

Annual Report 2009



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Editorial



The third year of existence of the Carnot LISA institute was marked by three important events which deserve to be emphasized.

Following the departure of its director, who is also the director of ITERG, one of the three institutions making up the LISA consortium, the LISA Carnot Institute Orientation and Follow-up Committee appointed me as director. Frédéric Carrière, Vice President of IMBL's board of directors, also part of the LISA consortium, took over my position as Head of the Science Department. Owing to the governing body's strong collegial values, these successive changes did not affect the good running of the Carnot Institute

The third year LISA follow-up audit showed the Carnot Institute was making good progress, and it was granted a top rating for 7 out of 12 objective criteria.

Finally, LISA organised its first Industry–Research relationship Seminar, which was widely attended by industrial players who also took part in the lectures. The seminar mainly focused on the subject of advancing research in order to develop innovative applications.

*Michel Lagarde
University Professor at the INSA Lyon
Head of the LISA Carnot Institute*

I. Presentation of the LISA Carnot Institute



Competence, reliability and scientific excellence are the main reasons why industrial customers choose the LISA Carnot Institute (January 2009 satisfaction survey). Three years after its certification, the LISA Carnot Institute has fulfilled its objective by imposing itself as a major player in the field of lipid science and technology and as a socio-economic research partner. The LISA Carnot Institute is a unique technological centre, working in partnership with industries and academic research institutions, which has built itself up as a centre of excellence through scientific resource sharing.

The LISA Carnot Institute was founded by three associate members, involved in the oil and fat industry, and was certified in 2007. The objective behind LISA was to develop research, provide solutions and anticipate the needs of industries and public institutions. The Carnot 'certification' rewards research centres that have demonstrated their competences in collaborating

with businesses. It increases their visibility and grants them financial subsidies based on the number of signed contracts. These subsidies help those centres to develop long term science and technological expertise and professionalize their partnerships with businesses.

1.1. Structure

ITERG (French Institute for Fats and Oils) located in Pessac near Bordeaux:

- Analysis Unit
- Nutrition, Health & Metabolism Unit
- Lipochemistry, Formulation & Technology Unit
- Audit-Counselling & Environment Unit

IMBL (Institute for Multidisciplinary Biochemistry of Lipids) involves teams based in Lyon and Marseille:

- UMR* 870 (INSERM** / INSA*** Lyon): Metabolic Regulation, Nutrition and Diabetes
- UMR 5123 (CNRS**** / Lyon 1): Cellular and Molecular Integrative Physiology
- UMR 5246 (CNRS / Lyon 1 / INSA Lyon): Molecular and Supramolecular Chemistry and Biochemistry Institute
- UPR***** 9025 (CNRS / Marseille): Interfacial Enzymology and Lipolysis Physiology Laboratory

Bordeaux University Research Cluster (PRES):

- UMR 897 (INSERM / Bordeaux 2): Epidemiology of Nutrition and Dietary Habits
- U2N (Bordeaux 1 / Bordeaux 2): Nutrition and Neuroscience Unit
- UMR 5248 LMDA (CNRS / Bordeaux 1): Dispersed Food Media Laboratory



Forming a cluster which includes:

126 permanent staff

51 doctoral and post-doctoral students

Areas of research

- Life Sciences
- Chemistry and Biochemistry
- Energy and Environment

- * UMR: Unité Mixte de Recherche
** INSERM: Institut National de la Santé et de la Recherche Médicale
*** INSA: Institut National des Sciences Appliquées
**** CNRS: Centre National de la Recherche Scientifique
***** UPR: Unité Propre de Recherche



1.2. Governing body

After its certification, LISA IC named a Governing body composed of ten members representing each one of LISA's units, and divided in four main bodies:

- Orientation and Follow-Up Committee
- Board of Directors
- Science Coordination Committee
- Operational Coordination Committee

The Governing Body has already undertaken to:

- ⇒ promote the professionalization and the development of socio-economic partnerships
- ⇒ strengthen and structure LISA's scientific offer and services to industries
- ⇒ integrate Carnot Certification requirements

When the Director of ITERG, Frédéric STAAT - also the Director of IC LISA - left in September 2009, the changes within the governing body had already been anticipated.

