated that: "... there are 30 companies in Nuevo Leon, mainly in the metal-mechanic area, that are candidates to enroll in the aerial industry. In that sense, the job of CEDIA will be to help them develop their certification processes..."<sup>128</sup>, and added: "...the objective to develop the academic preparation of students in the space area is very clear... the Manufacturing Systems Master's and the Quality and Productivity Master's both have interest in developing this subject... this is a need in our state; a trend; for example: the Autonomous University of Nuevo Leon just opened the Aeronautics Engineer course..."<sup>129</sup>.



### **Automotive Cluster**

The state of Nuevo Leon occupies the first place nationwide in the production of cylinder heads, engines, car batteries, glass and harnesses; it occupies the second place in the production of trucks and buses, electric and electronic equipment, as well as plastic parts for the terminal automotive industry. It also produces bodywork, transmissions, brakes, seats, metal stamps, tires, direction and suspension systems, to name a few<sup>130</sup>.

The Automotive cluster of Nuevo Leon is made up by light and heavyweight truck producers and by 195 auto-part companies, 50 of which are foreign companies and the rest are national. The Automotive and Auto-part Industry of Nuevo Leon has propelled economic growth and regional progress (it represents 8.4% of the national automotive industry GDP), it generates employment and its exports have tripled in the last 7 years by going from US \$638 million dollars in 2000 to US \$1,993 million dollars by the end of 2007<sup>131-132</sup>.

To support the competitiveness of this industry, work is being done to create a virtual laboratory and to exercise the link between companies and universities<sup>133</sup>.

The main companies that make up this field's cluster are: Nemark, Johnson Controls, Vitro Automotriz, Xignux, Navistar International, Mercedes Benz, Denso, Carplastic, Takata, Metalsa, Quimmco, Anchor Loch and Ficosa<sup>134</sup>.



Source: ITESM. Self-elaboration with data from Data Nuevo Leon.

### **Household Appliances Cluster**

Mexico is currently the main supplier in the household appliances industry in the United States, Canada and Central America due to the great network of qualified



suppliers in the production of plastic materials, thermodynamic and thermoelectric processes and in metallic imprinting<sup>135</sup>.

Nuevo Leon has become an attractive option for foreign companies seeking a profitable production and export platform in the household appliance industry. Nuevo Leon's economy currently has a solid household appliance cluster that is in continuous growth; it is a network of more than 100 supplying companies that have allowed companies such as Whirlpool, Friedrich, Carrier, York, Phillips, LG Electronics and Mabe, amongst others, to establish their operations in the state<sup>136</sup>.

The household appliance productive chain is also strengthened and integrated by other industries, such as the metal-mechanic, electric, plastics and others. Companies like *Collis de México*, *Criser*, *Danfoss*, *EPM Plastics*, *Estrosa* and *Kentek* are just a few that offer the industry's basic products and services, like plastic injection, electronic components, imprints, manufacture, packaging, etc. Most of these guarantee the quality of their products, since they have undergone certifications from *ISO 9000*, *ISO 9000:2000* and *TS 16949*<sup>137</sup>.

The government of Nuevo Leon has promoted the creation of the Household Appliance Industry Citizen Group with the intention of maximizing competitiveness. This council has taken actions to reinforce the supplier network and to consolidate their production chains<sup>138</sup>.

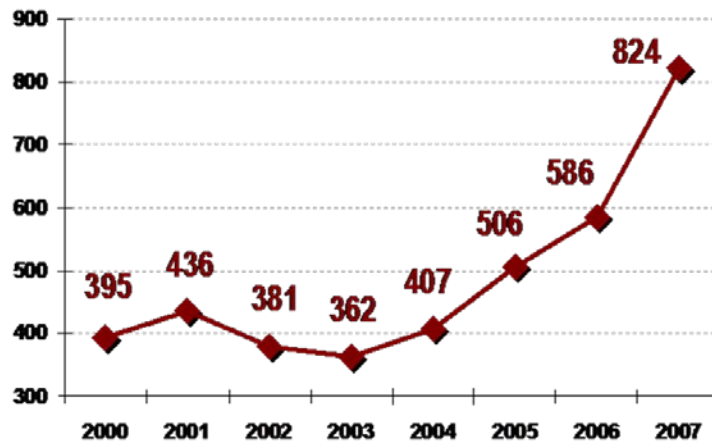
### ***Agribusiness Cluster***

In March 2007, the first agribusiness cluster in the whole country was constituted, in other words, the first specialized food and agriculture industry group, in which all the local agricultural and livestock producers participate<sup>139</sup>. From its beginning, this cluster implemented important programs for its competitiveness, among them are: the **Agro industrial Park** and a new (modern) **Central de Abastos (Supply Center)**.

The Supply Centers work with processes that allow the local producers to participate in globalization, through foreign trade, as well as join the productive chains and transform (added value) the food that is produced in this region of the country<sup>140</sup>.

With these actions, the link between the local food and agriculture industry and international markets has strengthened; to such a degree that exports from this sector have doubled in the past 4 years, going from US \$407 million dollars in 2004 to US \$824 million dollars in 2007, where meat, derived from stockbreeding, represents a very important sector<sup>141</sup>.

Nuevo Leon Exports  
Agroindustrial Sector  
Million Dollars  
2000-2007



Source: ITESM. Self-elaboration with data from Data Nuevo Leon.

Stockbreeding in Nuevo Leon has been constant since the foundation of the state because it represents not only an economic activity, but also a tradition linked to the sense of being northerners. For the first time in the state's history, the stockbreeding census surpasses 300 thousand livestock heads<sup>142</sup>.

### ***Advanced Information Technologies Cluster (Software)***

**The Council for the Development of the Software Industry in Nuevo Leon (CSOFTMTY)**, is born in August 18 2004, from an initiative by the business sector, the government and the universities to sustainably develop a large volume of qualified employment for the software industry of Nuevo Leon, and to generate the economic development of its members and the entity in general. It is worth mentioning that CSOFTMTY is one of the oldest Information Technologies clusters in the country.

CSOFTMTY's vision, toward 2014, is the generation of 20,000 new jobs related to the software industry and a turnover equivalent to USD \$1,000 million a year.

The cluster is constituted by 21 members, 11 enterprises (*Softtek, Neoris, Hildebrando, Internacional de Sistemas, Microsoft, TCA, MIGESA, TOWA, IDZ, Digital Minds, Mexware*); 5 universities (ITESM, UANL, UDEM, UR, *Tec-Milenio*) and 3 business associations (AETI, CANIETI, ORIGO) and 2 state government organizations (SEDEC and I<sup>2</sup>T<sup>2</sup>).

To fulfill CSOFTMTY's objectives, several initiatives have been developed and supported, including:

- The creation of the Institute for the Development of Talents in Information Technologies (IDETI) (Sub-chapter 3.1)

- The support for the development of Monterrey IT Cluster.
- An awareness campaign regarding software majors, in conjunction with the state of Coahuila, to attract new students and retrain people with engineering degrees to develop in the Software development field.

On the other hand, the **Monterrey IT Cluster** is a civil organization that groups enterprises dedicated to software research and development. The **Monterrey IT Cluster** joined the MIKC program and set up at PIIT. This meant that more than 40 enterprises and institutions joined to establish the **Monterrey IT Cluster**, a proposal from the **Information Technologies Enterprise Association (AETI)** to present a united front and be able to work on large scale international projects (mainly to save on operation costs); this strategy translates into greater competitiveness and productivity<sup>143</sup>. One of **Monterrey IT Cluster's** first achievements is to be certified under the CMMI (*Capability Maturity Model Integration*)<sup>144</sup>.

Through this cluster, that represents a USD \$12 million investment and occupies 22,000 square meters within PIIT, entrepreneurs project an integrated image favored by large US companies, as well as integrate SMEs, the collaboration of the local software industry and the development of infrastructure to become competitive<sup>145</sup>.

The member enterprises in the **Monterrey IT Cluster** are: *Eisei, Kernel, Northware, Citi, Ilinium, Intelexion, Mexware, Praxis, Expertec, Adepsa, Appteck, Expert Sistemas, LANIA, Logística, Ingeniería y Sistemas, OpenService, Cibernet, Comunicaciones Erlang, Dalai, E-Software & Business Solution, Multiaplicaciones Portátiles, Scatel, Sinersys, PlanNet, Bitam, Eduspark, Elevation Studio, Ercatech, Innevo, Microsip, SCAI, Sierra MicroTecnología, SIT Consultores, Source Code, Tecno Actual, UANL, Ventus Technology, Grupo Asercom, Syndein, Creaciones Interactivas de México and Multicomp*. The only requirement for this cluster membership being that they be dedicated to software R+D+i, rendering the equipment and solutions marketing organizations unfit to the profile to become part of the scheme<sup>146</sup>.

### **Specialized Health Care Services Cluster**

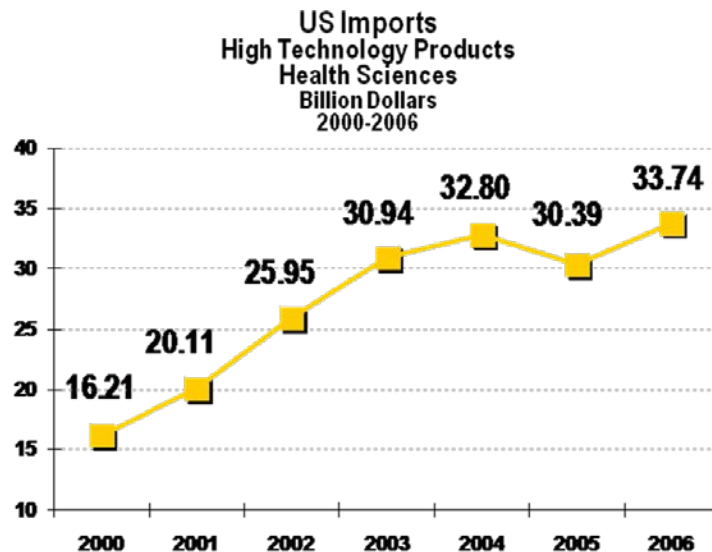
Nuevo Leon has become a hub of enterprises related to the specialized health care services sector, which offers world-class service to local and foreign communities, mainly for the United States. Hospitals, such as Christus Mugerza, Santa Engracia, *Tecnologico de Monterrey's* San Jose Hospital, UANL's University Hospital, Oca Hospital and the Osler Medical Center have been cataloged as high-quality health care suppliers by local and foreign authorities<sup>147</sup>.

Furthermore, there are many clinics and laboratories such as *Vitro, Nova, Cuauhtemoc and Famosa*, as well as research and innovation centers in fields

such as applied bio-technology, supported by the main local universities. All these hospitals, clinics and research centers have fostered the development of the cluster related to the supply of specialized health care service<sup>148</sup>.

Making this cluster more competitive includes the following actions: that through the creation of a Promotion Committee, including main medical institutions (hospitals and schools), cooperation proposals are being analyzed and generated to create a chain of certified supply for the national and international markets<sup>149</sup>, mainly to take advantage of the strong demand for medical services in the United States, a country that suffers from the high costs in this field. In 2006 alone, it imported high technology products in the health care field for the equivalent of USD \$33.74 billion dollars.

Other actions include: offering specialized education in administration, bio-medical engineering and bio-technology; seeking national and international certification of medical centers and hospitals; promoting projects within the hospitals and suppliers integrated network; treating diseases and performing surgeries of high complexity; developing research alternatives in pharmacology with the participation of medical schools, hospitals and the local pharmaceutical industry<sup>150</sup>.



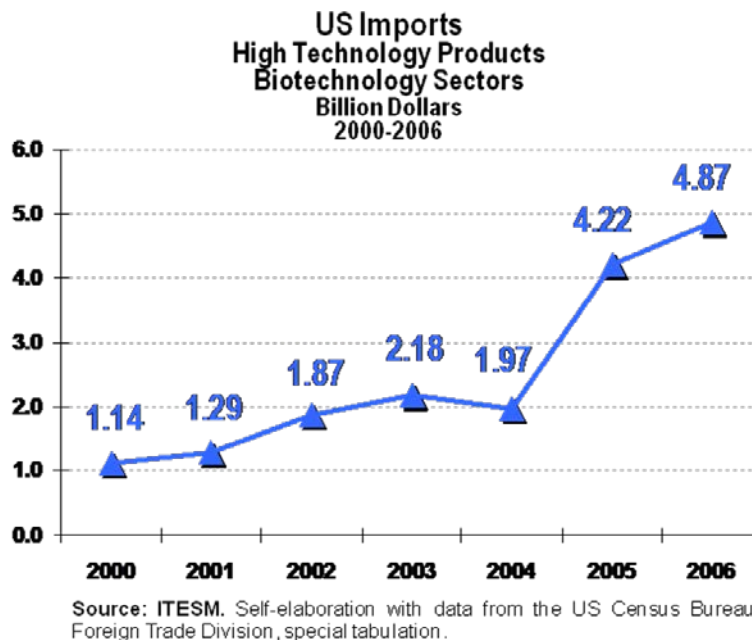
Source: ITESM. Self-elaboration with data from the US Census Bureau, Foreign Trade Division, special tabulation.

