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Nanotechnology incubator at PIIT Monterrey: Developing innovative entrepreneurship and upholding the traditional manufacturing industry in the region.

Parallel session 4

New business models for incubators in STPs

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EXECUTIVE SUMMARY

The establishment of the Research and Technology Innovation Park (PIIT) in 2006 in Nuevo León Mexico was the cornerstone of the politics for the attraction and retention of technology-based companies to the state. The nanotechnology incubator at PIIT, INANO, built in 2009, brought even closer the triple helix alliance between companies, academic institutions and government, allowing existing and new companies to introduce high value added products to the market.

The operating model of INANO is designed to tackle the development of a technology-based product using nanotechnology, even from the idea generation stage up to the final product with high added value.

The model of operation considers INANO product development projects that can be addressed in any of the stages IDEA, CONCEPTUALIZATION, FUNCTIONAL PROTOTYPE, COMMERCIAL PROTOTYPE, BUSINESS CREATION, INDUSTRIAL SCALING. It also considers as outputs of the model different strategies ranging from licensing to marketing the product.

1. INTRODUCTION

The design and creation of nanoparticles at laboratory levels and their processes of synthesis have demonstrated that, if it were possible to produce or reproduce them at industrial scale, certain nanomaterials and processes might have commercial applications, due to the fact that they invest with new properties market-positioned products or they make viable to use new compounds that give major margin to the products. However, to turn research discoveries into product innovation requires a heavy commitment of resources to invest in infrastructure and to strategize the business development plans for the creation of new companies or a new line of products.

According to Moore[1], infrastructure is perhaps the greatest hurdle. Research and development requires laboratory space and expensive scientific equipment, and these have to be replicated and scaled up for manufacturing and commercial trials. In addition, intellectual property issues related to the industrial applications require a level of confidentiality not usually found in university laboratories. Thus, incubators or "innovation accelerators" are established outside the research center or university premises, allowing the entrepreneurs to make use of the more expensive laboratory equipment in the universities for a nominal fee.

To develop a business in nanotechnology is not an easy task. Most of the time, the key idea for the business comes from a researcher or a scientist, a person not necessarily familiar with the skills needed to create a new company. Incubators not only must provide access to seed, angel and venture capital, but they must allow for counseling from experts in intellectual property law, business planning, and marketing.

Thus, incubators that can partner with universities and research centers are critical to the development of a robust nanotechnology industry. Innovation clusters have been built in various cities in several countries to bring together universities, technology incubators and accelerators, companies, and public research centers. For example, in USA, successful incubators focused on nanotechnology are part of the Northern California Nanotechnology Initiative, the Nano-Network of New Mexico, and the

[1] Moore, Valerie, MEMagazine, Nano entrepreneurship, April 2009
http://memagazine.asme.org/Articles/2009/April/Nano_Entrepreneurship.cfm

Nanotechnology Institute in southeastern Pennsylvania[2].

Nanotechnology incubators play a key role of bringing together researchers and the business community to allow the commercialization of nanotechnology, enabling this promising technology to reach its full potential.

2. BACKGROUND

Nanotechnology is a body of knowledge and methodologies aimed to study, characterize and fabricate functional structures with dimensions less than 100 nanometers[3], allowing modifications at that level that affects the physical, chemical and biological properties of the materials.

In Mexico there is a high potential for nanomaterials. It is estimated that over the next 10 years, it could reach sales of $1,500 Million dollars[4].

Nanotechnology has a profound impact on materials demanding industries such as aerospace, automotive, coatings, construction, cosmetics, ceramics, agriculture, detergents, molds, medicines, fertilizers, food, lubricants, surgical, metals, optical equipment, painting, paper, tools and textiles, to name a few examples.