In October 2009, Michel LAGARDE, a University Professor at INSA Lyon and the President of IMBL's Board of Directors, was appointed as Head of the LISA Carnot Institute, in agreement with the Institute's Orientation and Follow-up Committee.

Michel LAGARDE actively participated in founding the institute, together with Frédéric STAAT and Fernando LEAL-CALDERON. During the last two years, he was working as Scientific Director and was also a permanent member of the Board of Directors.

It was a smooth and easy transition and the mission ahead of him was clear and well defined:

- Pursue the work already undertaken and approved by the audit,
- Integrate the observations and recommendations stated in the audit as part of the global strategy for improvement,
- Develop LISA's research partnerships
- Promote the Carnot Certification.

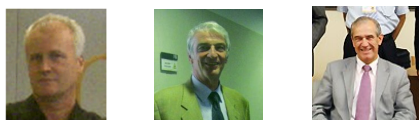
Frédéric CARRIERE, the Director of the CNRS UPR 9025 (Marseille) and the Vice President of IMBL's Board of Directors, was appointed as Scientific Director and took over as Head of the Science Coordination Committee (CCS).

As for Fernando LEAL-CALDERON, LISA's Vice-Director, he went to work for a year in Australia as part of a collaborative science project in the field of lipid science. Maud CANSELL, Head of the ENSCBP* Food Biology Department and highly involved in LISA Partnership Research, temporarily took over his position.

These changes within the Governing Body did not affect the stability of IC** LISA or hinder its development, confirming the strong involvement and cohesion of the different stakeholders, as well as their professionalism.

* Ecole Nationale Supérieure de Chimie, de Biologie et de Physique, Bordeaux

** Institut Carnot



LISA Orientation and Monitoring Committee

- PRES University of Bordeaux **Jean Baptiste VERLHAC**, Vice-President of the Board of Directors of Bordeaux 1 University and President of LISA Steering and Monitoring Committee
- ITERG **Jean-Pierre LEGRAND**, President of the Board of Directors
- IMBL **Jean-Marie REYNOUARD**, INSA Lyon Research Director



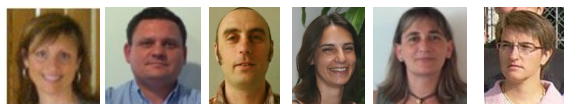
LISA Board of Directors

- **Michel LAGARDE**, IC LISA Scientific Director
- **Fernando LEAL - CALDERON**, IC LISA Vice-Director
- **Maud CANSELL**, IC LISA interim Vice-Director
- **Frédéric CARRIERE**, IC LISA Scientific Director



LISA Scientific Coordination Committee

- **Frédéric CARRIERE**, IC LISA Scientific Director
- **René ARMENGAUD**, President of ITERG Scientific Committee
- **Pascale BARBERGER - GATEAU**, Conference Manager, Team Manager, ISPED
- **Anne LE GUILLOU**, DANONE
- **Alain MILLUS**, SEPPIC AIR LIQUIDE
- **François LEGAY**, NOVARTIS



LISA Operational Coordination Committee

- **Claudie GESTIN**, IC LISA Communications Manager
- **Jean David LÉAO**, IC LISA Marketing and Business Manager
- **Christophe ZABAWINSKI**, IC LISA Legislation & Intellectual Property Manager
- **Catherine BAPTISTA**, IC LISA Good Practices Manager
- **Anne-Catherine MARILLONNET-LEBAT**, IC LISA Management Assistant
- **Céline COSTAZ**, Conference Manager IMBL



1.3. Key figures for Research Partnerships

As defined by the Carnot Certification, a research partnership consists in carrying out research projects in partnership with players in the market, in order to meet their socio-economic needs. This type of partnership implies a financial contribution on the part of the player and his commitment in terms of expressing his needs and defining the technical specifications to be met, which may also involve his taking part in the research work.

