Technology transfer in the sugarcane industry - the ICIDCA experience

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Abstract For more than half a century the Cuban Research Institute of the Sugarcane Derivatives had been engaged in R+D+I for the diversification of the Cuban sugar sector. It has helped drive the development of new products and technologies that have been introduced into commercial production to satisfy the industry's present and future demands, and having a favorable and novel impact over the relations between Research-Production-Trading. This has been driven by the economical and productive transformation taking place in the Cuban sugar sector. This paper presents an analysis of the transfer of the technological innovations within the 'global value chain', together with the evaluation of the positive and negative experiences in this process attained by ICIDCA in national and international environments. Our aim has to transform the transfer of technologies into a natural and fluid procedure that closes the research-trading cycle, and provides indispensable institutional financing that make possible the new research in the sugarcane sector. We give experiences of ICIDCA, the practical and feasible options today to attain a profitable and successful technology transfer process and a description of today's situation. This should be a very useful document to any R+D+I institution.

Key words Value chain, diversification, technology transfer, innovation, research-trading cycle, institutional financing

INTRODUCTION

At its foundation in 1963, The Cuban Research Institute of the Sugarcane Derivatives (ICIDCA) was conceived as an Applied Research Center to provide the technological knowledge to support the development of the Cuban sugarcane agroindustrial sector by introducing scientific advances in industrial practice. However, the socioeconomic transformations in Cuba and in the world have impacted, in different ways, on the relationship of the research center with industry.

This paper presents the results of empowering the technological transfer of technical and scientific results to face the challenges of an increasingly competitive and demanding world market. As well we evaluate the positive and negative experiences of ICIDCA in its technological transfer processes, in the national and international context, that make technology transfer a way to finance the evolution of the Research-Development-Innovation cycle in the sugarcane agroindustry. It is a useful time for mature reflection and a debate about the true impact of the scientific results over the economic results.

TODAY’S ICIDCA

The culture and the R+D+I results of ICIDCA make it an important center in Cuba and in the sugarcane world under the new world market conditions.

Today, the ICIDCA’s scientific program covers:
- Renewable energy
- Sugar technology
- Animal feeds
- Bioproduct technology
- Process engineering
Based on the above, ICIDCA had been working for many years to empower the transfer of technologies based on the portfolio of products and technologies developed by systematic research, development and innovation work. Examples are: in the national market:

- Technology for the production of the bio-stimulant FITOMAS-E industrial installation in operation at ‘Ciro Redondo’.
- Technology for bioproducts production: Bioenraiz, Gluticid and Nitrofix in ‘Dos Ríos’.
- Technology for the production of Vodka ‘Regenta’ in the distillery ‘Las Guásimas’.
- Descaling technology by magnetization of the evaporation system of Cuban sugar mills.
- Technology for the production of nutritional blocks for cattle feeding, operating at various sugar mills.
- Technology for the production of furanic resins used as protection in equipment repairing, industrial maintenance in Cienfuegos.

In the external market, examples are:

- Technology for the production of fodder single-cell protein in Venezuela.
- Bioproducts installations in Venezuela.

ICIDCA’S TECHNOLOGY TRANSFER PROCESS

The technology transfer cycle starts with basic and applied research that leads to a concept that can be tested in early stage development (Fig. 1). However, successful transfer of the technology requires a number of business steps:

- Opportunity studies.
- Market evaluation.
- Techno-economic pre and feasibility studies.
- Preparation of contracts and technical tasks, including confidentiality clauses.
- Consultancy for the manufacture of the technological equipment.
- Operation and quality control manuals.
- Training.
- Start-up assistance.
- Products and services marketing consultancy.

The TT cycle is complex requiring an active participation of the licensing supplier during the technological assimilation.

**Fig. 1.** General stages of technology transfer.
ICIDCA’s experience of 53 years of R+D+I practice in sugarcane has highlighted important considerations:

- Selection of the technologies to be transferred through a pre-feasibility study of the most relevant technologies in the market, paying special attention to the development impact in the sector; having in mind the interests of the clients and of the Institute.
- Ensure a feasible combination of social, economic and environmental impacts that ensure income to allow the financing of the R+D+I of ICIDCA.
- Define the value of the technology, the method of payment, and the responsibilities of each party.
- By considering different types of technologies, the scope of application, the novelty, and the economic, technical and commercial and environmental factors, ICIDCA gets a proportion of the revenues from the introduction of the new technology, but in an agreement that makes the client happy.
- As protection it is important to sign a confidentiality agreement at the beginning to protect sensitive knowledge - the core of the ‘know-how’.
- The secret is to interact closely with the clients “to keep them happy, satisfied, secure and well informed. They should be invited to participate in the process of deciding on future developments.
- Get contracts for entrepreneurial development not only inside, but outside the sugar-alcohol sector, develop international projects, obtain financing by contracts of R+D+I in the governmental sector; and widen, amplify, diversify and extend the technical services.