### ***Bio-Technology Cluster***

The bio-technology cluster was constituted in January 2008. This cluster has a special role in health care, but also in other areas that are having an impact in local and global economy, such as bionutrition, bioecology and biosafety. The cluster includes enterprises such as Merchant, Monsanto, Sigma, Novartis,

Signus, as well as a growing group of enterprises linked to the pharmaceutical sector<sup>151</sup>.

It is noteworthy that the United States has begun to increase their demand in this high technology sector. In 6 years, they have increased fourfold their imports in the biotechnology field. In the year 2000, the United States imported biotechnology products in terms of USD \$1.14 billion and, by 2006, imports reached USD \$4.87 billion.



The Biotechnology Center of *Tecnologico de Monterrey*, the Food Industry Technological Research and Development Center and the building of a tower for medical and biomedical research by the UANL were launched with the development of Nuevo Leon's biotechnology<sup>152</sup>.

Nuevo Leon's educational system and business sector backed the creation of the Citizen Advisory Council for the Development of Biotechnology, presided by the state government and supported by the active participation of UANL's academicians and researchers<sup>153</sup>. Another project, currently under design but strategic to the consolidation of Nuevo Leon's biotechnology cluster, is the scientists and technologists development program<sup>154</sup>.

### ***Nanotechnology Cluster***

The Nanotechnology cluster (science dealing with microscopic particles measuring a millionth of a millimeter) was formally launched 9 June 2008, with the commitment to develop, during 2009, nano-technological projects applicable to the local and international markets. The cluster's main actors include: the



UANL, ITESM, Arizona State University, the Advanced Materials Research Center (CIMAV), the Industrial Development and Engineering Center (CIDESE), the Electric Research Institute (IIE) and 17 enterprises such as, *Vitro, Sigma, Prolec, Metalsa, Cemex, Rex Plasticos, Viakable, Lamosa, Whirlpool, Ternium* and Industrial Group *Saltillo*<sup>155</sup>.

The cluster's objectives are human capital development, funding attraction and implementation of new businesses' projects with nanotechnology application.

### **Regional Competitiveness and Innovation Program**

To the Intellectual Capital and Competitiveness Center (CECIC), the age of Knowledge and information, technological revolution and market globalization are the characteristics of the new economy for the XXI century. These characteristics are known as global hyper-competition, which is to be faced through the development of innovation in Knowledge-based enterprises, clusters and regions to be successful, their strategic factor being intellectual capital<sup>156</sup>.

**Nuevo Leon's Regional Competitiveness and Innovation Program** suggested the local dimension and strategy for the regional integration of North-eastern Mexico and the South of the US: Nuevo Leon, Tamaulipas, Coahuila, Chihuahua and Texas, but it mainly laid the foundations for the MIKC Program<sup>157</sup>.

According to this program, the transition toward the new economy (from manufacture to mind-facture) is based on 6 fundamental pillars<sup>158</sup>:

- Strategic mind-facture clusters.
- Regional Innovation System, integrated by I<sup>2</sup>T<sup>2</sup> and its Innovation and Intellectual Capital Centers per strategic sector and cluster, for innovation development by means of integrating a network of public and private institutions and public policies which develop activities to create, attract and transfer Knowledge.
- Knowledge ICT's and Technological Parks Infrastructure.
- Learning-based Knowledge educational system, creativity and innovation for human capital training and development.
- Technological SME's development and policies to encourage investment in the technology sector.
- Efficient innovative government and public policies –for the creation of technological development and infrastructure clusters- as well as competitive public services and goods.



**The Regional Competitiveness and Innovation Program suggested the Coordinating Commission for Competitiveness and Innovation**, responsible for coordinating the orchestration of the program and identifying the actions which the entity's agents will perform to develop the clusters' competitive capabilities. The actors, enterprises, academy and government, are to create a chain of confidence that will lead them to work collaboratively under a same competitive objective and approach, to develop a state and regional economy where the added value is based on innovation, and which enables the transition to mind-facture<sup>159</sup>.

This program's expected outcome is the development of a competitive Nuevo Leon, accompanied by a greater integral human development: with a better quality of life, a greater knowledge, education and income per person in the state of Nuevo Leon.

### **Instruments for innovating in a TRIZ. Mexico does create.**

Technological innovation is essential to survive in a global competition system, **and for Mr. Manuel Zambrano Villarreal, COPARMEX Nuevo Leon 2008 President, Nuevo Leon's businessmen/women are convinced of it**<sup>160</sup>.

*"...the number of patents is an important indicator for innovation capability in a region or country..."* explained Mr. Luis Cardenas Franco, operative director for I<sup>2</sup>T<sup>2</sup>-161 during an interview for *Innovacion* (May 2008) *"...this is the reason why, discovering and finding innovative solutions to product and patent problems, is what more than two dozen enterprises have found through the TRIZ Program..."*

The Theory of Inventive Problem Solving (TRIZ acronym for the Russian *Teoriya Reseniya Izobretatelskin Zadach*) is a methodology that enables workers and leaders to considerably improve their inventive capability in problem solving, and helps them develop ideas that are so effective they may be patentable. The TRIZ methodology was developed by *Genrich Altshuller* from Russia<sup>162</sup>.

This methodology is available to businesses in the region through I<sup>2</sup>T<sup>2</sup> and COPARMEX which have formed an alliance with *Institut National des Sciences Appliquées (INSA)*, an Engineering school in Strasburg (France) and the Mexican Industrial Property Institute (IMPI) site Nuevo Leon to bring these courses to Nuevo Leon's businessmen/women.<sup>163</sup>

Through TRIZ, engineers and managers from local enterprises are trained to observe where their competitors are going from the technological point of view, and organize their competitors' information, identify development areas and generate patents to be applied on products with a greater added value. **From the beginning of the TRIZ program, in 2005, about 60 enterprises, 120 engineers and managers have participated, and about 30 patent applications have been generated.**



## **INVITE Program (Regional Technology Commercialization Program)**

The government of Nuevo Leon signed a collaboration agreement with the Innovation, Creativity and Capital Institute (IC<sup>2</sup>) of the University of Texas in Austin, in 2004, to incorporate researchers from North-eastern Mexico to a commercialization in international markets program, due to the government's major concern for bringing technological innovations closer to international markets<sup>164</sup>.

This is how the **Program for the Integration of the North-eastern Regional Development and its Linking to Texas (INVITE)** was created, through which researchers learn to make business plans and find funding to commercialize their patents.

In 2005, the first invitation was issued to all inventors in Nuevo Leon, Coahuila and Tamaulipas. The only requirement was to present research projects with a high degree of technological development.

Universities, scientific and technological research centers, enterprises, laboratories and independent researchers participated with 38 projects, six of which concluded the program successfully. Some are closer to their finish line and others continue their search for investors to back up their introduction to the market<sup>165</sup>.

For the program's second emission, which began in August 2006, 70 initiatives were registered, most with a great orientation towards commercialization, which enabled the selection of 20 for training and advisory. One of the advantages of the agreement signed with the IC<sup>2</sup> is that it includes training of technology seekers and selectors. Additionally, the IC<sup>2</sup> will strengthen their linking to the local market through the permanent headquarters to be set up in the PIIT<sup>166</sup>.

## **MIKC and the Mexican Industrial Property Institute (IMPI)**

Guarantee the protection, exclusivity and economic profitability of patents developed in Nuevo Leon is a function performed by the "Monterrey, International City of Knowledge" Program, in coordination with the **Mexican Industrial Property Institute (IMPI)** of the Mexican Federal government<sup>167</sup>.

Patents are not only guaranteed protection and exclusivity, they are also an incentive that recognizes the creativity and inventiveness of enterprises and people; therefore, "...we take people by the hand because it is a process that may last up to five years..." explained, during an April 2007 interview for **Innovacion**, Mayra Nuñez Vasquez, head of the IMPI North Regional Office (dependence overseeing Nuevo Leon, Coahuila, Tamaulipas, Durango and

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

---

Chihuahua), and adding, “...the IMPI also offers its training services to universities, technological institutes, enterprises, incubators, entrepreneur programs and independent researchers to encourage patent applications in the state of Nuevo Leon and the region...”<sup>168</sup>.

### **Accelerators and Incubators: The entrepreneur spirit of Nuevo Leon**

For a new enterprise to prosper and reach goals established, it needs a guide or professional guidance, one that will give it access to a network of contacts and which will help it improve its business model in such a way, that it will have access to the global market and, at the same time, acquire the competencies to attract resources and capital to enable a sustainable growth.

As we saw at the beginning of this chapter (3.3), entrepreneurs are one of the actors who most contribute to the processes of technological innovation and development in a region and, as a result, they strongly boost the development of Knowledge economies and societies.

During the last years, Nuevo Leon has renovated that entrepreneur spirit so characteristic since its foundation, therefore encouraging the creation and operation of more business incubators and accelerators, those of which develop and internationally boost new enterprises, especially highlighting those which are technology and innovation based, with the purpose of generating regional and national well-being and sustainability.

### ***Tecnologico de Monterrey (ITESM) Business Accelerator***<sup>169</sup>

The EGADE (ITESM), in August 2007, inaugurated its business accelerator which in 2008 assisted 100 businesses under development, 71 of which are SME's and 29 are “gazelle” enterprises (a SME with a growth significantly higher than the GDP and the national employment rates, estimating parameters of 15 – 25% of annual growth). SME's assisted by the EGADE-ITESM business accelerator during 2008 are classified as displayed in the chart below.

During the 2008-2009 period, the accelerator has been working with, at least, 140 enterprises (40 “gazelles” and 100 SME's).

### ***Technology Innovation and Transfer Center (ITESM)***

The **Technology Innovation and Transfer Center of Tecnológico de Monterrey (CIT<sup>2</sup>)** has the objective of encouraging the development of technology-based enterprises, enable activities for technology transfer and accelerate commercialization of new technologies, creating the environment and

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

---

atmosphere that are adequate to promote growth and alignment of these enterprises to global markets.

CIT<sup>2</sup>'s facilities are incubating the following enterprises (2008 data): WIPRO Technologies, Dextra Technologies, Wave Group, Nara Communication Technologies, Proforma Latinoamerica, Adoxis and OniVoice. The CIT<sup>2</sup> currently has 2 basic operations: the Technology-based Incubator and the Landing Program or program to realize new national and international technology businesses. CIT<sup>2</sup> also houses EGADE's business accelerator's physical installations. A third CIT<sup>2</sup> operation is being planned: the Medici Program, for technological undertakings from the research chairs. This program will be in charge of linking a research chair professor with a student from the entrepreneur modality so they jointly develop and commercialize technological products and services.

***Business Incubation and Technology Transfer Center of UANL***<sup>170</sup>

The **Business Incubation and Technology Transfer Center (CIETT)** is an incubator created by the UANL in 2005, aligned with the objectives stated in its 2012 vision. The CIETT was created to support, regulate and perform innovation, intellectual property protection, business incubation and technology transfer processes generated by the professors, students and employees of the UANL. This center includes experts in technology or state-of-the-art search, intellectual property protection, negotiation, business plans, marketing, collaboration agreements, contracts and business activities.

CIETT's mission is to support and regulate innovation, intellectual property protection, business incubation and technology transfer processes from the UANL to the productive sector, and generate resources to support university programs in education and research, as well as to award innovators and entrepreneurs.