The main reasons businesses decide to work in partnership with Carnot institutes is because:

- They are looking for highly qualified collaborators
- They wish to develop innovative solutions
- They are looking for professional efficiency
- They are targeting specific markets with specific industrial needs

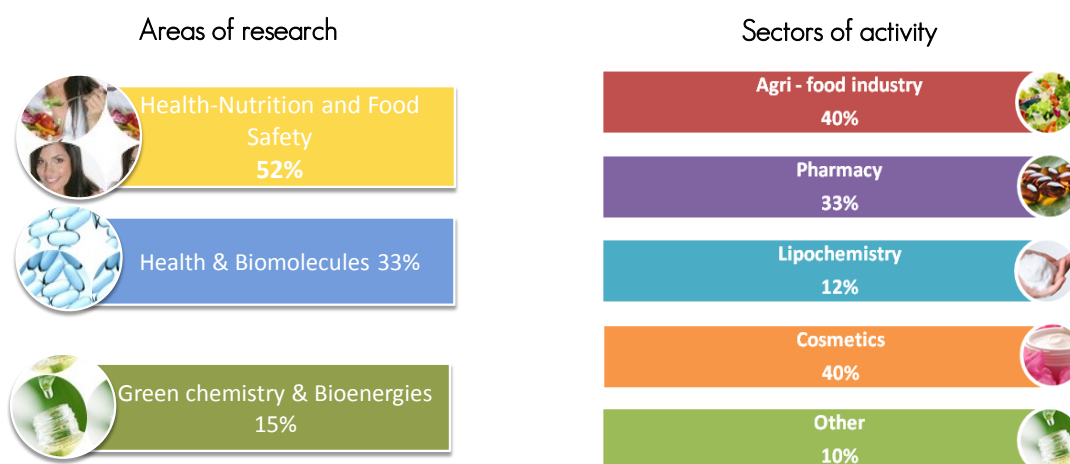


The turnover of IC LISA's Research Partnerships has grown from 2 367 K€ in 2007 to 3 270 K€ in 2009 (an increase of 38%).

This progress is the result of the Institute's development strategy aimed at achieving a +10% progress/year.

The number of contracts signed with **SMEs** has also progressed and accounts for **23%** of global turnover in 2009.

The main areas of research are Nutrition, Health and Food Safety.



Issues that are linked with industrial clients' sectors of activity, 40% involved in the agri-food industry and 30% in the pharmacological industry.

86% of research partnerships are carried out with French partners, strongly represented by regional businesses and institutions as IC LISA is based in Bordeaux, Lyon and Marseille.

II. Technological challenges

IC LISA has developed a pluridisciplinary approach aimed at industries and other sectors processing, producing or working with lipids.

It relies on the synergy of existing competences within LISA's different units for scientific resource sharing through the emergence of transverse and innovative projects.



80% of the ANR*'s contribution to the Carnot institute is devoted to developing scientific and technological resource sharing and socio-economic partnerships, in order to widen the institute's partnership research offer to meet new technological challenges and acquire essential competences. Scientific resources are shared internally between IC LISA units and externally through national and international scientific research partnerships.

* National Research Agency

2.1 Areas of research

IC LISA's areas of research cover a wide range of scientific and technological challenges in connection with economic and social issues such as food, nutrition, health, green chemistry and new sources of energy.



Area of research 1: Health and Nutrition & Food Safety

⇒ Improving the general health of the population by optimizing the quality of dietary lipids

'Growing up and getting old healthily'

⇒ Guarantee the health benefits and risks of dietary lipids in order to improve the quality of industrial production 'Safe and Healthy food'



Area of research 2: Health & Biomolecules

⇒ Understanding lipid metabolism and its biological medias

'Understanding lipids in order to prevent and cure connected diseases'

⇒ Develop simple and effective analytical tools adapted to biological medias.

'Optimize costs'

⇒ Develop non invasive medical diagnosis methods (lipid probes and stable isotopes)

'Developing safe methods of diagnosis'



Area of research 3: Green Chemistry & Bioenergy

⇒ Developing new biofuels

'Managing the transition to renewable energies'

⇒ Developing new bioproducts and new processes for obtaining them

'Environmentally friendly solvents, lubricants, detergents, paints, etc...'

