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DEVELOPMENT OF A TECHNOLOGICAL

AND ECONOMIC INTELLIGENCE SYSTEM

Demonstration Project Proposal for Uruguay

With Special Reference to Biotechnology

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## 1. INTRODUCTION

UNIDO is encouraging the use of processed information through the development of a technological and economic intelligence system (INTELL), to improve decision making. In 1990 a proposal related to a demonstrative project was submitted, with special reference to agroindustry (Project XP/RLA/90/112).

It includes a plan for strengthening institutions in Argentina, Costa Rica and Ecuador to show the benefits of the INTELL in promoting innovation and competitiveness.

Shortly after the report was submitted, AUDEBIO (Uruguayan Association of Biotechnological Firms) and CID (Information and Development Center) showed great interest to develop another INTELL project.

This report explores the characteristics of that initiative: a possible INTELL demonstration unit, to be installed in Uruguay, to provide information products and services to the local biotechnological activity.

A visit was made to Uruguay, to meet the AUDEBIO and CID representatives and also to interview entrepreneurs, government officers, R&D centers, and related institutions, to obtain information from direct personal and institutional contacts.

## 2. THE ELECTION OF BIOTECHNOLOGICAL ACTIVITY IN URUGUAY

The branch selection is based on the capability to demonstrate INTELL services. For that purpose several conditions are required:

- a) existence of institutions capable and willing to be the host for the demonstration units, providing the local expenses;
- b) a business environment that needs INTELL services;
- c) existence of information infrastructure and supporting institutions.

In Uruguay there is a small biotechnology activity, mostly based on agricultural, livestock and food processing applications, that fulfil the first and third requirements, but within a limited business environment, that may be insufficient to support the intelligence unit after the project completion. This may be compensated by a combination of additional national and international support and by means of increased training to provide the team an earlier capability to self-support part of their expenses.

The subject, an advanced technology, as well as the small size of the activity, will provide subsidiary outputs:

a) An Intelligence Demonstrative Unit (from now: IDU) on biotechnology in Uruguay will not only promote the INTELL, but also the biotechnological activities in the country.

b) Strategic elements on how to develop high technology activities in small countries may be obtained;

c) The development of biotechnological INTELL, as a second step to bioinformatics, will bring to UNIDO the opportunity to link this project with its related programs, specially those carried out by the International Centre for Genetic Engineering and Biotechnology (ICGEB), at Trieste and New Delhi.

### 3. BRANCH DESCRIPTION

The biotechnology activity in Uruguay is carried out by approximately 25 enterprises, but only 10% of them may obtain most of their income from biotechnology products and services.

Biotechnology means the use of animal and vegetable cells to elaborate products and services. Many of the current biotechnological processes are well known, such as fermentation in bakeries, in dairy products, wineries, breweries, etc. However significant advances have been made to improve the traditional practices. However, other process, as the recombinant ADN, are new and have been introduced as innovations in the last fifteen years.

Except in one enterprise, the uruguayan biotechnological activity uses traditional processes updated and refined through the new developments.

The leading enterprises of this branch of activity are small in size but internationally linked, technically and commercially: they are interested in expanding and diversifying their exports. These firms are concentrated on agricultural and livestock applications.

The uruguayan biotechnological firms may be classified according to the field of application, as shown by table 1. Eleven of them belong to AUDEBIO, mostly the leading and the most active ones, but those that use large traditional biological process do not belong to the organization yet.

Table 1

	Firms Number		
	AUD	Oth	Total
Agricultural: seeds, tissues, inocula, plant propagation, etc.	3	9	12
Livestock: vaccines, animal health products	3	5	8
Food: meat plants, breweries, dairy products, wineries, other food processing	4	26	30
Other industries: chemical, leather, wool, pulp and paper, etc.	1	9	10
Total	11	49	60

Source: Own estimates

The firms of groups 1 and 2 are small and medium sized and their activity is specialized in narrow product lines and services, such as vaccines, horticultural seeds, etc. Those that already belong to AUDEBIO are aware of the constraints imposed by the limited local biotechnological market and are trying to promote its development as well as the penetration in Argentina, Brazil and other international markets.