The nanotechnology incubator INANO opened its facilities at the Research and Technology Innovation Park (PIIT) at the end of 2009. With an investment of $7 Million USD in this first stage, its infrastructure comprises four patented pilot plants platforms developed by research centers in México and two more built with licensed world-class technology. The platforms installed at INANO are as follows:

1. Production of organic and inorganic nanoparticles by milling.
2. Production of nanoparticles of metals, metal oxides and composites onto via humid.
3. Production of carbon nanotubes.
4. Production of coatings under 100nm thickness by the technique of chemical vapor disposition.
5. Production by two different extruders of Nano composites.
6. Production of functionalized nanoparticles.

It has already supported the creation of the first Nanotech Company in the country, and it has another two companies incubating in tis premises. It is also an incubator where the established companies can develop new products and processes and receive technical assistance. The consultants are already engaged in more than 20 research projects with local companies. Entrepreneurs can also apply for financial aid and receive business advice as their companies evolve and mature.

INANO also has a characterization laboratory, not to compete with the existing equipment in the other research centers residing at the PIIT, but to allow fast testing of pilot plant products to adjust manufacturing conditions. This lab allows measuring of mechanical, optical, electrical, microbiological and rheological properties, zeta potential and conventional measurements of pH, conductivity, etc.
Nowadays, the INANO facilities located within the PIIT consists of 1,500 m2 of space for laboratories, pilot plants and offices to accommodate new entrepreneurs, and it is recognized by the Ministry of Economy as a high technology incubator with highly skilled human capital to operate and advise SMEs and entrepreneurs in the application of nanotechnology. The investment

[2] Regional, State and Local Initiatives in Nanotechnology: Report of the National Nanotehcnology Initiative Workshop, NNI Publications and Reports, July 2013
[3] a nanometer is one ten-millionth of a centimeter
[4] Data from the Ministry of Economy, Mexico, 2011

Current capabilities of staff and infrastructure allow developing 15 projects in their research stage and housing 6 companies for full incubation package, graduating two companies per year. These capabilities represent 60% occupancy and are forecast to be exceeded by the end of 2013.

3. Purpose of INANO

The overall objective of INANO is to strengthen PIIT infrastructure, creating a link between companies and research centers to develop new business opportunities based on nanotechnology. It seeks to combine the talent, infrastructure and resources of the incubator for significant and permanent advantages from the economic point of view, developing competitive capabilities derived from knowledge, adoption and industrial application of nanotechnology.

The establishment of INANO serves two purposes: the creation of new businesses based on nanotechnology, and to supply an answer to the demand of established companies that would like to use nano-materials in their products and processes to impart new or better properties or to lower manufacturing costs. The creation of the INANO emerges as an offer to the demand for regional companies to cover the stage of industrial upgrading and then perform scaling to commercial stage, in addition to specialized advice for business development in the industrial sectors of the new economy

4. SPECIFIC OBJECTIVES OF INANO

- Improve and support development in the area of nanotechnology in México.
- Train highly qualified technical personnel for pilot plants operation as well as for operation of the lab and plant equipment in the incubated companies.
- To build a multidisciplinary and cross-sectors community made up of institutions and companies to promote technological development and innovation in Nanotechnology.
- Perform technology development projects in Nanotechnology.
- Encourage the development of nanotechnology-based prototypes for commercial and social objectives.
- Create and strengthen specialized Nanotechnology infrastructure for academic and business sectors to pilot and industrial scaling.
- Foster a corporate culture focused on creating innovation through Nanotechnology to compete in new markets with high added economic value products.
- Promote the creation of new enterprises using the nanotechnology platforms available at INANO.
- Promote synergy between nanotechnology innovators, funding programs, innovation initiatives and the public sector.

The operating model of INANO, which is innovative, consists of a set of steps and processes that allow us to turn an idea into a product of nanotechnology with high added value. This model is designed to tackle a project of developing a technology-based product even in the earliest stage (idea generation) to generate business.