⇒ Scaling-up technological processes to the industrial level

'Moving up from laboratory to industrial pilot scale at a lower cost'



2.2 Research carried out by the LISA units

One of the strong points of IC LISA lies in its capacity to merge the competences of public and private institutions, as well as businesses.

In order to use these skills in an efficient way to achieve the common objectives of the IC LISA teams, it is vital to develop a strong cohesion between all the players and give them the feeling of belonging to a scientific community.

The research teams of the Carnot Institute expressed their wish of being able to organize a Science Open Day to be able to work together on new projects and future technologies.

Science Open Days

This event brought together twenty researchers working for ITERG, IMBL and PRES in Bordeaux.

They were able to discuss their different activities and team work results. These rich and constructive exchanges were focused on three strategic issues.

In 2009, two scientific meetings were held on the following subjects:

- ⇒ Biological and biomimetic membranes
- ⇒ Enzymes and lipolysis



Programme for the meeting 'Biological membranes and biomimetic membranes'

- Biomimetic membranes and potential for study within the IMBL IBiSA platform as part of the LISA Carnot Institute Research Studies.
- Formation of domains enriched in cardiolipin within membrane models mimicking the internal membrane of mitochondria: role of mitochondrial creatine kinase.
- Influence of lipids on the interfacial properties of model peptides.
- Kinetic study of lipase using monomolecular lipid film spread over the surface of a zero order reaction tank.
- Catalytic oxidation of unsaturated lipids using monomolecular film.
- New glycolipid bioprobes for membrane imaging using non linear optics.
- Lipid imaging.
- Lipid domains and myogenic differentiation.
- Lipid peroxidation metabolites and pathophysiological implication.
- Matrix vesicles: background, role and applications.
- Endocannabinoids and status epilepticus neuroinflammation in a rat model.

Programme for the 'Enzymes and Lipolysis' Day

- Overview of gastrointestinal lipolysis and pharmacological applications.
- Presentation of the internal LISA project 'Development of an In Vitro model for testing the bioavailability of lipid emulsions after enzymatic degradation and absorption by enterocytes.'
- Lipolysis in fat tissue.
- The DAGOIL project: producing diacylglycerol-rich oil (DAG) using an integrated enzymatic refining process. (project submitted in 2009 by several of LISA's partners in response to the call for proposals of the Carnot - Fraunhofer Institutes).
- The GALACTOLIPASE project: using galactolipids to extract fatty acids from one of the main lipid sources available on earth (Project financed as part of ANR CP2D).
- OPTIMOILS Programme and new technologies for preserving oil micronutrients.
- Methods for lipolysis product analysis

Collaborative projects:

LISA call for proposals: In 2009, further to an internal call for proposals, the Science Coordination Committee selected **three collaborative projects submitted by different IC LISA units**. Each one of these projects was granted funding (32 to 50 k€) for a global amount of 122 k euros.

Title	Description	Partners
'Heterogeneous catalytic epoxidation of vegetable oils and their by-products plus ester functionalization in the presence of simple sugars'. (Year 2)	Unsaturated oil epoxide synthesis based on the processes patented by ITERG. Developing new detergents and emulsifiers for industrial applications. Glycolipid agrosurfactants.	ITERG Lipochemistry
		IMBL (UMR 5246)
'Effect of vector-mediated Docosahexaenoic Acid on neuroprotection during epileptogenesis in a rat model.'	Formulation and use of Docosahexaenoic Acid as part of a value adding industrial strategy aiming to offer new therapeutic and nutritional options for certain types of neurodegenerative diseases.	IMBL (UMR 5123)
		ITERG Nutrition
		PRES U2N
'Preliminary study for developing a project model for long-chain omega-3 fatty acid supplementation as a means of preventing cognitive decline'	Identification and analysis of bottlenecks which must be solved before new studies are carried out to evaluate the benefits of EPA and DHA supplementation in food.	IMBL (UMR 870)
		PRES (U897)
		IMBL (UMR 870)

A policy in favour of doctoral students

Doctoral studentships are one of the pillars of IC LISA's scientific resource sharing.

Since 2009, **43** doctoral students have joined LISA, 35 of which received a grant from the government, while 7 received a grant from the CIFRE scheme (private/public co-funding) and 1 received a special grant as a Doctoral Engineer (BDIE).