***Business Incubation and Development Center of UDEM***<sup>171</sup>

The **Business Incubation and Development Center (CIDEM)**, of the University of Monterrey, has the mission to: foster the development of enterprising leaders and strengthen the creation of competitive SME's that generate great added value, focusing on innovation, technology commercialization and internationalization. The CEDIM, the goal of which is to position itself as one of the ten most important and best operating incubators in Latin America, includes an incubation and post-incubation program for the successful launch and follow-up of the new businesses' operation, which includes: incubation plan certified by the Ministry of Economy, linking to seed capital, linking to UDEM centers, fitted

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

---

offices, business network, specialized courses in business areas, access to specialized software and specialized and personalized consultancy.

It also offers business development services for those enterprises seeking growth, consolidation and internationalization by means of: an international commerce business plan, linking to TechBA business accelerator (operated by the Mexico United States Foundation for Science), specialized courses in Technological Commercialization, the Certified Global Business Planner Seminar, a business network and specialized and personalized consultancy.

### ***Business Incubator of Regiomontana University***<sup>172</sup>

The **Business Incubator of Regiomontana University (INEUR)** began operations in 2006, with the support of the 2005 SME Fund and the consultancy and technical support from the Ministry of Economic Development of Nuevo Leon (SEDEC), the Ministry of Economy through the Sub-Ministry for SME's and the SME Commission from CAINTRA.

This incubator develops entrepreneurs and creates technological enterprises which are innovative, profitable, globally competitive and employment-generating for students and graduates from the *Regiomontana* University and for people interested.

Its operation guidelines are:

- To strongly promote the generation of businesses and the support for entrepreneurs.
- Information Access for business decision making.
- Capital and credit access.
- Technology application.
- To develop a revolving income model.
- To strengthen the creation of high technology enterprises.

Some INEUR's active enterprises (2008 data) include: *3G, 4Diabetics, buscarcasa.com.mx, Creativos Diez, Central Power, Ekon, iBrandi, Jesco, Lintramex, Neo Horizons, Nova Health, Regio Alimentos, Royal Material, Supera, Villadherente* and *Villafuerte*. December 2007 witnessed the first graduation of businesses stemming from the incubation process: *Agredano, Blanc, Blupons, Cocimsa SA de CV, Creativiti, Empanadas Che* and *Regi*.

### ***Business Incubator Monterrey***<sup>173</sup>

The **Business Incubator Monterrey (INEM)** is accountable to the municipality of Monterrey. The INEM supports entrepreneurs in the launching and consolidation of new businesses; it offers a physical establishment, support through

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

specialized consultancy, linking and training to reduce costs and risks in the creation of businesses, therefore increasing their survival in the market.

Additionally, the INEM intends to be a training and linking business center. INEM offers the following services:

- Entrepreneur project incubation.
- Training: Conferences, workshops, courses and seminars.
- Accounting, legal, financial and marketing consultancy and advisory.
- Channeling to credit services and to public and private offices.
- Entrepreneur project exhibition.
- Secretarial and administrative support.

Some of the enterprises incubated include (2008 data): *Aeroluz, Sistemax, Expanden, Mamá Actual, Novasol, Golosinas Toin, Humankey, Genergy, Nurse International, Sinemed Systems, Aip, Pixel Innovation, Vía Ferratas, Xochicalli, Lopsor and Gloriosas Tentaciones.*

**State New Business Incubators System of Nuevo Leon**

State of Nuevo Leon  
Incubators/Type  
2007

Incubator	Type
ITESM	Traditional (Social)
ITESM	Intermediate Technology
ITESM (CIT <sup>2</sup> ) - Accelerator EGADE	High Technology
CIDEM (UDEM)	Intermediate Technology
UANL	Intermediate Technology
CIETT (UANL)	High Technology
FIME (UANL)	Intermediate Technology
FACPAyA (UANL)	Traditional
INEUR (UR)	Intermediate Technology
UNITEC Cumbres Campus	Intermediate Technology
CECATI Monterrey	Traditional
Monterrey Municipality (INEM)	Traditional
San Pedro Municipality	Traditional
<b>Total= 13</b>	

Source: ITESM Self-elaboration with data from SPYME (Sub-Ministry of Small and Medium Enterprises) (June 2008)

The table summarizes the **new business incubators system of the state of Nuevo Leon**, strongly promoted since 2004 by the state government, the federal government, the municipal government of MMA, the universities and the local business sector (Triple Helix model).



## Monterrey, International Knowledge City (MIKC) Summary Phase 1 and Master Plan Proposal Phase 2

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By 2007, there were a total of 13 new business incubators which have strongly contributed to strengthening the MIKC Program.

### **3.4 Urban Infrastructure and Equipment**

To achieve for the citizens of Nuevo Leon a life and coexistence within a society fostering growth, innovation, education, research, health, sustainability, culture, globalization and governability, steps have been taken to carry out very important local urban projects intended for a greater economic development that will have a strong impact on the well-being and development of Nuevo Leon's society.

It is noteworthy to mention that the projection and preservation of public works is vital to the MIKC Program; therefore, urban infrastructure and equipment are considered priority actions, carried out by the **Strategic Urban Projects Coordination**, an organization the objective of which is to enable, promote, plan, design and execute plans, programs, and projects that will solve urban and traffic problems (for more information, see Chapter 2). **One of its most important and transcendental projects is the urban integration of *Macropiazza-Fundidora Park-Santa Lucia River Extension*, to rescue the downtown area of the city of Monterrey**, defined as a strategic project in the 2004-2005 PED.

## **INFRASTRUCTURE FOR KNOWLEDGE**

### **Technological Research and Innovation Park (PIIT)**

As mentioned in Chapter 3.3, one of the most important projects carried out during the MIKC Program, Phase 1, is the construction of PIIT for the support of regional research, development and innovation.

**PIIT is an architectural piece that beautifies the urban panorama. It is located on Km 10 of the International Airport of Monterrey highway, in the municipality of Apodaca (where 40% of Monterrey's industry is concentrated)<sup>174</sup> and it faithfully represents the region's transition toward the mind-facture (which is the achievement of productivity through the incorporation of people's knowledge and abilities to industrial processes and products, translated into new ways of doing things; and, therefore, enabling the differentiation of products and services to make them more internationally competitive).**

PIIT has served as a detonator for the region's development, attracting not only the high technology and innovation industry, but also the areas of service, commerce and residential zones.<sup>175</sup>

## **URBAN INFRASTRUCTURE**

### **Aerotechnopolis**

The **Aerotechnopolis** is a very important project, currently at the design stage, which may have a great impact on the MIKC Program development and consolidation. Since 2007, it has undergone consideration regarding its setting near Monterrey's International Airport. This project intends to integrate a manufacturing area of high technology and logistics with a residential area, including all services, such as commerce, schools, health care and others. The Aerotechnopolis is mainly focused on the talents dedicated to knowledge generation and application at the PIIT.

As mentioned by Mr. Abel Guerra Garza, **Coordinator for Strategic Urban Development Projects of Nuevo Leon**, in May 2008: "...*promoting an Aerotechnopolis would enable the state's development...*"<sup>176</sup>.

Additionally, Mr. Luis David Ortiz Salinas, Executive President for the **Urban Development Agency (DUNL)**, reiterated around the same date: "...*the next stage for PIIT should be the building of a near residential area, commercial equipment, to offer quality of life to the people who are going to work there, so they do not have to cover long distances to the city of Monterrey...*"<sup>177</sup>

### **Upgrading the Metropolitan Urban Development Plan: Considering Action Estates (or Integral Sub-centers)**

A very important project that is strongly under way is upgrading the **Metropolitan Urban Development Plan**, which considers the building of what are called **Action Estates** in Monterrey's conurbation. These estates are equivalent to the **integral sub-centers where there are planned integral areas, with all the infrastructure needed (residential, commercial and services) and with the investment of public resources from the state and municipality, as well as private resources.**

Mr. Luis David Ortiz Salinas (DUNL) mentioned in May 2008 that "...*we must foster at least 5 new action estates and we are working on a pilot estate in the municipality of Zuazua...*"<sup>178</sup>. He also mentioned that the reforms to the State Urban Development Law, which considers several of these actions, were under discussion.

### **Urban Integration: *Macroplaza- Fundidora Park- Santa Lucia River***

The projection and preservation of public works is essential to the MIKC Program. One of the most strategic programs, and which is based on the 2004-2009 State Development Plan, is the urban integration: ***Macroplaza- Fundidora Park- Santa Lucia River Extension***, to rescue Monterrey's downtown area,

## Monterrey, International Knowledge City (MIKC) Summary Phase 1 and Master Plan Proposal Phase 2

---

which translates into the projection of road infrastructure, the building of shopping malls, green areas, museums and auditoriums<sup>179</sup>.

This project directly or indirectly contemplates 21 blocks and 1,010 lots, additional to the extension of the *Santa Lucía* Riverwalk with a length of over 1.5 km and incorporates the Federal Government Palace and the House of Government together with some museums and preserved areas for the economic development of the area and the building of a shopping mall<sup>180</sup>.

This urban integration has contemplated the following projects<sup>181</sup>:

- Integration of the *San Luisito* district.
- Restoration of *Fundidora* Park (Lewis Bay, the Arts Center and Steel Museum expansion, among others).
- Regeneration of *Barrio Antiguo* and the *Santa Catarina* River, to be connected to *Fundidora* Park and *España* Park.

It is worth noting that the urban regeneration processes carried out in the metropolitan area of Monterrey have been undertaken in large cities, such as Barcelona and Seville (Spain), San Antonio, Texas (USA), Osaka (Japan) and Montreal (Canada), taking advantage of international forums where great events are staged and where, at the end of these, the urban works remain for the enjoyment of citizens and visitors<sup>182</sup>.

### ***Santa Lucía* Riverwalk**

Connecting *Fundidora* Park to *Macropiazza*, through a pedestrian and aquatic route through the *Santa Lucía* Riverwalk (inaugurated September 2007) has been a very valuable heritage for the families of Nuevo Leon<sup>183</sup>.

The project had an investment, according to data published on Nuevo Leon's government homepage (2003-2009) of \$918 million pesos; it includes a navigable canal 2.5 km long, together with walking paths of up to 15 meters wide, cultural and shopping areas, illumination, 24 fountains and a number of gardens<sup>184</sup>.

With the building of the first stage, the main fountain of the Mexican History Museum was enlarged, making it part of the canal's journey. The water-bearing strata of the old *Santa Lucía* natural pools were stretched to reach Felix Uresti Gomez Avenue. The second stage ends at *Fundidora* Park, where an artificial lake is being built together with a wave fountain and pedestrian bridges to cross the canal<sup>185</sup>. The building of the *Santa Lucía* Riverwalk attraction, in the light of the 2007 International Forum of Cultures, has been considered one of the 13 wonders of Mexico in the category of man-made wonders<sup>186</sup>.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

---

### **Regia Metropolis Program**

The most beautiful, clean, green and modern city in Latin America, promoted and maintained by citizens that take ownership of their town, could be the result of the **transformation of Monterrey's Metropolitan Area (MMA) thanks to the Regia Metropolis Program.**

The city of Monterrey and its metropolitan area may be distinguished, through history, 400 years after its foundation, by three key moments: the first with agricultural activity, where stockbreeding and sugar cane stand out; the second, when it becomes the country's industrial Mecca; and the third, when it becomes, very soon, a Knowledge region<sup>187</sup>.

To contribute to this process, the *Regia Metropolis Program* works under these six components<sup>188</sup>:

- **Strategic Roadways:** Subdivided into traffic yields and exits, for example from the Airport through Miguel Aleman Avenue.
- **Park System:** It will function as another urban system: traffic, transport, electric and sewer. It will integrate parks, plazas, green areas, rivers and mountains.
- **Urban Integration:** The connection between *Fundidora Park* and *Macropiazza*, through Santa Lucia Riverwalk. This integration housed the 2007 International Forum of Cultures.
- **Historical Areas:** Or historic districts, trying to protect the historic architecture and heritage, for example, *Obispado* (Bishop's Castle), *Purísima* and *Colegio Civil*.
- **Strategic Districts:** Create urban sub-centers such as *Lincoln*, the *Unidad*, as well as university districts around UANL, *Tecnológico de Monterrey*, UDEM and UR.
- **Large Equipments:** Governmental or private, but for citizen use: Subway extension, Rain System Network, New Bus Station and New Football Stadium.