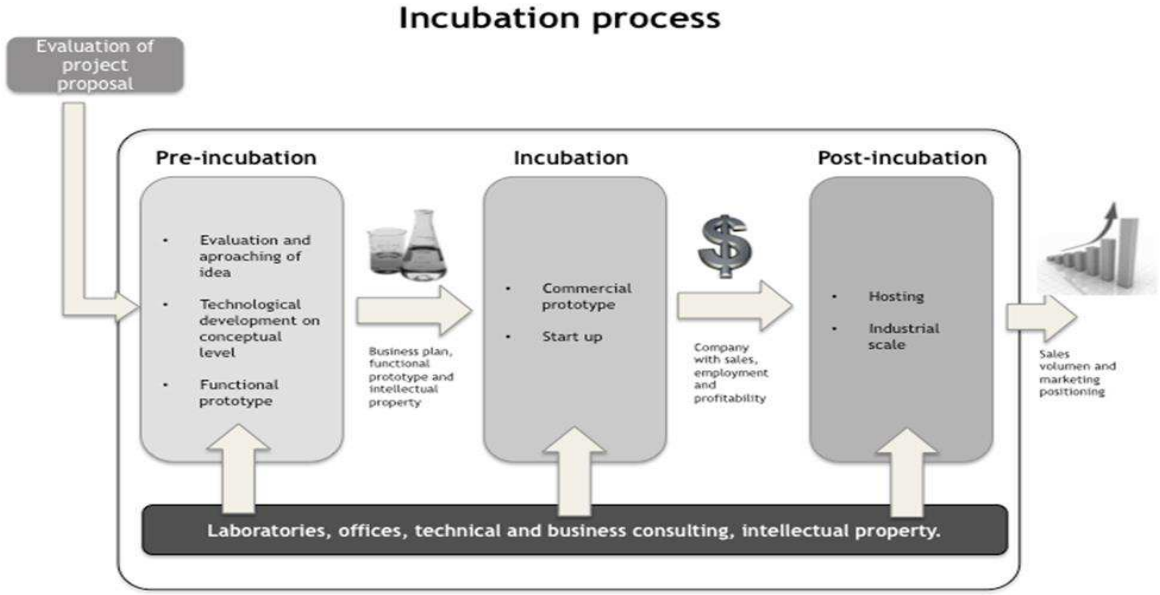
5. METHODOLOGY

The incubation model of the INANO was designed to ensure the success of the incubator in the ecosystem of entrepreneurship proposed in for the state.

In general, the incubation process for businesses in nanotechnology is divided into three main stages, which in turn are composed of steps or sub-steps clearly identified with specific targets.(Figure 1)

Figure1. Incubation Process at INANO

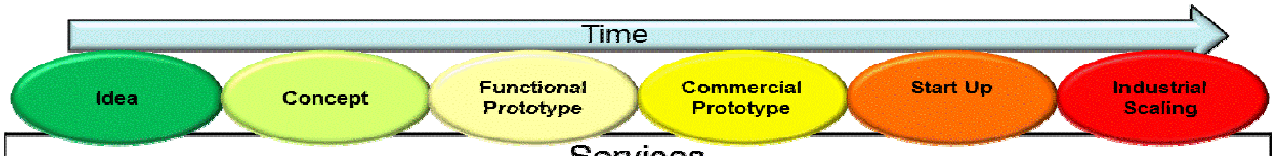
The model of operation of INANO considers product development projects that can be addressed in any of the stages: Pre-Incubation, Incubation and Post-Incubation, at any of the sub-stages or steps of: IDEA, CONCEPTUALIZATION, FUNCTIONAL PROTOTYPE, COMMERCIAL PROTOTYPE, BUSINESS CREATION



and INDUSTRIAL SCALING. It also considers as outputs of the model different strategies ranging from licensing to marketing the product. These steps correspond to the path of a technology development project, from its beginning as an idea until it has established itself as successful business or product line. Figure 2 shows a schematic representation of this process in terms of time and of the services and support provided by incubators, indicating the deliverables of each stage.

Figure 2.