The ANR contribution helped to co-finance wages and two CIFRE scheme (private/public co-funding) studentships

⇒ *Leslie Couédelo, 2008-2010.*

Nutritional bioavailability of colloidal systems rich in Polyunsaturated Fatty Acids (PUFAs)

In Vitro and In Vivo studies

Co-headed by PRES (LMDA)/ITERG.

Area of Research 1:

Health and Nutrition & Food Safety

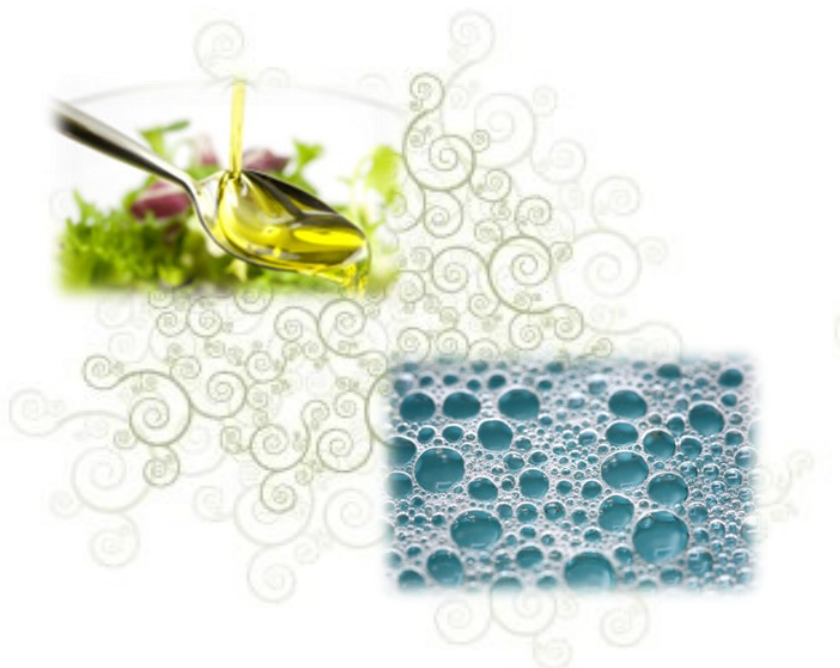
⇒ *Cédric Epoune, 2008-2011.*

Heterogeneous catalytic epoxidation of vegetable oils and their by-products plus ester functionalization in the presence of simple sugars.

Co-headed by: IMBL (UMR 5246) / ITERG.

Area of Research 3:

Green Chemistry & Bioenergies



At the time of the 2009 internal call for proposals, the Coordination Committee specified that priority funding would be granted to projects including a doctoral student. This funding does not include wages.

This policy is aimed at encouraging the recruitment of doctoral students who largely contribute to IC LISA's scientific resource sharing.

The number of studentships involving a private partner (CIFRE or BDIE) are on the rise. Seven out of eight of these studentships were started after IC LISA was founded in 2007. Under the prevailing conditions, the objective is to reach a ratio of CIFRE and BDIE grants equal to 25% of total doctoral studentships. The specific requirements of the Carnot Certification, the development of science and technological expertise to meet the challenge of industrial demand, plus the institute's strategy in favour of professionalization are as many favourable elements which should help attain this objective.



2.3 Science partnerships

IC LISA intends to take advantage of its position to develop national and international partnerships in its areas of research and contribute in this way to develop scientific excellence. The short term objective consists in submitting at least one project a year, involving IC LISA's different units in response to national and international calls for proposals, a strategy which aims to strengthen team cohesion and improve the visibility of IC LISA.

On an International Scale

As a member of the French CARNOT network, IC LISA has established partnerships with other Carnot Institutes, essentially in the field of 'Green Chemistry & Bioenergies' as part of the 'Green Chemistry' UMT* bringing together ITERG and a laboratory connected with the MIB** (Organic Polymer Chemistry Research Laboratory, UMR CNRS 5629).