### **MOBILITY AND TRANSPORTATION**

#### Sectorized Transport and Traffic System MMA

A society is competitive in the measure that it is able to mobilize its population, transport goods and merchandise, exchange ideas and information swiftly and efficiently. The transport and traffic problems must be viewed from the inside functioning of MMA, as well as from the perspective of its economic links in the North-eastern region and its international relations.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

---

The **2004-2009 Sectorized Transport and Traffic System** gives continuity and enriches **the 2004-2009 State Development Plan**, particularly the chapter named: **For an ordered and sustainable development**, and specifically the objective of the **efficient and competitive Traffic transport system**. This program also supports the Strategic Project: **Restructuring and extending collective transport** over the same period<sup>189</sup>.

This project is the result of a large exercise in participative planning which included citizen proposals and demands collected during the Public Consultation to integrate **the 2004-2009 State Development Plan** and which was enriched with the contributions from the **State Transport and Traffic Council**<sup>190</sup>.

The general objective of the program is to be able to count on a competitive traffic and transport system, with an efficient balance between public and private services for the whole state and particularly MMA. Its strategic objectives have been:

- To develop a transport system for people, goods and merchandise that is safe, efficient, ecologic and competitive in its different modalities.
- To develop the basic elements for the integral public transport system.
- To achieve a link between mobility needs generated by urban developments in MMA and the definition of feasibility of public transport services considered basic, taking into account the adaptation of its road structure<sup>191</sup>.

The program has the goal of improving quality of life of all MMA inhabitants and its competitiveness, therefore trying to solve the mobility problem by means of:<sup>192</sup>

- Important investments in roadways to build a system based on a core network.
- The greatest ease for passenger public transport (in the current road system and the new urban development).
- A Subway network to be the backbone for the transport systems and connecting and local systems based on buses.
- Modernized vehicles; establish high standards of performance in urban transport and effective maintenance and operator training systems.
- Regulate and rationalize the development of the different transport “services”; particularly those of passengers and cargo (mobilization to and from MMA and internal distribution within MMA) and school and personnel transportation.

### **Metropolitan Beltway and Radial Trunk Roadway System**

The construction of the **Metropolitan Beltway and Radial Trunk Roadway System** is a very ambitious project that is under development in MMA because it intends to connect roadways and avenues in different municipalities of the metropolitan area of San Nicolas, Guadalupe; Monterrey, San Pedro Garza Garcia and Santa Catarina through the following roadways: *Rogelio Cantu Av., Raul Rangel Frias Av., Anillo Periferico, Lazaro Cardenas Av., Juan Pablo II Av., Via Tampico Av., Las Americas Av., Azteca Av., Exposicion Av., Las Torres Av., Puerta del Sol Av., Paseo de las Americas Av., Solidaridad Av., Revolucion Av., Alfonso Reyes Av., Lazaro Cardenas Av., Monterrey Av., Gomez Morin Av., Morones Prieto Av.* and the *Puente de la Unidad* <sup>193</sup>.

### **South-eastern Roadway**

A part of the most important urban projects (2004-2009) under the **Strategic Urban Projects Coordination**, the South-eastern Roadway between the municipalities of Juarez and Monterrey would cover 19.8 km of roads with a 26 meter section for traffic ease into access roads from bordering municipalities connecting to MMA, increasing its traffic capability and becoming a fast and safe mobility alternative. Furthermore, this project guarantees safety and higher speed, which in turn reduces journey time, delays, saves hours/man, reduces the use of fuel and pollution emission. <sup>194</sup>

### **Interport Monterrey: a first-class logistics platform**

**Interport Monterrey** is a logistics platform Project with the objective of strengthening the International Colombia-Monterrey commercial roadway, which connects Houston-Dallas-San Antonio-Laredo-Colombia- Monterrey-Salttillo to the rest of Mexico. The Interport includes multimodal services such as transport, strategic fiscalized precincts, customs, and installations for a large number of private national and international enterprises committed to providing specialized logistics and transport services; additionally, a high technology industrial park for the automobile and auto parts sector (planned to be built in 2008). From the point of view of accessibility and connectivity, it includes railways, highways and is closer to Monterrey's International Airport <sup>195</sup>.

**Interport Monterrey** is part of the **Logistics Development for Competitiveness Program** (2008) which includes eight highway projects, two agricultural projects, four railway projects and several academic programs <sup>196</sup>.



Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

---

### **Modern infrastructure and fast-lane border crossing**

As a strategic measure for the development of the Colombia highway surrounding area (border between the state of Nuevo Leon and the US), the construction of 2 exclusive high technology lanes named **Fast-Express** lanes was inaugurated. These lanes ease the flow of cargo transport in both directions, saving time and money for importers, exporters and carriers who have signed up to different safety programs and certifications that Mexico and the US customs administrations have created to guarantee a safer and more efficient commercial exchange between the two countries within the legal framework.

This measure enables a faster and more efficient exchange between Mexico and the United States, which derives in more benefits for the people from both countries<sup>197</sup>. “...***the challenge we face is to build a safe border, sustainable, progressive, with economic growth, developing; that is the best safety belt that our countries can build together for the benefit of a region...***” words expressed by State Governor (2003-2009) Mr Jose Natividad Gonzalez Paras, during the launch of this project<sup>198</sup>.

Furthermore, a new access route to Colombia highway, from Salinas-Hidalgo, is being habilitated to improve cargo and passenger transport in the Monterrey-San Antonio route and enable border crossing through a free-way (no cost) and a greater flow of cargo vehicles, and becoming a new door to a model customs office which intensifies foreign trade between the states of Nuevo Leon (Mex) and Texas (US).

The **Strategic Projects Corporation of Nuevo Leon** (2004-2009) has implemented a thorough program to encourage the promotion of industrial and commercial activity at the Colombia border. The Corporation has supported different state dependencies involved in the development of all above mentioned programs, as well as with the necessary steps before the Ministry of Communications and Transport (SCT).

Currently (2008), the construction of the first segment of this 13-Km-highway is underway in the North area of Colombia. The Corporation has also participated in the negotiation of rights of way for this project<sup>199</sup>. This program’s main objectives include increasing the flow of users and improving logistic schemes for exporting enterprises, with a forecast of a 92% increase against 2005<sup>200</sup>.

## **ECOLOGICAL CITY**

### **Bio-energy from trash, unique in Latin America**

The state government (2003-2009), through the **Integral System for Ecological Management and Waste Processing (SIMEPRODE)** launched, in August 2008, the second phase of **Monterrey II** (extension program for electric energy generation through trash), which strengthens Nuevo Leon’s position as a pioneer

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

---

entity (by being the first energy program in Mexico and Latin America), by using, as a fuel, all the biogas that forms in the sanitary filling of Salinas Victoria's municipality<sup>201</sup>.

The **SIMEPRODE's** plant, with an investment (2008 data) of US \$6.5 million dollars, is working with five additional imported electric energy motor-generators, having the capability of increasing electric energy generation in more than 70%, enough to provide 100% of the energy required by MMA's Subway and to increase the percentage (50% to 60%) of public lightning supply of the metropolitan area municipalities, as reported by SIMEPRODE's Director, Jorge Padilla Olvera, in a press release last April 2008<sup>202</sup>.

**Bio-energy of Nuevo Leon S.A. de C.V. (BENLESA)**, a mixed society constituted by SIMEPRODE and BEMSA (GENTOR Group), during the first phase of **Monterrey I**, had the capability of generating electric energy through the collection of biogas produced in solid waste, preventing the release of methane gas (which turns into carbon dioxide), thus reducing the atmospheric contamination of MMA.

With these operations, we have the benefit of the green bonuses, said Jaime Saldaña, Nuevo Leon's Bio-energy President, in April 2008. The second stage withholds a commitment of decreasing one million carbon dioxide (CO<sup>2</sup>) metric tons; such quantity, in the carbon bonuses market, implies between US \$10 million dollars and US \$12 million dollars of additional economic benefits by destroying greenhouse effect gases. This equals to withdrawing 90,000 automobiles from circulation or to plant 970 hectares of forest. It is estimated that enough electric energy will be generated to supply 80% of public lightning in MMA and supply electricity to 15,000 social interest houses<sup>203</sup>.

With this expansion, the Bio-energy plant will be in condition to supply 100% of energy to the first and second lines of Monterrey's Subway (so as its extensions). The electric energy supply percentage will be increased for *Fundidora* Park and the Santa Lucia Riverwalk, as well as for the municipal public lightning of MMA, highlighting San Pedro Garcia, where it will increase in 100%. This will reflect a \$5.0 million pesos savings per year in city councils' expenses<sup>204</sup>.

### **Parks and Wild Life of Nuevo Leon**

A defining condition to achieve a sustainable development on the planet, which recently suffers a global warming impact, is, without a doubt, the ecosystem balance. To contribute to this purpose, and to offer a healthier life to the

## Monterrey, International Knowledge City (MIKC) Summary Phase 1 and Master Plan Proposal Phase 2

---

inhabitants of the state of Nuevo Leon, an implementation of public policies is required to sustainably preserve and maintain the wild flora and fauna, through the linking of all government and society levels<sup>205</sup>.

The urgent task of working to protect the environment of Nuevo Leon is carried out by the state **Park and Wild Life** organization, the tasks of which are related to hunting activities, sport and recreational fishing, amusement, resting and healthy outdoor recreation. Additionally, it is in charge of all state parks, including **La Pastora Zoo Park**, offering recreational and green areas to the all Nuevo Leon's society<sup>206</sup>.

### CONNECTIVITY

#### Digital Nuevo Leon (NL Digital), free wireless network

Having access to a broadband Internet service free of charge is a very important and high impact project for a society and city of Knowledge (MIKC). Coordinated by the state government (2003-2009), **NL Digital** is a pioneer project in the country, in its connectivity aspect, providing service to thousands of users. Nowadays, **NL Digital** hosts 120 hectares of wireless Internet coverage free of charge<sup>207</sup>.

This part of the **NL Digital** project consists of three stages related to the free Internet access infrastructure, of which two are already in progress. The first stage began in 2005 and covers the entire *Macroplaza*, from the Government Palace to the Municipal Palace; it is noteworthy that this zone turned into **the first wireless Internet broadband service free of charge in Mexico**, with a speed of 11Mbps and five access points which support up to 50 users without diminishing its speed<sup>208</sup>. The second stage operates in *Fundidora* Park which also has five access points or hot spots. The third stage contemplates the coverage of the entire Santa Lucia Riverwalk, therefore joining the three public areas<sup>209</sup>.

In a near future, wireless Internet connectivity will cover all the southern state's municipalities, bringing the connection to each municipality's head district, servicing government offices and public access to main plazas, as mentioned by Mr. Damaso Fernandez Sepulveda, Governmental Technology, Information and Communications General Director<sup>210</sup>.

All the people who can connect will have a limited time access to the Internet service, with the purpose that all may enjoy a better service, which includes a security filter system in the matter of page content or any inappropriate website.

### **3.5 The institutions: articulating the process**

For the development and consolidation of the “Monterrey: International Knowledge City” program, a leadership and the creation of fundamental alliances between the government, universities and enterprises (Triple Helix model) is essential, in addition to integrating the society to the actions carried out. Therefore, Phase of the MIKC Program was promoted by giving a great priority to the creation and strengthening of public, private and mixed institutions that have supported the rise of Nuevo Leon’s Knowledge society.

**That is how the Innovation and Technology Transfer Institute (I<sup>2</sup>T<sup>2</sup>), together with its Civic Council for the Development Orientation of the MIKC Program, were created. The Science and Technology Coordination of Nuevo Leon (COCyTE), the Strategic Projects Corporation and the Strategic Urban Development Projects Coordination were also founded.**

On the other hand, the **30 Civic Councils** created between 2004 and 2008 represent an important advancement achieved during the MIKC Program’s Phase 1. Additionally, through the years, **a number of decentralized and civic participation organizations that contribute to the MIKC Program strengthening** have been constituted. These institutions, that have been supporting the development of the MIKC program, were previously presented in detail in Chapter 2.5.

### **3.6 Invested economic resources**

Responsibly financing the development and well-being of a society, under economic models sustained on Knowledge creation and diffusion, is a complex, systemic and interdependent process, in which community, governments, enterprisers, universities and of course, its main beneficiary: the civic society, interact.