Some of the most active enterprises were recently created and are conducted by young professional managers that attended American and European universities.

The food industry is a traditional activity in Uruguay. It includes large, medium and small enterprises, but the biotechnological activity is incipient in them: except in a few cases they remain with the traditional processes of fermentation, enzymatic changes and separation of proteins and other substances.

Uruguay exports include: meat and meat products, dairy products, fish and derivatives, wine, etc. They cover the internal market in those products as well as the local demand of beer, bakery, preparations of fruits and vegetables, sugar, oils and fats, etc.

Only two meat plants and two wine producers belong to AUDEBIO in spite of the interest of the modern biotechnology in production processes, effluent treatment, by-products and services. Only few applications are in use, and that indicates a potential demand that may be developed.

The fourth group includes export oriented as well as domestic market oriented firms. Uruguay exports include: leather and its products, wool and its products, some paper products, etc. Among the domestic market oriented firms, ANCAP, that process fuels and ethanol and some chemical firms, may be mentioned.

The information and INTELL products for the third and fourth groups may attempt, at the first stage, to become an "alert system" for technological and economic innovation.

Only one small firm of this group belongs to the Association. A growing interest on biotechnology in the large firms of the activities mentioned can be expected.

The biotechnology enterprises of Uruguay are well connected with Argentinian and Brazilian firms through CABBIO (Argentina and Brazil Biotechnological Center), the Argentinian Biotechnological Forum and related institutions.

#### 4. DEMAND CHARACTERISTICS

The demand of elaborated information and INTELL includes not only the enterprises that use or may use biotechnological processes, but also other institutions such as the R&D centers, agricultural cooperatives, public services, etc.

An universe of one hundred firms and institutions interested in elaborated information and INTELL, may be estimated.

Table 2 shows the result of a brief survey to entrepreneurs on the needs of elaborated information and INTELL related to biotechnology business. The entrepreneurs perception of the information needs is related to the current market situation, that is the domain of the technology already available.

However the need of information and INTELL to promote future business may lack adequate coverage in the table. In other terms: the entrepreneurs are thinking of products and information related to competition in specific markets; while there is another kind of information about the biotechnological business that relates to the general overview and future opportunities of the activity and to the trends that can be inferred from the R&D efforts, patent registration, etc.

Table 2 shows that the main demand subjects groups are: patents and intellectual property and technological forecast.

The analysis of each group indicates:

Table 2

Needs of elaborated information and INTELL

Subjects	Relevance Given
<b>1. INTERNATIONAL MARKET: CURRENT AND FORECAST</b>	
1.1 Product competitiveness	
1.2 International demand trends	
1.3 Exports: current and potential	*
1.4 Prices: structure and trends	*
1.5 Import countries legislation	*
1.6 Country economic risk (Argentina, Brazil & LA)	
<b>2. TECHNOLOGICAL FORECAST</b>	
2.1 Products	*
2.2 Processes	*
2.3 Quality and sanitary requirements	* *
2.4 Packing, Labeling and other requirements	* *
<b>3. PATENTS AND INTELLECTUAL PROPERTY</b>	
3.1 Patenting and registrating methodology	* *
3.2 Patent registration follow up	* *
3.3 Registration of own developments	*
<b>4. COMPETITION AND MARKETING</b>	
4.1 Stages of the marketing chain	*
4.2 Main competitors	*
4.3 Trade agreements	*
<b>5. COMPETITIVE CAPABILITY</b>	
5.1 Compared production costs	
5.2 Diversification possibilities	*
5.3 Supply of services related to products	
5.4 National and international aids for exporters	* *
<b>6. INVESTMENT FOR COMPETITION</b>	
6.1 Production facilities	
6.2 Technology	*
6.3 Commercial activities (products and technology)	*
6.4 Human capital, training	
<b>7. ORGANIZATION AND OTHER SUBJECTS</b>	
7.1 Subcontracting	
7.2 Joint-ventures, consortiums	*
7.3 Promotional agencies, chambers, associations	
7.4 Who is who in international biotechnology	

Source: elaborated from data provided in 6 interviews.