*Mixed Technological Unit

**Material and systems Institute of Bordeaux

Acronym and abstract	Unit(s) involved
TRANSQUAL (2006-2008) Naturally occurring trans fatty acids in dairy foods. Comparative study with artificial trans fatty acids	LISA : ITERG, IMBL (UMR 870)
COGINUT (2007-2009) Cognition, antioxidants, fatty acids, inflammation : an interdisciplinary approach studying the connection between nutrition and brain aging	LISA : PRES Bdx (U 897, U2N), ITERG
LIPAGE (2008-2010) Dietary lipids and inflammatory response : implication in the development of sarcopenic obesity	LISA : ITERG
NEUROPROTECT (2008-2011) Human metabolism of a structured marine phospholipid and effect on neurons	LISA : IMBL (UMR 870), ITERG
EUREKA! Liplant (2006-2009) Adding value to vegetable lipase enzymes in latex	LISA : IMBL (UPR 9025)
PHELIN (2007-2011) Design of Immobilized Phosphorus Heterocycles for Lipase Inhibition and Enzyme Capture in Complex Biological Materials	LISA : IMBL (UPR 9025)
GALACTOLIPASE (2009-2013) Using galactolipids to extract fatty acids from one of the main lipid sources available on earth	LISA : IMBL (UPR 9025), IMBL (UMR 5246)
MIEN FOAMY-TUB (2009-2013) Mycobacterium tuberculosis survival mechanism: deciphering the molecular mechanisms controlling lipid acquisition and enabling TB granuloma to survive in foamy macrophages	LISA : IMBL (UPR 9025)

The ITERG Nutrition Unit and the Nutrition and Neuroscience Unit of the PRES in Bordeaux are currently working together within the framework of the 'Lipid Nutrition and Brain Aging' UMT.

The IC LISA teams are also involved in cooperative research projects endorsed by the ANR within the framework of different research programmes in connection with the Institute's areas of research : PNRA (National Research Programme on Food and Human Nutrition), ALIA (Food and Agri-food Industries), CP2D (Chemistry and processes applied to sustainable development), PCV (Physics and Chemistry), collaborative projects have also been developed with the Voir & Entendre IC (LISA UMR 870 and UMR 897) and with the I@L IC (UMR 870 on 'lipids and joint tribology').

On an International level

IC LISA seeks to develop international collaborative projects based on specific criteria:

- qualified and/or complementary competences,
- long term collaboration
- help for the geographical mobility of collaborators working as researchers and university lecturers

The first step consists in issuing a call for proposals. For this type of project, several units belonging to a single IC or several ICs can get together in order to offer a wider range of skills and fulfil requirements. Four projects were referenced in 2009 (see table below)

Several IC LISA Bordeaux teams have established an ambitious and long term partnership with teams from the Institute of Nutraceuticals and Functional Foods (INAF) in Quebec. An international laboratory dedicated to Health and Nutrition - The Aquitaine and Québec Nutrition Institutes (INAQ) was founded in 2009.

A close collaboration was also developed between the Ste Justine CHU Research Centre, the University of Montreal, the UMR 870 (IMBL) and the Rhône-Alpes CRNH. An official partnership was concluded between the Montreal Research Centre and IMBL's Lipidomic platform (RIO/IBiSA Platform) for research in the following areas 1: Health and Nutrition & Food Safety and 2: Health & Biomolecules.



Acronym and abstract	Call for proposal	Unit(s) involved	Area of Research
<p>DREAMER (2009) Decipher the regulation mechanisms common to Eating disorders and addictions Mark the Effect of food components and identify the socio-psychological reasons</p>	Europe KBBE-2009-2-2-01	LISA: ITERG / PRES (U2N)	Health & Biomolecules
<p>ENZYMOIL (2009) Use of bioreactors through a multienzymatic integrated system starting from vegetable oils, obtaining the main Omega-3 and Omega-6 fatty acids</p>	Europe FP7-KBBE-2009-3	LISA: IMBL (UMR 870) / ITERG	Health and Nutrition & Food Safety
<p>DAGOIL (2009) Producing diacylglycerol-rich oil (DAG) using an integrated enzymatic refining process.</p>	ANR PICF 2009	LISA : IMBL (UMR 870 et UPR 9025) / ITERG FRAUNHOFER : IVV	Health and Nutrition & Food Safety Green Chemistry & Bioenergies
<p>POLYVOILS (2009) Innovative polyurethanes and polyesters made from rapeseed and sunflower oils</p>	Europe FP7-NMP-2009-SME-3	LISA: ITERG Lipochemistry - Technology Unit MIB : LCPO	Green Chemistry & Bioenergies