In this sense, the CONACYT General Director, Mr. Juan Carlos Romero Hicks, highlighted in April 2008 the following investments strongly related to the MIKC program: *“... Nuevo Leon’s Mixed Funds have the largest investment in the country with \$288 million pesos in fiscal incentives out of Mexico City’s metropolitan zone... Nuevo Leon has generated the largest investment in the country with \$2 thousand 728 million... in the Fund for Innovation an amount of \$126 million pesos are recorded... we also have a record of great contributions in the Sector Funds... Nuevo Leon has 510 members in the National Researcher System ... the triple helix model is needed for all this perspective ...”*<sup>211</sup>.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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On the other hand, through an analysis of the **Expenditure Budget of the state of Nuevo Leon**, from 2004 to 2008 performed by the *Tecnológico de Monterrey's* work team, **the items with direct or indirect incidence in the MIKC program were identified and these reached \$5,411.0 million pesos by the 2008 closure.** Nevertheless, it is necessary to highlight the following points regarding the budgetary and financial resources for the MIKC Program.

**The MIKC Program is focused on increasing Nuevo Leon's economic competitiveness.**

Nuevo Leon's (2003-2009) government officials have made clear that MIKC's long term goal is to raise the Gross Domestic Product Per Capita, to the level of more dynamic regions in developed countries, through the promotion of industries, Knowledge-based activities and a culture of innovation<sup>212</sup>. Achieving this goal could improve the region's inhabitant's quality of life, since the investment in innovation and technology areas will generate better paid jobs in this type of enterprises, creating a more dynamic economy activity and enabling sustainable development<sup>213</sup>.

During Phase 1 of the MIKC Program, more economic resources from the state budget have been invested to promote and support multiple strategies, public policies, programs, projects and institutions.

Additionally, resources from a variety of federal government programs have been negotiated, including more institutional investments from organizations such as private and public R+D+I centers; local, national and foreign enterprises; and international organizations such as the Inter-American Development Bank (IDB), that have been supporting some strategies linked to MIKC.

Nuevo Leon's government has reiterated that without the infusion of local, federal and international economic resources, the MIKC Project would have never materialized. **From 2003 to 2008, more than \$2,000 million pesos have been invested in Nuevo Leon on innovation, science and technology related programs<sup>214</sup>**, and this has been achieved coordinately between the state government, federal government, universities and private sector (Triple Helix Model).

On the other hand, **more than 1.0% of Nuevo Leon's Gross Domestic Product is being invested in science and technology. The medium and long term goal is to achieve 2.0% and eventually surpass the national percentage.** In Mexico, 0.37% or 0.38% of the GDP is assigned to science and technology, when industrialized and more developed countries allocate between 1.5% and 2.0% to develop Knowledge areas<sup>215</sup>.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

In the specific case of PIIT, around **\$1,000 million pesos (estimated at 2008's closure) have been invested and, in years to come, public and private contributions that surpass \$2,000 million pesos will be added**<sup>216</sup>. According to information and data from I<sup>2</sup>T<sup>2</sup>, the present state administration (2003-2009) will be investing **\$221 million pesos on high quality infrastructure and services for the PIIT by 2009**, which will reach an accumulated amount of **\$861 million pesos from 2006 to 2009**. This investment is shown in the following table.

**Technological Research and Innovation Park  
Nuevo Leon Government Investment  
Million Pesos  
2006-2009e**

Item	2006	2007	2008e	2009e	Total
Land	102.0	0.0	0.0	0.0	102.0
Basic Infrastructure	90.0	173.0	80.0	105.5	448.5
Designs, studies & engineering	15.0	1.0	2.0	0.0	18.0
Proceedings	0.0	2.0	0.0	0.0	2.0
Electric power	0.0	65.0	52.0	0.0	117.0
Public services/Optic fiber	0.0	0.0	58.0	15.0	73.0
Lanscaping and paving	0.0	0.0	0.0	100.5	100.5
<b>Total</b>	<b>\$207.0</b>	<b>\$241.0</b>	<b>\$192.0</b>	<b>\$221.0</b>	<b>\$861.0</b>

e) Estimate

Source: ITESM. Self-elaboration with data from the Innovation and Technology Transfer Institute (I<sup>2</sup>T<sup>2</sup>) of Nuevo Leon (July 2008).

**\$3,000.0 million pesos from third-party investment (public and private technology centers) on buildings, equipment and laboratories** will be added to this investment<sup>217</sup>. The PIIT research centers currently installed and those to be set up have modern laboratories and equipment of the best quality to carry out their research. The total investment, by 2008, in this area is **\$630 million pesos**, approximately<sup>218</sup>. The state government has granted in 2008 and 2009 an additional support of **\$350 million pesos**, to support the infrastructure for the public research centers<sup>219</sup>. In addition, the PIIT houses research centers that have been built using their own resources. These institutions are normally universities with a budget, from where they get their funds. The ITESM center and the UANL center are clear examples of this scheme<sup>220</sup>. Total investment allocated to technology development and innovation in educational institutions and established PIIT research centers are shown on the following table.



Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

**Technological Research and Innovation Park**  
**Technological Development and Innovation**  
Investment Total and Employment  
2005-2009e

Educational Institutions/ Research Centers	Inversión Estimada (millones de pesos)			Personnel Estimate
	Equipment	Infrastructure	Government	
CiIDIT-UANL	80.0	180.0	20.0	250
CINVESTAV	25.0	125.0	118.0	250
CiDEP-ITESM	20.0	150.0	0.0	50
CIDESI-CONACYT	31.0	70.0	45.0	210
CIMAV-CONACYT	25.0	76.0	45.0	100
CIATEJ	75.0	70.0	20.0	150
CIMAT	5.0	20.0	10.0	50
CICESE	30.0	20.0	20.0	60
IIE	80.0	70.0	25	250
IC <sup>2</sup> Institute	8.0	10.0	0.0	50
Arizona State University	20.0	10.0	0.0	50
CiDET-UDEM	9.0	18.0	10.0	70
Motorola	40.0	65.0	0.0	250
Pepsico	120.0	80.0	0.0	200
Lania	3.0	5.0	6.0	50
Water Institute	7.0	3.5	30.0	60
Monterrey IT Cluster	28.0	120.0	0.0	1,200
Texas A&M University	20.0	10.0	0.0	50
<b>Total</b>	<b>\$ 626.0</b>	<b>\$ 1,102.0</b>	<b>\$ 349.0</b>	<b>3,350</b>

e) Estimates

Source: ITESM. Self-elaboration from data supplied by the Innovation and Technology Transfer Institute (I<sup>2</sup>T<sup>2</sup>) of Nuevo Leon (March 2008 data).

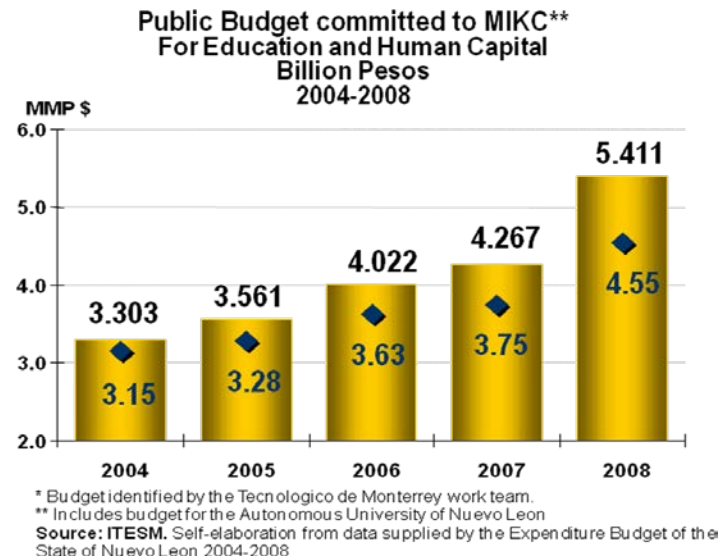
Additional to the science and technology investment, Nuevo Leon's state government has assigned **funds for social development and to achieve greater economic and urban modernization competitiveness** through the public investment state program. During the four year government period of Mr. Jose Natividad Gonzalez Paras (2003-2009), public investment has increased to \$25,000 million pesos for the aforementioned topic<sup>221</sup>.

In regards to education, there has been an annually investment of \$15,000 million pesos in public education from 2004 to 2009. During the same period, around \$2,000 million pesos have been assigned to construction of buildings linked to the educational sector<sup>222</sup>.

**Public budget for development and education of human capital linked to Monterrey: International Knowledge City**

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

To conclude this section, the following chart shows the importance of the public budget assigned to the MIKC Program and especially for the development of the educational sector and the human capital in the MIKC context, since the human factor is one of the most important pillars for a knowledge-based economy or society development.



Additionally, for the development of intellectual capital in the ICT's sector, a \$10 million pesos scholarship fund for 300 students has been created (Publication: 25-06-08)<sup>223</sup>.

## INVESTMENT FUNDS

For the MIKC Program, the state government of Nuevo Leon has recognized that **making the best of the support from different public, private or mixed funds is of vital importance**. The governmental management has been able to add resources to support technology-based projects through public federal funds (CONACYT and the Ministry of Economic) and state resources<sup>224</sup>. The main funds created and/or used for the MIKC Program development during the last four years (2004 to 2008) are described below.

### **CONACYT Mixed Funds**

Nuevo Leon has made good use of the **Mixed Funds (FOMIX) offered by CONACYT** to those federal entities that decide to support science and technology development. With the contribution of resources from the private sector, Nuevo Leon's state government and the academic sector, additional to CONACYT's contributions, the Mixed Funds for the support of the local R+D+i

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

have the highest investment in the country: \$840.7 million pesos for the 2003-2008 period.

Resources Granted by Mixed Funds (FOMIX)  
State of Nuevo Leon  
Million Pesos  
2003-2008

Year	Projects	Investment (Million pesos)				
		Private S.	Nuevo Leon	CONACYT	Academy	Total
2003	12	\$19.5	\$15.3	\$15.3	\$0.0	\$50.1
2004	25	\$64.7	\$31.3	\$31.2	\$3.7	\$131.1
2005	4	\$65.0	\$79.1	\$75.5	\$43.6	\$263.4
2006	12	\$65.3	\$27.8	\$27.8	\$8.0	\$129.0
2007	13	\$49.2	\$22.4	\$22.4	\$61.5	\$155.8
2008	18	\$36.9	\$25.0	\$25.0	\$24.0	\$111.0
<b>Total</b>	<b>84</b>	<b>\$300.8</b>	<b>\$201.2</b>	<b>\$197.6</b>	<b>\$141.0</b>	<b>\$840.7</b>

Source: ITESM. Self-elaboration with data from the 5th State Governance Report (2004-2009).

Regarding fiscal incentives for R+D+i investment (fiscal credits), these have accumulated a total of \$2,728 million pesos from 2004 to 2007<sup>225</sup>. These funds granted by CONACYT to support R+D+i projects consist of a 50% investment contribution from each research center or institution and 50% from both CONACYT and the state government. This plan has been very useful for centers such as the CIMAV and the CIDESI, since they have been able to finance their laboratory equipment and, in some cases, the construction of the first stage of their buildings<sup>226</sup>.

### ***Technological Innovation Fund***

On the other hand, the **Technological Innovation Fund**, presented to the public on 2 July 2007 by the federal government through CONACYT and the Ministry of Economy, that year counted on an initial \$500 million pesos budget to strengthen the Mexican technology and innovation SME's<sup>227</sup>.

The development of the basic sectors of the knowledge economy are strengthened by these funds; among these are nanotechnology, biotechnology, biomedical devices, telecommunications and electronics, information technologies, mechanical engineering, advanced manufacture and design, advanced chemical engineering and materials, which are some of the technological areas fostered by the MIKC Program<sup>228</sup>.

The resources contributed by the federal and state governments to this fund are assigned to the development of initiatives proposed by the SME's; universities and higher education institutions, either public or private, and the R+D+i national laboratories and centers<sup>229</sup>.

### ***Fund for the Promotion of Technological SME's***

The **Fund for the Promotion of Technological SME's** was also created and launched in September 2007, with a \$100 million pesos grant, its first goal to encourage 42 software developing SME's to join the **Monterrey TI Cluster**<sup>230</sup>.

The Sub-Minister of Economy for Small and Medium Enterprises, Mr. Heriberto Felix Guerra, said in August 2007 that even though the **Fund for the Promotion of Technological SME's** will begin with a \$100 million pesos grant, this will grow in time. The federal officer pointed out that the objective is for "*...the technological small and medium enterprises to become **gazelle enterprises** which will lead other small business to growth...*"<sup>231</sup>.