Sub-Stages in the Incubation Model for High Tech Companies at INANO



Services					
Market Feasibility Technical Evaluation Intelectual Property and State of the Art Benchmark Expert Opinion Evaluation	Technology Roadmapping mentoring Mentoring to apply for public fund support RFPs (innovation, r&d, federal , state funds) Advice in R&D or Joint development contracts Intelectual Property and Patent Registry Advice	Technology Preassessment Mentoring and tutoring in apply for public support funds RFPs Lab Services and Protyping in Pilot Plants Intellectual Property and Patent Registry Advice	Technology Assessment Fiscal and Legal Advice Mentoring and tutoring to apply for pubic support funds RFPs Pilot plant use and support Intellectual Property and Patent Registry Advice Commercial Roadmapping tutoring	Business Plan development Execution Plan development Board Support Mentoring and tutoring in looking and applying for Angel and Venture Capital Human resources advice and mentoring Marketing Plan development	Market and Business Strategies Check up and adjustments if needed Mentoring and tutoring in looking and applying for Angel and Venture Capital Industrial Scaling Business Acceleration facilities and Nests
Deliverables					
Market Study Technical Assistance Patent Analysis Technology and business advice	Technology roadmap Proposlas and strategies for public funding Intellectual Property Assessment	Firstlook assessment Proposals for applying for Funding Functional Prototype or pilto plan tests Intellectual Property	Quicklook assessment Certificate of Incorporation Strategy for Funding Market ready product Intellectual Property Porfolio Comercialization roadmap	Business Plan Execution Plan Strategy for attraction of angel or venture funds Management Team Market Plan	Volume Manufacturing and Market Positioning

It is noteworthy to mention that technology based product developments require constant market validation along the incubation process. This is because as it progress from stage to stage, the project commonly discovers new approaches to what is expected as the final product, as technology may be applied to different consumer products in new ways not predicted at the beginning of the project.

Thus, through the incubation process it repeatedly mentions developing feasibility studies or market validation, each presenting a level deeper than its predecessor. Some of these feasibility studies will become different versions of the business plan of the project, each emphasizing the relevant information to apply for government funding for technology development, or investment funds, depending on the present stage of the project.

Similarly, validation of patentability, and intellectual property registration, are recurrent themes throughout the incubation process. This is because in each step of the technology development care must be taken to ensure that new developments are included in the intellectual property strategy.

6. DESCRIPTION OF THE MODEL FOR INCUBATION INANO

A description of the stages and sub-stages is provided:

Stage 0: Diagnosis

Prior to joining the INANO, is the "Stage 0: Diagnosis", in which is conducted the project selection process. Each project proposal must be evaluated by the Technical Committee of the incubator, with the intention of validating the idea in terms of 1) technical and market feasibility, 2) profile of entrepreneurs who want to develop the project, and 3) economic capacity the entrepreneur.

Stage 1: Pre-incubation

After obtaining the approval of the Technical Committee, through a letter of acceptance, the entrepreneur begins its process. The main objective of the pre-incubation step is to develop the functional prototype and to assess if the technology is susceptible to be patented. The duration of this step may vary between 6 and 9 months. To reach this result, the following sub-stages must be completed:

Idea: In this phase, the basic idea is assessed, with no need to start technology development at laboratory level. A group of experts reviews the technical, market and patent feasibility of the project to determine whether or not it should proceed to the next step.

Concept: At this step, the technology is evaluated at the conceptual level, with the collaboration of researchers from research centers and institutions of higher education. To this end, INANO offers support for entrepreneurs to apply for government funding.

Functional Prototype: the first version of the business plan is developed, aimed at raising funds for the development of a functional prototype. This prototype will be developed in the laboratories and pilot plants of INANO. Once the prototype is proven to work, it will be developed the intellectual property needed for its legal protection.

Stage 2: Incubation

Once the business plan is developed, the functional prototype is passed to the stage of incubation, where the company is legally established and starts its operation with pilot-plant level testing. This second phase lasts for 12-24 months and consists of two main steps:

Commercial Prototype: Starts with the legal constitution of the company and the work at pilot plant level for a commercial prototype. The critical path for the commercialization of technology is identified through the Commercial Roadmap.

Business startup: Sales may start with the intention of receiving feedback from customers and keep improving the final product. Also, a business plan is prepared with the aim of prospecting for investors to scale production. The Management team is formed and an implementation (execution) plan is devised to reach industrial volume scale.