Relevance: (\* \*) high; (\* ) medium; ( ) low.



a) Several enterprises remarked the need of information on international markets, but as a difference from the answers obtained in Costa Rica, Ecuador and Argentina, the product competitiveness receive low attention. Most of the interest in this group is directed at exports (current and potential), prices (structure and trends) and import countries legislation. One firm pointed out the need of information on Latin American countries economic risk conditions for international business.

b) Technology forecast group of subjects receive great attention, specially the quality and sanitary requirements and the packing, labeling and other requirements. Product and process forecasts seem less priority.

c) Patents and Intellectual Property subjects receive the greatest relevance of this survey. The indicators of this group were suggested by the entrepreneurs and show the need of information on how to register a patent, how to protect the own developments and how to use the information on patents and intellectual property to follow the trends in the competitors development. An intelligence activity on this subject related to the product lines of the Uruguayan firms may be the kind of INTELL service that may supply immediate answer to a sound demand.

d) The indicators on competition and marketing receive medium attention, specially related to main competitors and trade agreements.

e) The information to build up competitive capacity in products and services receive, in general low attention. There is a moderate (declared) need for "diversification possibilities" and a high need to know the aids of national and international agencies for new and small exporters.

f) Two of the indicators on investment for competition obtained more relevance than the others: the commercial activities to sell products and services, mainly technology, and information for investments in technology.

g) In the last group the most relevant information subject was the joint venture and consortium organization.

The results of table 2 are different from those of the 1990 INTELL Project Report:

i) Information needs are more concentrated on technology-related subjects, while commercial information plays a complementary role.

ii) There is a greater need to up grade the firms organization and commercial activities in the biotechnological activity than in the traditional agribusiness and food production.

The survey provides a first overview of the needs, but as was indicated, do not provide all the information about demand. As this analysis goes deeper, other subjects will emerge as relevant needs of general INTELL, in terms of technology, scientific knowledge, commercial capabilities and government regulations.

For the current explicit biotechnological activity the table 2 subjects information will relate to product families for some agricultural and livestock applications and to specific needs of meat plants and wine producers. If the needs of other industries are included, the extent of the information broaden out adding more product families, but to provide the general INTELL needed to promote the activity, not only it is necessary to scan the niches, but to be aware of the novelties in broad branches of the biotechnology.

## 5. HOST INSTITUTIONS FOR THE DEMONSTRATION PROJECT

Two institutions may establish an agreement to host the IDU: AUDEBIO and CID.

AUDEBIO (Uruguayan Biotechnological Enterprises Association) was created in 1987 as the result of a meeting on the development of biotechnology in Uruguay. The members are mostly small and medium size enterprises that were already mentioned.

The main activities of the Association are: promotion of the sectorial activities, seminars, lectures, national institutional contacts (government, R&D and academic centers), international contacts, specially with Argentinian and Brazilian institutions and international cooperation agencies.

CID (Innovation and Development Center) is a small research center devoted to a project: NEXO, on entrepreneurial information services, currently in its second year of the three planned. It receives financial support and assistance from IDRC, Canada.

NEXO was conceived as a pilot project to implement a reference service for entrepreneurs and specially for new entrepreneurs.

After the first year devoted to study the users needs and the information services offered by several institutions in Uruguay, Canada and Latin American countries, a change of objectives was suggested by the end of 1990, to meet the unsatisfied demands for processed information.

CID learned about a possible INTELL demonstrative project supported by UNIDO almost simultaneously with its objective review and is willing to apply its staff and experience as the local counterpart of the demonstrative unit. This has to be consulted with its sponsors.