### ***PROSOFT Fund***

Through the **PROSOFT Fund**, an instrument for the promotion of the software industry development and other services related with to ICT sectors<sup>232</sup>, significant strengthening of this kind of enterprises has been achieved in the state of Nuevo Leon. This fund is managed by the Ministry of Economy through an agreement with the different federal entities and the private sector. In this way, the resources are combined to be used in the development of the ICT industry<sup>233</sup>.

The PROSOFT Fund objectives are<sup>234</sup>:

- To contribute to the preservation and creation of formal job opportunities in the ICT's and software sectors.
- To promote the regional economic development.
- To promote the creation of enterprises in the software development and related industries, as well as to strengthen the existing enterprises.
- To promote productive development opportunities in the ICT's sector.
- To stimulate the technological innovation, development and modernization of the ICT's sector.
- To contribute to the improvement of the productive processes in the ICT's sector.
- To contribute to the human resources training level in the ICT's sector.
- To promote the integration and strengthening of the productive chains in the ICT's sector.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

- To contribute to the development of physical infrastructure, as well as the high technology parks, to encourage the integration of ICT's enterprises' technical, operative and commercial capabilities.

In Nuevo Leon, the Software Civic Council, in alliance with the Ministry of Economy and state government approved the creation of a trust which was initially funded by the "Monterrey: International Knowledge City" project<sup>235</sup>.

From 2004 to 2008, Nuevo Leon's government has invested \$163.7 million pesos in the PROSOFT Fund, which together with the private and federal funds totalize \$802.3 million pesos for the promotion of the software industry in Nuevo Leon. This investment reflects on 821 beneficiary enterprises; around 4,500 improved jobs and almost 4,000 new jobs in Nuevo Leon's software industry, over the same period of time<sup>236</sup>.

Software Industry Development Program (PROSOFT)  
Impact and Investment Indicators  
State of Nuevo Leon  
2004-2008

Year	Impact Indicators				Investment (Million pesos)			
	Projects	Enterprises	Jobs Improved	Jobs Generated	State	Federal	Private S.	Total
2004	17	42	279	119	\$13.5	\$18.3	\$20.2	\$52.0
2005	32	118	960	335	\$20.0	\$27.2	\$53.8	\$101.0
2006	45	238	991	1,055	\$35.0	\$57.3	\$125.7	\$218.0
2007	59	152	977	1,146	\$43.6	\$54.6	\$94.4	\$192.6
2008	58	262	1,244	1,336	\$51.6	\$67.6	\$119.5	\$238.7
<b>Total</b>	<b>211</b>	<b>812</b>	<b>4,451</b>	<b>3,991</b>	<b>\$163.7</b>	<b>\$225.0</b>	<b>\$413.6</b>	<b>\$802.3</b>

Source: ITESM. Self-elaborated with data from the Ministry of Economic Development of Nuevo Leon (SEDEC).

The "Monterrey: International Knowledge City" program took part in the Software Council, in the definition and action development guided toward the advancement of this industry in the state. Additionally, periodic Council reunions are being held, in order to observe and measure this industry's advancements and its development within the state<sup>237</sup>.

### ***Risk and Seed Capital Funds***

On the other hand, the generation and granting of **Risk and Seed Capital Funds (state and federal) for technology-based projects and enterprises** are fundamental for knowledge-based development. In Mexico, the Ministry of Economy (SE in Spanish), together with the SEDEC, have a seed capital fund to support enterprises subscribed to the incubators registered and certified by the SE<sup>238</sup>.

This fund works as a loan for the new enterprises, with low interests and no warranties, which allows the access to economic resources for the launch of

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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activities<sup>239</sup>. Normally, this type of funds is oriented to recently created businesses and, preferably, in the innovation arena.

The seed capital constitutes the investment necessary to cover enterprise creation costs, assets purchase and work capital until the moment it begins to generate enough income to cover its costs<sup>240</sup>. Nevertheless, in Nuevo Leon the seed capital concept has been extended to the first foreign investment that it is received by a new enterprise, since others already established which required of new capital contributions to generate a high growth, in the way of assets or participation are also considered investment opportunities<sup>241</sup>.

A local project, to promote the creation of high risk capital funds that connect science and technology investment, with commercial application that generates new businesses, is the **Nuevo Leon Fund for Innovation (FONLIN)**. The **FONLIN** its being achieved with the participation of several actors, such as the Inter-American Development Bank (IDB), the I<sup>2</sup>T<sup>2</sup>, CONACYT, the Ministry of Economy and other private investors. The initial amount with which the FONLIN began operations is \$100 million pesos, contributed in the following way: \$25 million from I<sup>2</sup>T<sup>2</sup>; \$10 million IDB; \$10 million CONACYT; and \$55 million from private investors<sup>242</sup>.

The objective is to reach a \$300 million pesos investment; the support amounts will be up to \$5 million pesos, in two modalities: Non-refundable support (incubation) and Refundable credits/Contributed to Capital (operation launch)<sup>243</sup>. A minimum of 100 job posts have been estimated. The beneficiaries will be entrepreneurs and, consequently, the innovation and knowledge-based enterprises<sup>244</sup>.

The FONLIN structure is a trust. A specialized firm will be in charge of the administration and there will be a collection of cases, evaluation, follow up and balance<sup>245</sup>. As for the **Risk Capital Funds**, in August 2007, the launch of a Risk Capital Fund was announced for the support of new enterprises and Dr. Jaime Padilla Avila, I<sup>2</sup>T<sup>2</sup>'s General Director, explained that there will be between US \$20 and US \$30 million dollars for this fund<sup>246</sup>.

### ***IDB's Fund***

The Inter-American Development Bank (IDB) has also played a very important role in the development and consolidation of the MIKC Program. In October 2007, an economic support was announced, to lost fund, on behalf of the IDB of between US \$200,000 and US \$300,000 dollars, to support the MIKC Program<sup>247</sup>.

Mr. Eduardo Bosque Andrade, I<sup>2</sup>T<sup>2</sup>'s Forecast and Planning Director, explained in August 2007 that: "... *the support was approved 14 June 2007 and the*



Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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*resources are granted by the Technology and Innovation Korean Fund, which is part of the IDB... it is a technical cooperation project which will be carried out through the use of non-refundable funds ...*<sup>248</sup>.

Phase 2 of the MIKC Program was supported by the IDB with a US \$272,400 dollar contribution, resources that were assigned to the elaboration of the Master Plan for the 2008-2025 period<sup>249</sup>.

Mr. Antonio Zarate Negron, MIKC Program Executive Ex-Director (the first one), mentioned in August 2007 that: *“...the objective is to ensure the organizational, human and economic resources to make the MIKC vision a reality. It is also important to analyze this model’s potential, since it may be replicated or adapted to the characteristics of other cities and countries of Latin America ...*<sup>250</sup> and pointed that: *“...the support granted to this program by IDB encourages us because it is a recognition of our strategy and it will allow us to consolidate a long term action plan to strengthen Nuevo Leon’s development... ”*<sup>251</sup>.

Another important aspect of the MIKC Program development is the **Law for Promoting Investment and Employment in the State of Nuevo Leon**, published in the Official Journal, number 98, and dated 20 July 2007. The purpose of this law is<sup>252</sup>:

- To encourage the productive investment the state, through clear and transparent incentives, which will grant the investors with institutional security, strengthening current enterprises’ competitiveness and enabling the establishment of new job sources that will generate more stable, better paid and high added value jobs.
- To dictate the measures that promote the competitiveness of the entity’s enterprises.
- To promote the entity’s economic development, in order to foster its balanced growth over sustainable development bases and human capital development.
- To encourage the generation of new job sources and consolidate the existing ones; especially from those sectors which greatly enable human capital development: innovation, research, development and knowledge and technology transfer; as well as the ones with the most impact in logistics modernization and competitiveness.
- To encourage enterprise collaboration and partnership with technological innovation and research centers, particularly in the sectors defined as strategic, with the objective of consolidating knowledge economy development.
- To encourage the organized and decentralized industrial growth, through the establishment and consolidation of industrial zones and parks in the different state municipalities.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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- To promote, establish and consolidate financial mechanisms which will enable major resources for the promotion of investment and employment in the state.
- To encourage the creation and development of the micro, small and medium enterprises promoting, in their favor, the financing instruments and negotiating municipal, state and federal support.

With this law, Nuevo Leon seeks to encourage its economic growth through the promotion of the micro, small and medium industry and the creation of an Investment Promotion State Council and, therefore, have an instrument to continue the consolidation as a State of progress and development<sup>253</sup>.

### **3.7 The bet is giving results: main achievements and impacts**

In November 2004, with signing of the framework agreement, the MIKC Program was formally launched with the firm purpose and conviction to boost the state of Nuevo Leon's growth through a development model, with an initial strong emphasis on education, the bet on R+D+i, and on an economy focused on innovation, technology and knowledge. The agreement has been the platform, but the tools to build Nuevo Leon's knowledge economy and society have been its people's talent, tenacity and creativity.

The state of Nuevo Leon is living (and accelerating) its evolution process, from an industrial society based on manufacture to the knowledge services and items production era, in which, the basis for the development is the intellectual capital and the capability to create, innovate, development and transfer technology. **This process is translating into greater competitiveness and sustainability for the local economy.** More and more Nuevo Leon enterprises have the possibility of positioning themselves at high profitability markets, the economic benefits of which are transferred to the society through more employability creation and better salaries these enterprises' collaborators.

Interviewed in February 2008, on the matter of the MIKC Program's original expectations and proposed goals when the program was first conceived by the state governor, Mr. Jose Natividad Gonzalez Paras (2003-2009) expressed that: ***"...the project has run above expectations... this means that Nuevo Leon now has, along with the maquila and capital goods industry, a knowledge industry, which arises from offering mind power..."***<sup>254</sup>.

The Academy-Enterprise-Government strategic alliance (Triple Helix model) and link ***"... has enabled us to advance in an important way and make an opportunity window, which opens in times of globalization, for enterprises to approach, linger and remain in Nuevo Leon. What is interesting about this process is most of these global investments have nothing to do with maquiladoras, but with high technology enterprises... I think that the project (MIKC) will be operating at its fullest capacity in three or four***

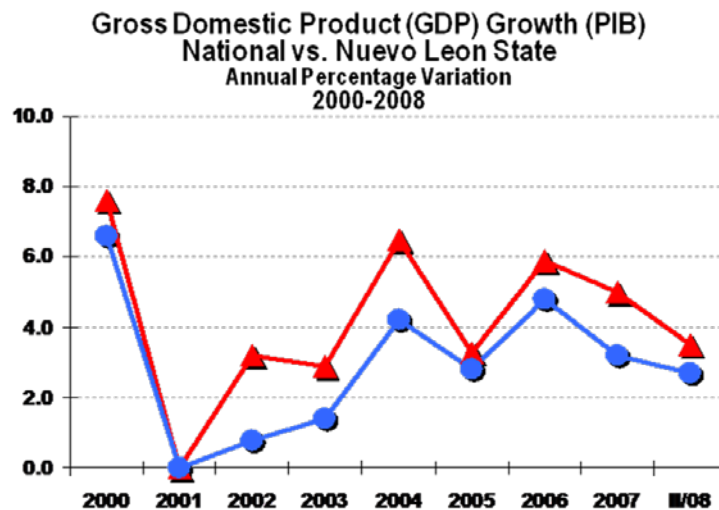
Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

*years... but we must take additional steps, like the constitution of risk capital funds, strengthen the researcher network growth, increase promotion to persuade the global technology-based enterprises to settle here...”* said the governor Mr. Jose Natividad Gonzalez Paras during his participation during the closure of the first Business summit in Monterrey in October 2006<sup>255</sup>.

**What the statistics tell us:**

**The bet is having positive results**, even in the short time since MIKC’s formal launch, and this being a long term program the goal of which is the raise the state’s GDP per capita to the level of the more dynamic regions or cities in the developed countries in the world, and to improve its inhabitants quality of life; there are some results that are important to emphasize and which demonstrate that the program’s focus, and the sum of efforts, strategies, public, private and institutional actions are having good results.

In the last 3 years (2004-2007) the GDP in the state of Nuevo Leon has grown an average of 4.7%, this is, 1.1 percentage points above the national average GDP’s growth over the same period of time. For 2008’s first semester, this tendency/relation is maintained at around 1.0 percentage point in local against national growth.