Stage 3: Post-incubation

Once testing the effectiveness and acceptability of the final product on the market, it proceeds to industrial scaling. To this end the company, which up to now has an office at the incubator, and is using the facilities (pilot plants and labs), will be invited to move to occupy a space in the accelerator or nests that are being built next to INANO. The duration of this stage is 24-36 months. It is to be expected that, at this stage, the company still requires the use of the infrastructure of the INANO, but it will certainly be lesser once it

Business Graduation

Finally, at the end of the 3 stages, companies complete their incubation process to a graduation ceremony. To reach this point, the performance of the companies is evaluated according to criteria previously established by the Technical Committee and the Advisory Council.

The competitive advantages of the INANO model are integrated and focused exclusively on nanotechnology and alignment of talent, knowledge and experience in all institutions and teams. This process involves scientific and commercial talent working in close collaboration for effective research, translation and commercialization of science and technology

7. BUSINESS MODEL FOR FINANCIAL SUSTAINABILITY OF INANO

The business model of the INANO is characterized for a singular and determined incubation focus of innovative companies involved in the discovery, translation and integration of solutions in Nano science and Nanotechnology with industrial capacity to meet market needs.

INANO model brings together a wide range of actors, resources and regional institutions to support business incubation, both from market and research perspectives, with the use state of the art tools and methodology to align stakeholders and successfully meet the marketing objectives.

The business model is described based on nine factors of success - Key Partners, Key services, Key Resources, Value Proposition, Customer Relationship, Channels to reach the customers, Market Segments, Cost Structure and Income Stream.

7.1. KEY STRATEGIC PARTNERS

The success of the INANO depends on having reliable partners whom are providers of resources and support activities to the operation of the incubator:

• The Institute of Innovation and Technology Transfer (I2T2) of Nuevo Leon is the main partner and contributes with the physical facilities and equipment of the incubator.

• The Center for Research in Advanced Materials (CIMAV), a center belonging to the public network of the National Council for Science and Technology of México (CONACYT). CIMAV is the strategic partner that provides personnel, knowledge and technology for development and operation of the laboratory and pilot plants. CIMAV specialized knowledge in nanotechnology makes an ideal partner to support INANO operation, contributing with its own infrastructure to support research or lab tests for projects in the early stages of pre-incubation and incubation.

• The Center for Global Innovation and Entrepreneurship (CGIE) at the University of Texas at Austin, managed by the IC^2. The CGIE contributes with the knowledge and methodology incubation of technology-based companies and partners with INANO to coordinate resources and provide advice on market issues, intellectual property, finance, organization and management. The startup companies or spin offs from the universities can take advantage of the business and technology commercialization advice given in partnership with the CGIE.

• The Nanotechnology Cluster organizes the business community, the universities and the research centers around the issue of nanotechnology, proposing technology developments of strategic interest to existing companies and promoting the creation of new enterprises.

• Research centers and universities, both public and private, that contribute with potential science spin offs and licensing of technology to entrepreneurs.

7.2. MARKETING: PRODUCT - SERVICES

Through the wide variety of service options and flexibility in the configuration of enterprise projects, the INANO offers competitive prices internationally. Service packages range from the most basic like lab test and analysis, market and technology state of the art studies, applications for funding, to full service packages of business incubation. The services offered by the INANO for R&D projects of existing companies, and to entrepreneurs, scientists, new companies may include:

- Fabrication of nano-materials at pilot scales.
- Process simulation
- Technical assistance
- Marketing consulting

- Access to seed and venture capital

Based on these premises, five types of project have been defined both the development of new products for an existing company to complete incubation of startups for entrepreneurs and researchers:

[Company] Strategy for New Product Development - Uses technical and business consulting services to explore the potential of a new Nano composite it wants to develop.

[Entrepreneur] New Product Development - An entrepreneur arrives with a specific idea to develop new Nano technological components for a company that he already owns.