CID staff consist of: one team leader, three professionals, two juniors, and one secretary. They have office installations for 10 or more researchers, computers, communication facilities, etc.

The research done during the last year allowed them to identify the locally available sources of information (national and

international) and some characteristics of the information demand, through consultations with entrepreneurs. CID also strengthen contacts with training organizations, non governmental promotion agencies, finance institutions, and others.

The CID may reach an agreement with AUDEBIO and with the IDRC to host an IDU, to provide information products and services to the Uruguayan biotechnology activity. This will allow the successful completion of INTELL and NEXO projects.

This arrangement may not provide permanent support to the intelligence unit, therefore several alternatives will have to be developed during the 12 months of the INTELL project to finance the future activity: the sales of the own products and services, additional support from IDRC, contracts with the ICGEB of UNIDO, etc.

The IDU products and services at the end of the INTELL project may be:

- a) a reserved newsletter for the Uruguayan biotechnology firms and institutions;
- b) an inquiry service;
- c) reports on markets, intellectual property, technological forecasts, etc.
- d) training in information gathering and elaboration;
- e) advisory services, publications and others.

An approximate amount of 5,600 working hours per year are needed to: edit the newsletter monthly, answer 1,000 questions/year, elaborate two 100 pages reports, etc.

To provide 5,600 working hours the IDU team may have the following composition:

team leader,  
one professional: biotechnology,  
one professional: marketing,  
one professional: patents and intellectual property  
(part-time).

The IDU would have the following strengths:

- a) a team trained in information services through the NEXO project;
- b) links with the international and national information sources;
- c) a very good relation with AUDEBIO, R&D centers, Government, and non governmental promotional agencies;
- d) financial support, through IDRC, till the end of 1992, with possible extension;
- e) a team aware of the need to sell products and services as part of their future sustainment.

The IDU seems to be weak in:

- a) continuation assurance after the INTELL project;
- b) lack of specific training in current bioinformatics, specially in technical and commercial data and information. Access to bioinformatics is considered difficult and heterogeneous.

The continuation assurance will depend on how the IDU meets its objectives:

- at the sectorial level: promote biotechnological activity.  
This objective may be supported by AUDEBIO and UNIDO..
- at the branch level: promote the elaboration and the use of global biotechnological INTELL.  
This may be supported by the Uruguayan biotechnological activities, IDRC and UNIDO.
- at the firm level: promote the elaboration and use of specific INTELL to improve firm competitiveness.  
This has to be supported directly by the firm or group of firms that receive the results.

The lack of familiarity with bioinformatics may be solved providing training to the team, for example at the ICGEB. The team leader may be invited to spend two weeks at the Centre, to learn in detail about sources of information, availability of information, expertise that can be used by the IDU, possible links between the IDU and the ICGEB, etc.

## 6. INFORMATION INFRAESTRUCTURE

The CID recently surveyed the local institutions that may provide simple and elaborated information. The most interesting ones for the INTELL project seem to be:

CNPI	Intellectual Property National Center
CNTPI	Industrial Technology and Productivity National Center
UAPI	Industrial Promotion Advisory Unit
CNDCTE	Scientific, Technical and Economic Documentation National Center
CENCIU	National and International Trade Statistics Center
LATU	Uruguayan Technological Laboratory
CI	Industry Chamber

Important support may be provided by the Biological Research Institute "Clemente Estable", that belongs to the Education Ministry, the LATU, the Biotechnological National Committee and the Chemical Faculty of the National University.

## 7. GOVERNMENT INSTITUTIONS THAT SUPPORTS THE PROJECT

The Industry Ministry, through the DINAPYME (Small and Medium Enterprise National Direction), may support the IDU providing:

- links with the Uruguayan attaches (Foreign Service)
- coordination with national sources of information and R&D centres
- access to foreign data basis through the Ministry links
- support from international cooperation agencies
- promotion of the information products and services demand in national and also in large industries
- other support

CONICYT, National Scientific and Technological Research Council, through the Biotechnology National Committee, can provide additional support. They submit a request for bioinformatics and also for expert visits within a loan of the Interamerican Development Bank.