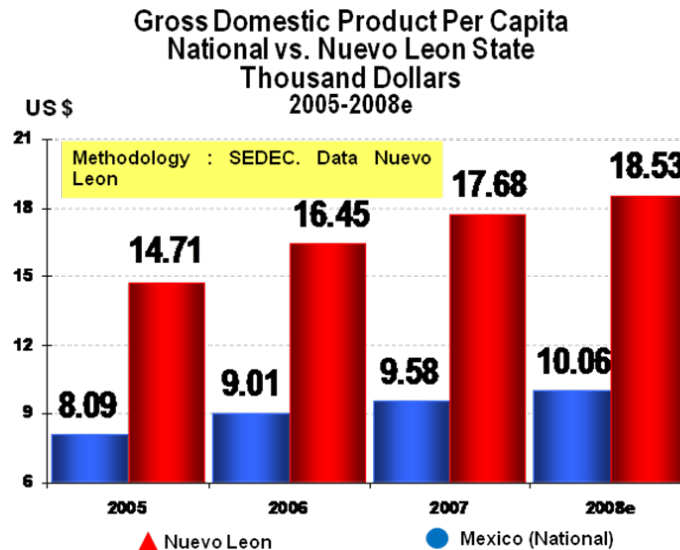


Source: ITESM. Self-elaboration with data from INEGI and from Data Nuevo Leon (Data NL).

This growth pace, which has been increasing over the past years and may keep growing stronger in medium and long term, with the bet on the MIKC Program, has let Nuevo Leon’s GDP Per Capita to be 1.8 times greater than the national average by locating itself, at 2007’s closure, in US \$15,680 dollars per inhabitant

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

per year. By 2008, according to the SEDEC's forecast (Nuevo Leon Data) made known in the document with a methodology of its own entitled: Nuevo Leon's Regional Economic Competitiveness and Development Conditions General Annual Report (14 February 2009), the local GDP Per Capita will reach US \$18,534 dollars per inhabitant per year.



e) Estimate

Source: ITESM. Self-elaboration with data from Data Nuevo Leon. General Annual Report of the Condition of Economic Competitiveness and Regional Development (11 February 2009).  
FIX Exchange Rate (BANXICO): \$13.89 (January 2009).

On the other hand, according to the document **Nuevo Leon and the Knowledge-Based Economy; Knowledge-Based Economy Index 2008**, created by the Strategic Studies Center (CEE) of the *Tecnologico de Monterrey*, Guadalajara Campus (as part of state diagnosis as a knowledge region for Phase 2 of the MIKC Program), **the state of Nuevo Leon occupies the first place at the national level in the component of international attractiveness, competitiveness and foreign orientation with 8.44 points in a scale of 0 to 10 points** (more details in Appendix VI).

Nuevo Leon's leadership in international markets is corroborated with its export dynamics. In 2004, this represented 19.0% of the local GDP and by 2007 this proportion reached 30.3 percentage points.

This means that Nuevo Leon's exports went from US \$10,400 million dollars in 2004 to US \$20,620 million dollars in 2007, with an average annual growth of 26.0% over this period of time.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2



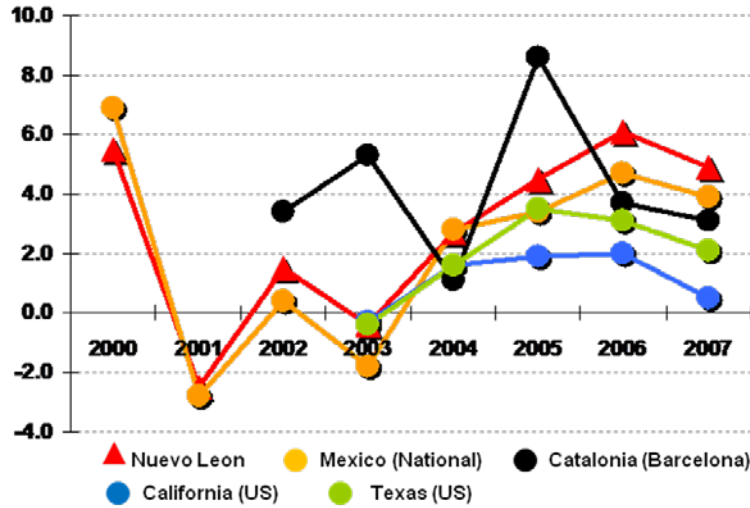
The formal employment growth in local private sector (measured through the insured workers on the IMSS registry) has also been getting stronger from the beginning of the MIKC Program. The average annual employment growth in the private sector at a national level was 4.0% in the last 3 years, while it was 5.2% in the state of Nuevo Leon.

Furthermore, this local employment generation dynamic is above that of Cataluña's region (Barcelona), which recorded (over the same time period) an average growth of 5.1%; that of the state of California, the job positions of which grew in a ratio of 1.5% annually; and to the employment generation in the state of Texas, where job positions increased in an average annual rate of 2.9% over the last 3 years.

**In 2007, the state of Nuevo Leon maintained this strength by increasing its job positions to a 4.9% rate; while at the national level (Mexico) the growth was 3.9%, Cataluña's region (Barcelona) recorded a 3.1% increase and 0.5% and 2.1% in the state of California and Texas respectively.**

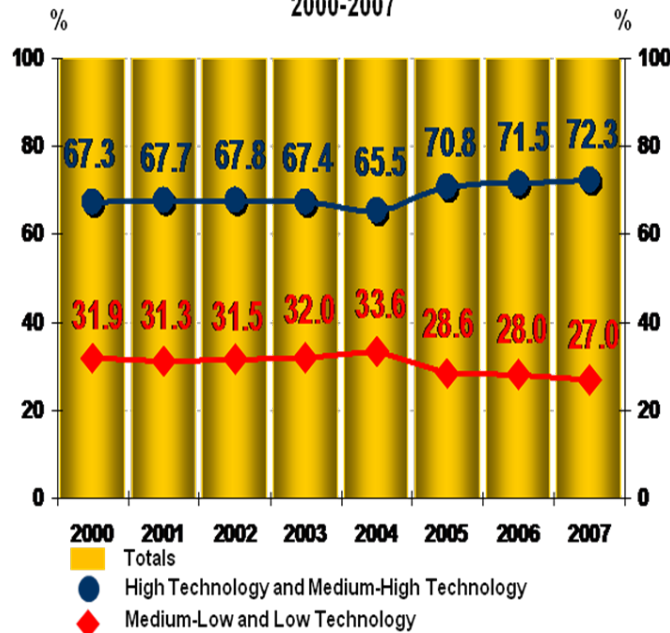
Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

**Formal Employment Growth in the Private Sector**  
Country/State/Region Selected  
Annual Percentage Variation  
2000-2007



Source: ITESM. Self-elaboration with data from IMSS; STPS; IDESCAT  
www.idescat.net; Bureau of Labor Statistics www.bls.gov.

**Total Exports for Nuevo Leon**  
Knowledge Sectors  
Percentage over Total  
2000-2007



Source: ITESM. Self-elaboration with data from Data Nuevo Leon.  
Knowledge Sectors Classification: OECD 2004.



Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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A fact that reflects the state of Nuevo Leon's real advancement as a technology and innovation linked society is the export composition from the enterprises residing in the state.

According to the **classification established by the OECD** for the knowledge sectors and with the Ministry of Economic Development data for the state of Nuevo Leon (NL Data), the *Tecnologico of Monterrey's* work team was able to **determine that by 2007 the high technology and medium-high technology exports represented 72.0% of total exports in Nuevo Leon and were equivalent to almost US \$15,000 million dollars.**

**It is noteworthy that in 2004 the high technology and medium-high technology export represented 65.5% of the total exports, which means that in 3 years these increased 6.5 percentage points or US \$8,000 million dollars in absolute numbers.**

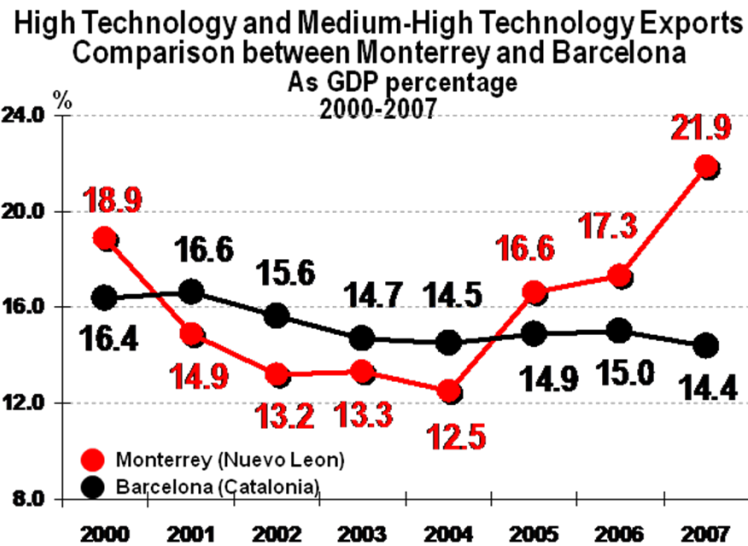
Comparing the state of Nuevo Leon to other internationally renowned knowledge regions or cities, we may ascertain some significant advances. **For example, since 2005 Nuevo Leon's export percentages (measured as a GDP percentage) linked to knowledge (high and medium-high technology) surpass those recorded in Cataluña's region (Barcelona).**

**In 2007, the local knowledge exports represented 21.9% of the local GDP, while Barcelona's knowledge exports represented 14.4% of that region's GDP, that is, a 7.5 percentage points difference, being that in 2005 it was 1.7 percentage points and in 2006 it was 2.3 percentage points.**

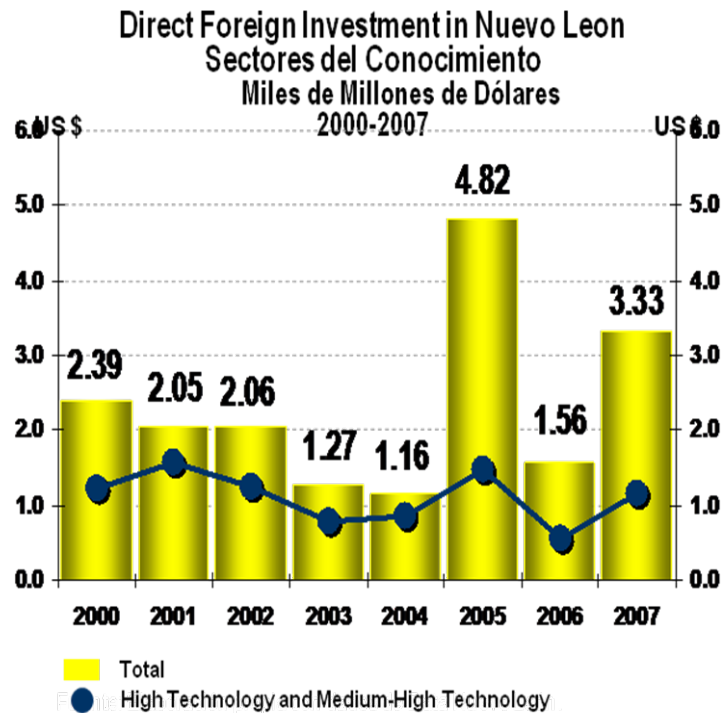
Another indicator that shows the state of Nuevo Leon's advance as a knowledge economy and society is the Foreign Direct Investment (FDI) in the high and medium-high technology manufacture sectors and in knowledge intensive services.

**From 2005 to 2007, the FDI in those knowledge sectors added almost US \$3,200 million dollars and in 2007 this represented a third part of the investment flow that entered the state (US \$1,143 million dollars).**

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2



Source: ITESM. Self-elaboration with data from Data Nuevo Leon (Data NL); INEGI; Bank of Mexico; FX History; IDESCAT www.idescat.net. Knowledge Sectors Classification: OECD 2004.



Source: ITESM. Self-elaboration with data from the Ministry of Economy (SE). Knowledge Sectors Classification: OECD 2004.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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Some of the foreign enterprises that decided to have operations in the state of Nuevo Leon in the last years (2004-2008) and that are linked to knowledge are: **Lenovo** (US \$20 million dollars); **Halliburton** (US \$20 million dollars); **Hill-Rom** (US \$20 million dollars); **Infosys** (investment not available); **NGK** (US \$244 million dollars), among others<sup>256</sup>.