[Entrepreneur] Development of a New Technology Company - An entrepreneur wants to develop a new company, in its own installations, based on a definite idea of nanotechnology compounds and uses.

[Entrepreneur] Incubation of a New Technology Company - An entrepreneur wants to develop a new business using the incubator space based on a definite idea of nanotechnology compounds.

[Researcher] Development of Technology for a New Nano compound - A researcher wants to explore the potential of a new component he has developed and design the technology for the commercial use.

For each of these test cases, it is estimated the amount of resources required to produce the desired result. The estimated resources required, either in hours of counseling, use of laboratory hours or pilot plants, or months of "rent" for use of office space.

7.3. OPERATION AND ORGANIZATION

To ensure proper operation INANO and its strategic progress, two bodies have been created to evaluate and regulate the operations of the incubator.

- Board of Directors
- Operating and Technical Committee

8. CONCLUSIONS

In the state of Nuevo León the implementation of the innovation ecosystem has translated into a highly developed and an efficient regional business development for Nanotechnology, helped along with world-class research that is developed in local institutions. The Nanotechnology Incubator INANO is located in a prime location (the Research Park and Technological Innovation (PIIT)) for the development of multidisciplinary teams and open innovation to encourage and accelerate the growth of new businesses that fulfill the needs expressed by the market.

The State of Nuevo Leon is starting to be recognized as a region specializing in science and technology related to the topic. Not only many of the major universities in the region have specialized programs in Nano science and Nanotechnology but they are already developing joint programs with foreign universities. An example is the development of a joint PhD in Nanotechnology from the Autonomous University of Nuevo Leon, the Center for Research in Advanced Materials (CIMAV), Monterrey Tech, the University of Texas and Chalmers University of Technology in Sweden.

The Nanotechnology Cluster promotes the development of regional and international networks and projects with the aim of increasing the global presence of Nuevo Leon’s companies in nanotechnology.

This work has generated international funding participants. In addition, partners based in the region can use federal or state funds in these projects.

The INANO at the PIIT along with the Nano cluster are connected in their mission to transform the traditional industrial sectors of the state (ceramic, glass, steel, polymers and food industry) through the incorporation of nanotech processes and materials into their products, for which purpose they are encouraging the selection of strategic projects between the members of the cluster, and the formation of consortia for research and development with support of state and federal research funds. Additionally, both are engaged in the promotion of spin offs and the commercialization of available research done at the research centers and universities, using the resources of the Innovation Fund FONLIN, (Fondo Nuevo León para la Innovación).

The INANO is designed to cover all services to bring a new idea to the business start-up and development in the field of nanotechnology. In Latin America, INANO is the first nanotechnology incubator that integrates technology and business advice with services, not only for entrepreneurs but for researchers and established companies that look for new lines of products or for testing their new scientific developments.

Anticipating the good acceptance and global projections for the commercialization of nanotechnology, INANO has plans to increase its facilities in order to strengthen its capacity and services. The second phase of expansion of the building INANO consists of 1400m2 of space for laboratories, pilot plants and offices. The investment required for the additional infrastructure is around $6 Million USD, to bring the total investment from the state government in the INANO to $13 Million USD. New platforms will be focused on solving application development for mechanical reinforcement of polymers and plastics for the automotive industry. Furthermore, the expansion will have infrastructure for the development of nano-biotechnology applications such as production of nutraceuticals and controlled drug release.

The Nanotechnology Incubator (INANO), in partnership with universities and research centers of international quality, incorporates infrastructure and innovative methodologies for the generation of nanotechnology-based businesses. Thus, the experimental infrastructure provided for INANO supports the development of proof of concept, experimental prototype, commercial prototype, and even pilot plant production, enough for any business to start operations and to run trial tests. Furthermore, companies and projects in incubation in INANO, have the advice not only of technical personnel (PhD) to develop their ideas or products, but also in business consulting and technology commercialization by one of the world leaders in the field, the Center for Global Innovation and Entrepreneurship (CGIE) from the IC^2 Institute of the University of Texas at Austin, also established in the research park PIIT.