## 8. PROJECT ACTIVITIES

The INTELL development may be seen as a sequence of three stages during the project:

- . the preinitiation,
- . the initiation of the INTELL service as a pilot operation,
- . the semiautonomous operation.

After the project the IDU may reach the stage of autonomous operation.

### The Preinitiation

This stage begins with the project approval and includes only one activity:

#### 1) Development of detail project planning

After the approval it will be necessary to review this report, confirm the institutional and financial support, set final agreements with host and promotional institutions on the IDU implementation: office, facilities, staff requirements, relations with information sources, effective setting of local counterparts and other aspects. With all those elements a final plan of activities may be developed.

This task will be carried out by a Technical Adviser hired by UNIDO to advise and supervise the IDU installation and operation.

## Initiation of the demonstration activity

### 2) IDU complementary installation and staffing

It will be necessary for CID, in addition to its staff, to hire a professional in biotechnology and another one (part time) with experience in intellectual property.

A plan to upgrade CID availability of reports, subscriptions, software and reference materials, according to INTELL needs will be elaborated. Current office facilities are enough to begin the operation.

### 3) Training at the ICGEB

The team leader will travel to the ICGEB to get acquainted with the bioinformatics, to learn about the sources of information and the expertise that the ICGEB can provide to the IDU.

The Technical Adviser may also travel to the ICGEB, but only for a few days, and then will visit the UNIDO headquarters to receive first hand information on other programs on biotechnology/bioinformatics and also to explore the possible links between the IDU and other agencies.

### 4) Methodological guidelines

A first draft of the operational methodology will be elaborated by the Technical Adviser and the team leader after the travels.

### 5) Initial phase of training

There will be a training seminar with the assistance of the Technical Adviser. The seminar will be attended by two experts:

Expert i) INTELL specialist

He will elaborate and provide methodological guidelines to the IDU: data interpretation, synthesis and abstraction, perception of key signals from markets, technology and regulations, classification of results developed and software.

Expert ii) Patents and Intellectual Property applied to biotechnology

He will elaborate a report to help the IDU staff to understand the subject and to know the information sources, the analytical and forecasting methods using data related to patents, intellectual property and R&D.

During the seminar the materials provided by the experts will be analysed by the IDU staff and the operational methodology will be reviewed and upgraded.

6) INTELL products delivery in preliminary formats

Some services and products will be delivered at the end of this stage on preliminary basis, as a test of the format and content of the products offered.

7) Training and technical assistance plan

With the participation of another expert in biotechnology commercial prospective, the second phase will be planned.

The plan will include recommendations on correspondents, subscriptions and expert visits.

8) Second phase of training

A short seminar will be held at Montevideo to review the activities of the first two stages, to set corrections and to listen to:

Expert iii) on biotechnology commercial prospective

He will prepare a paper on international competition in biotechnology, specially related to agriculture, livestock and food applications, and also on the commercial opportunities for a small developing country. The paper will be analysed together with the IDU staff in a short seminar. The Technical Adviser will also attend the seminar.

The Technical Adviser and the Team Leader will prepare a report on the advances of the methodology and will indicate operational recommendations for the following stage.

Semiautonomous operation

9) INTELL products and services delivered on a permanent basis

At this stage the IDU must reach substantial potential in terms of quality and quantity of products and services delivered, and regularity in internal analysis and processing. Some returns must be obtained from its output, but its amount may be only a part of the IDU expenses.

10) Reviewing and reporting the experience

The Technical Adviser will periodically review the advances and will report them to UNIDO.

Autonomous operation

The IDU must try to get the self-support of its activity by a combination of product and service sales, institutional support

and special financing for definite purposes.