With this approach, ICIDCA has become stronger in the techno-transfer processes, especially by using a combination of innovation management, such as ‘To learn by doing’ and through open innovation by means of the Net.

Positive scenario demands are:

- Have a solid portfolio of transferable technologies with corresponding techno-economic documentation.
- Develop a well-trained team of business agents to handle the transfer processes.
- Have a deep and diverse knowledge of the internal and external market, with systematic studies to ensure up-to-date information.
- Have specialized personnel, lawyers and business agents with international experience.
- Manage its portfolio of patents and marks.

To prevent negative scenarios the following are required:

- Special efforts to promote the importance of the creative activity.
- Interrelations with enterprises in other sectors that are known to finance their projects wisely.
- Take advantage of the assistance of leading institutions in technology transfer.
- Influence the discipline in the industry through training courses for technicians and executives.

CONCLUSIONS

More than half a century had taught us that the way to sustainable success is through being flexible and proactive as scenarios change, making the market our main source of income, adequate management of the innovation in a way that allows the intangible values to become technological products and services with wide social and economic impact, and being highly eco-friendly.

We understand that by means of effective technology transfer, the development of a diversified sugarcane agroindustry can be a strategic paradigm for the future of the sugar-producing countries. This is the message of this paper.

Le transfert de technologie dans l’industrie cannière - l’expérience de l’ICIDCA

Résumé. Depuis plus d’un demi-siècle, l’Institut de recherche Cubain de dérivés cannoirs (ICIDCA) s’est engagé en R+D+I afin de diversifier le secteur sucrier cubain. Cet institut a contribué à développer de nouveaux produits et technologies et à les introduire dans la production commerciale afin de satisfaire les demandes actuelles et futures de l’industrie, avec un impact favorable et novateur sur les relations recherche-production-commerces. Tout cela a été dicté par la transformation économique et productive qui se profile dans le secteur sucrier cubain. Cet article analyse le transfert des innovations technologiques au sein de la chaîne de valeur globale et évalue, au niveau national et international, les expériences acquises par l’ICIDCA dans ce processus, qu’elles soient positives ou négatives. L’objectif est de rendre le processus de transfert de technologies renfermant le cycle recherche-commerce, plus naturel et fluide, et d’offrir des financements indispensables aux institutions pour permettre une recherche novatrice dans le secteur sucrier. Les expériences de l’ICIDCA avec les options concrètes et réalisables pour atteindre un processus de transfert de technologies rentable et viable et une description de la situation actuelle sont décrites. Ce document devrait être un outil très utile à n’importe quelle institution R+D+I.
Transferencia de tecnología en la industria azucarera - la experiencia del ICIDCA

Resumen. Por más de medio siglo el Instituto Cubano de Investigaciones de los Derivados de la Caña de Azúcar (ICIDCA) ha estado vinculado en la I+D+I para la diversificación del sector azucarero cubano, aportando en el desarrollo de nuevos productos y tecnologías que se han introducido en la producción comercial, para satisfacer las demandas actuales y futuras, alcanzando un impacto favorable y novedoso sobre la relación Investigación-Producción-Comercialización. Esto ha estado influido por las transformaciones económicas y productivas que tienen lugar en el Sector azucarero cubano. Este trabajo presenta un análisis de la transferencia de las innovaciones tecnológicas dentro de la "cadena global de valor"; junto con la evaluación de las experiencias positivas y negativas logradas por el ICIDCA en el entorno nacional e internacional. Nuestro objetivo ha sido transformar la transmisión de tecnologías en un procedimiento natural y fluido que cierre el ciclo Investigación-comercialización, asegurando un indispensable financiamiento institucional, que posibilite las nuevas investigaciones en el sector azucarero. Se ofrecen las experiencias del ICIDCA, las opciones prácticas y viables para alcanzar un proceso de transferencia de tecnologías lucrativo y exitoso, junto a una descripción de la situación actual. Este debe ser un documento de mucha utilidad a cualquier institución de I+D+I.

Palabras clave: Cadena del valor, diversificación, transferencia de tecnologías, innovación, ciclo investigación-comercialización, financiamiento institucional