### Global and world class enterprises in the knowledge city

#### ***Softek. Latin America Leader***<sup>257</sup>

Creator and leader of the near-shore industry, **Softek** is the largest independent provider of information technologies services (ICT's) in Latin America. Founded in 1982, it is a global provider of IT solutions and business processes, integrated by more than 6,000 collaborators and 30 offices in North America, Latin America, Europe and Asia. It has eight global delivery centers in Mexico, Brazil, Spain and China. It offers profitable and high quality solutions to leading corporations in over 20 countries, employing onsite service delivery models, onshore, offshore or through the Near Shore® model, **Softek's** copyright since 1997.

**Softek** is distinguished by:

- Implementing the first application outsourcing models in Mexico.
- Being the winner of 10 SAP "Excellency Awards" (Latin America) prizes in 11 years.
- Being the first Latin America ICT's enterprise to achieve the Level 5 CMMi certification.
- Its quality orientation (Level 5 CMMi, Six Sigma and automated process).
- Being one of the best enterprises to work in Mexico, Brazil and Argentina.
- Being the major employment generator for ICT professionals in Mexico.

#### ***Infosys establishes its first Latin American branch in Nuevo Leon***<sup>258</sup>

The software firm and computer consultants of **Bengalore Infosys Technologies** arrived to Monterrey from **India's Silicon Valley**. This subsidiary began its operations inside the *Tecnologico de Monterrey* (at *Tec Milenio* University's technological park) through the regional adaptation program created for foreign technology-based enterprises called **Landing Program**. One of the main reasons why the enterprise decided to create its first Latin American branch, its first office and its first global development center in Nuevo Leon, was because it was believed that there was enough talent and human capital in the city to develop **Infosys** in Mexico and Latin America.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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*“... we have considered the Tecnológico de Monterrey to be one of the enterprise’s main recruitment sources, for that its graduates be the candidates to fill the vacancies to be created in **Infosys**...”* said Sam Prasanth Infosys Mexico Head of Delivery IT who added that: *“... the experience acquired by **Infosys Technologies** working with the Tecnológico de Monterrey’s graduates is very good, since they have all demonstrated they are professionals with very high quality standards and a very solid knowledge basis, besides being capable of developing and programming software, learning and adapting quickly to the ever changing technology...”* and later added that: *“... by 2008 **Infosys** has planned to close the year with 200 new job positions, and that in three years of completed operation, it expects to have more than 1,000 positions...”*

### **Nuevo Leon: First places in Competitiveness**

*“... we are beginning to see the positive impact on the region’s economy... in the attractiveness that global technology-based enterprises, companies that came here to stay, have seen in the facilities we offer... this has meant close to a 5% growth during three consecutive years...”* explained the state governor, Mr. Jose Natividad Gonzalez Paras, during his participation in the second Business Summit which was held in Monterrey; he also recognized Nuevo Leon’s advances as a knowledge economy and as a **society committed to an entrepreneur culture**, during the same event<sup>259</sup>.

**These advances are reflected in Monterrey’s Metropolitan Area’s (MMA) competitiveness which occupies the first place in the Mexican Cities’ Competitiveness Index** (among 60 metropolitan areas) published by the Economic Research and Teaching Center (CIDE) and the Ministry of Economy (SE in Spanish) in 2007. **MMA’s position improved between 2003 and 2007 by escalating from the second to the first place in global terms**, improving 9 places on the institutional competitiveness component; 2 places on the socio-demographic competitiveness component and one place on the urban competitiveness component.

On the other hand, the **Knowledge Economy Index**, elaborated by the This Country Foundation in 2005 and 2007, **also reflects Nuevo Leon’s meaningful advances as a knowledge based economy and society.**

Among the most meaningful advances are the economic growth; the human development index; labor productivity; literate population above age 15; households with computers; telephone density and the state of Nuevo Leon’s mobile technology penetration.

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

**Competitiveness Index in Mexican Cities  
The New Agenda for Urban Municipalities  
Monterrey's Metropolitan Area (MMA)  
CIDE/Ministry of Economy  
2003-2007**

Competitiveness Component	2003 Rank	2007 Rank	Δ Rank
General	2 <sup>nd</sup>	1 <sup>st</sup>	+1
Economic	3 <sup>rd</sup>	3 <sup>rd</sup>	--
Institutional	16 <sup>th</sup>	7 <sup>th</sup>	+ 9
Socio – Demographic	5 <sup>th</sup>	3 <sup>rd</sup>	+ 2
Urban	2 <sup>nd</sup>	1 <sup>st</sup>	+1

Where 1<sup>st</sup> represents the best position and 32<sup>nd</sup> the last position at the national level.

Source: ITESM. Self-elaborated with data from the document: Competitiveness of Mexican Cities 2007 (CIDE-SE).

**Knowledge Economy Index (KEI)  
Variables and Indicators Selected  
Este País Foundation  
2005-2007**

Variable /Indicator	KEI Points 2005	KEI Points 2007	Movement
Total KEI Nuevo Leon	4.202	4.608	+ 0.406
GDP Growth	5.792	7.437	+ 1.645
Human Development Index	8.456	8.513	+ 0.057
Labor Productivity	5.550	6.359	+ 0.859
Literate Population (> age 15)	8.630	8.744	+ 0.114
Households with computers	3.160	5.020	+ 1.860
Fixed phone density	3.800	4.210	+ 0.410
Mobile phone penetration	3.906	4.110	+ 0.204

Scale from 1 to 10

Source: ITESM. Self-elaborated with data from: Mexico and the Knowledge Economy Challenge. *Este País* Foundation.

By September 2008, according to the last evaluation by the Mexican Competitiveness Institute, A.C (IMCO) in its document: **2008 State Competitiveness Index: Aspirations and Reality**, the state of Nuevo Leon, for the second consecutive period, was positioned as the second most competitive federal entity in Mexico, only behind the Federal District (Mexico City). Noteworthy is the advance which it had in the **market** competitiveness factor

Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

where it advanced 2 positions and in the efficient governments factor where the state advanced 5 places positioning itself as the most competitive state in the country for this item.

This document states that: “... *Nuevo Leon’s competitiveness surpasses the national mean in the ten sub-indexes, reaching the best positions in competitiveness. The entity presents a great advantage in three factors (global class Precursor Sectors; Vigorous competing sectors and making the best use of international relations) and only one factor represents a competitiveness burden (Efficient factors market). In relation to the five Northeast region states, Nuevo Leon is the most competitive entity...*”

**State of Nuevo Leon Competitive Ranking  
in regards to rest of Sates  
per Competitiveness Factor  
2006-2008 Ranking**

Competitiveness Factor	2006 Rank	2008 Rank	Change	Positions
Legal system	1 <sup>st</sup>	1 <sup>st</sup>	--	--
Environment	2 <sup>nd</sup>	2 <sup>nd</sup>	--	--
Educated society	2 <sup>nd</sup>	3 <sup>rd</sup>	▼	- 1
Stable economy	7 <sup>th</sup>	11 <sup>th</sup>	▼	- 4
Political system	11 <sup>th</sup>	11 <sup>th</sup>	--	--
Factors market	15 <sup>th</sup>	13 <sup>th</sup>	▲	+ 2
Precursor sectors	2 <sup>nd</sup>	2 <sup>nd</sup>	--	--
Efficient governments	6 <sup>th</sup>	1 <sup>st</sup>	▲	+ 5
Foreign affairs	4 <sup>th</sup>	5 <sup>th</sup>	▼	- 1
Economic sectors	2 <sup>nd</sup>	2 <sup>nd</sup>	--	--
Global	2 <sup>nd</sup>	2 <sup>nd</sup>	--	--

Source: ITESM. Self-elaboration with data from the Mexican Competitiveness Institute (IMCO). State Competitiveness Index 2008.

In the words of Dr. Rafael Rangel Sostmann, *Tecnologico de Monterrey’s* Provost, in November 2004, during the MIKC Agreement signing “... **the Monterrey International Knowledge City program is not a six year project, it is a long term project for Monterrey’s community...**”, which means that the MIKC program is a bet which will be contributing in an important way to achieve a dignified, honorable life for the personal, family and society development of Nuevo Leon as a whole.

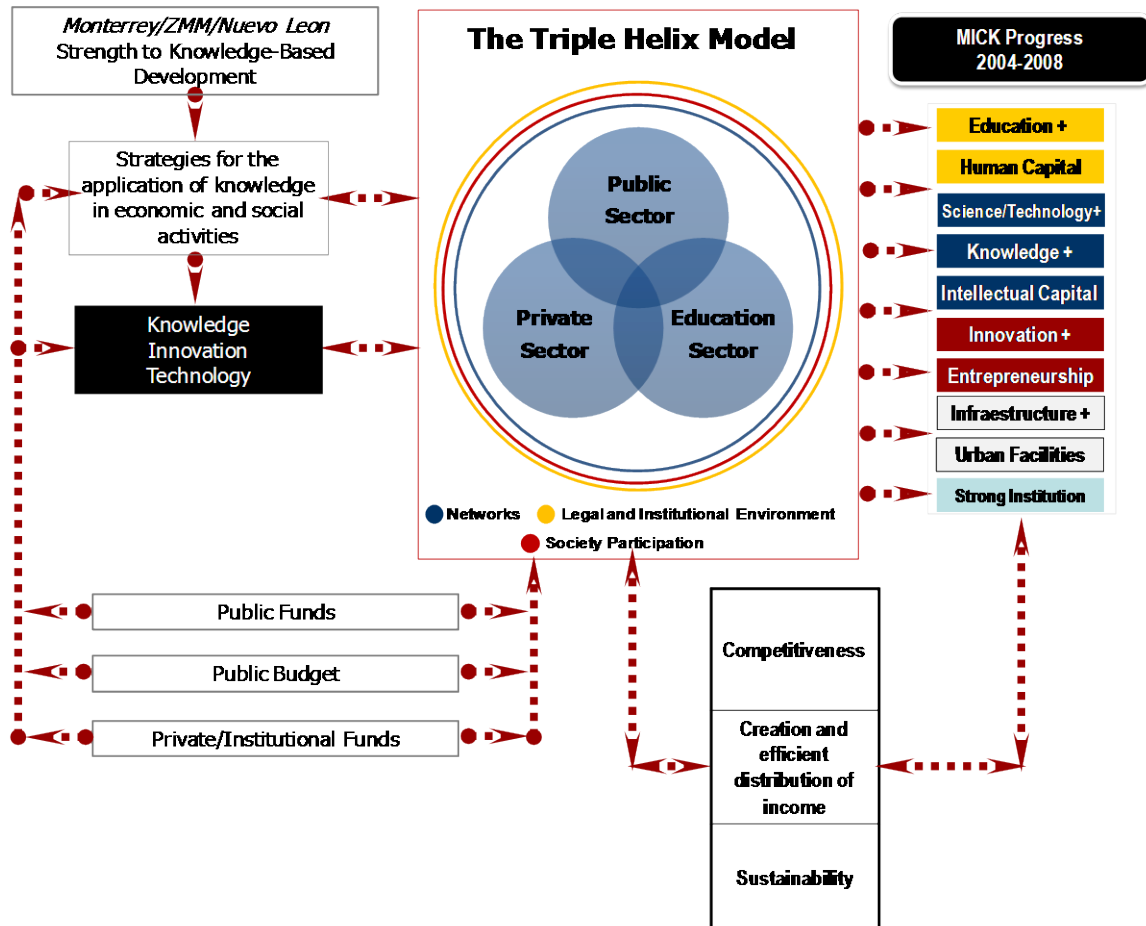
**Its successful implementation and the fulfillment speed of planned goals will depend on the program’s continuity, as well as the level of commitment, collaborative work, vision, investment, and the different public, private and institutional actors’ involvement.**



Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

### 3.8 Summary Chart

To conclude this chapter, the subjects approached are synthesized in the following chart.



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Summary Phase 1 and Master Plan Proposal Phase 2

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Monterrey, International Knowledge City (MIKC)  
Summary Phase 1 and Master Plan Proposal Phase 2

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Summary Phase 1 and Master Plan Proposal Phase 2

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Summary Phase 1 and Master Plan Proposal Phase 2

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## Monterrey, International Knowledge City (MIKC) Summary Phase 1 and Master Plan Proposal Phase 2

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## Monterrey, International Knowledge City (MIKC) Summary Phase 1 and Master Plan Proposal Phase 2

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