The commitment of the host institutions must include the support of the trained unit until the stage of autonomous operation, that may last several years to be reached.

9. PROJECT SCHEDULE

activities/month	1	2	3	4	5	6	7	8	9	10	11	12
Preiniciation												
1. Detail.Plan	---											
Iniciation												
2. IDU Installat.	---											
3. Train. ICGB		---										
4. Meth. guidel.			---									
5. Train. ph. 1				---								
6. Prel.I.Deliv.				===	===	===						
7. T&TA plan					---							
8. Train. ph. 2							---					
Semiauton. oper.												
9. INTELL deliv.							===	===	===	===	===	===
10. Rev.&Report.						---						---

Note:           === :   Intell delivery

10. BUDGET

In table 3 the budget for the IDU is presented and in table 4 the budget for UNIDO cooperation

Table 3 includes the expenses of the local team (salaries, office facilities and office expenses) and the UNIDO contribution to the INTELL service:

- . Subscriptions to data basis, publications and reference materials;
- . expert contracts to provide advice or information on specific subjects, including correspondent fees;
- . training at the ICGB;



. software.

Some of the UNIDO inputs, such as expert contracts and bioinformatics, are included in an assistance request to the Interamerican Development Bank. It is not easy to know if this assistance will be ready to use the moment that CID and AUDEBIO are ready to start with the project.

Table 3 Uruguay. Budget for the INTELL Demonstrative Unit.  
Biotechnology (in u\$s)

item	Quant.	Un.Val.	TOTAL	LOCAL	UNIDO
Team Leader (mo)	12	1,400	16,800	16,800	
Professionals (mo)	30	1,000	30,000	30,000	
Secretary (mo)	12	500	6,000	6,000	
Personnel Subtotal . . . . .			52,800	52,800	
Computers and software	3		10,000	5,000	5,000
Communication equipment			4,000	4,000	
Furniture			2,000	2,000	
Office Facilities Subtotal . . . . .			16,000	11,000	5,000
Office Expenses (mo)	12	1,500	18,000	18,000	
Subscriptions			15,000		15,000
Expert contracts			15,000		15,000
Training: initial at the ICGB			5,000		5,000
Total URUGUAY IDU . . . . .			121,800	81,800	40,000
TOTAL URUGUAY IDU . . . . .			121,800	81,800	40,000
INSTALLATION EXPENDITURES			16,000	11,000	5,000
TRAINING			5,000		5,000
OPERATIONAL EXPENDITURES Local currency			70,800	70,800	
OPERATIONAL EXPENDITURES Foreign curren.			30,000		30,000

In table 4 the UNIDO budget to support its assistance to the project is analysed. The inputs taken into account are the following:

A Technical Adviser will be hired to assist CID and AUDEBIO and to supervise the project. He will report the results of the project to UNIDO.

This may be a part-time activity, estimated in 5 months (full-time equivalent) during the project. He will need u\$s 1,000/mo of office expenses (including secretary, communications and other expenses).

Three experts will be hired, for one month each, according to the fields already explained. The total salary may be u\$s 20,000. The travels of the experts to attend the training meetings are estimated in 2,500 each.

A Technical Adviser living in Buenos Aires will need 16 travels to Montevideo (u\$s 100 each) and 75 days of per diem (u\$s 80 each). He will also travel to Trieste and Vienna (estimated in u\$s 5,000).

Table 4. INTELL URUGUAY: UNIDO Technical Assistance Costs (U\$S)

ITEM	Quant.	Un. Val.	Total
1. UNIDO assistance to training and supervision			74,000
Technical Adviser	mo. 5	5,500	27,500
Office expenses	mo. 5	1,000	5,000
Experts	3		20,000
Meetings	3	2,500	7,500
Travels	17		12,600
Other expenses			1,400
2. Assistance through the IDU			40,000
3. Total UNIDO expenses			114,000