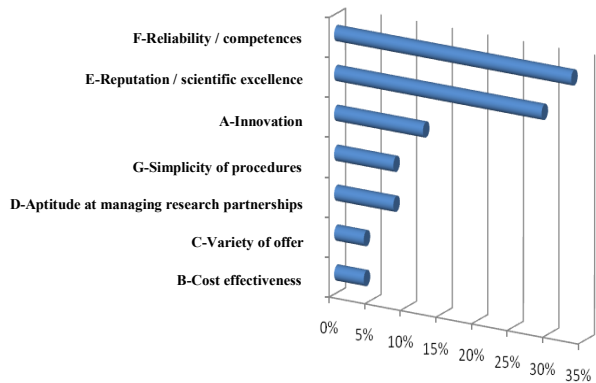
III. Important Events in 2009



3.1 Satisfaction survey

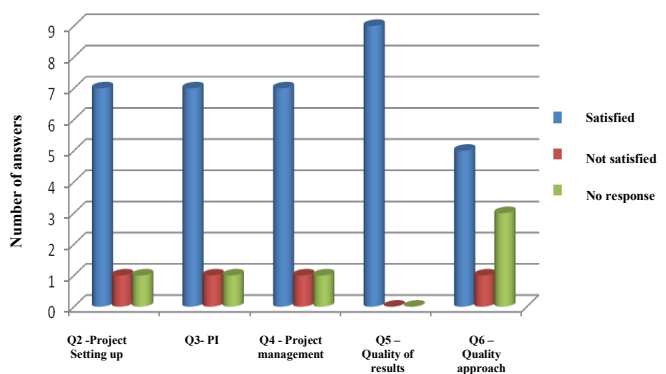
In January 2009, the marketing department carried out a satisfaction survey including a representative sample of industrial clients. This survey aims to fulfil the Institute's wish to remain aware of the needs of its industrial partners while going on improving its offer. The industries that choose to work with IC LISA are looking for qualified collaborators and scientific excellence.

WHAT ARE THE MAIN CONSIDERATIONS THAT MADE YOU CHOOSE US ?

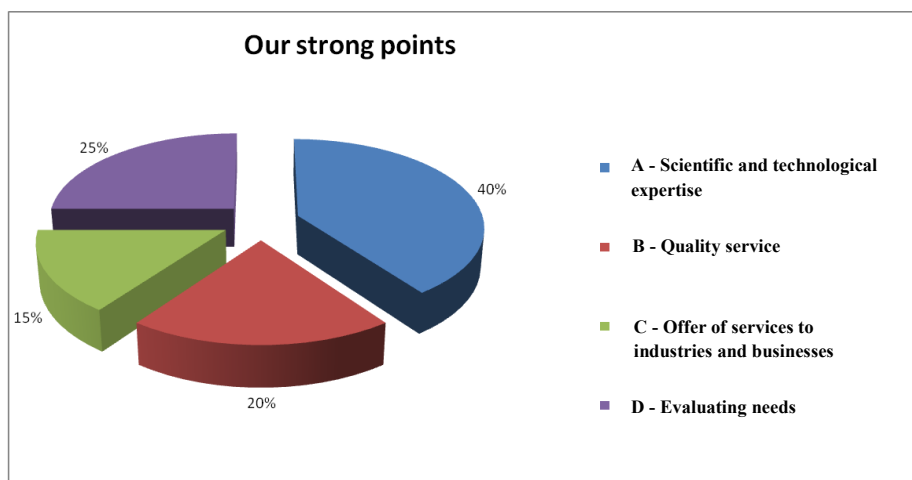


Although IC LISA doesn't appear to be chosen for its aptitude at managing research partnerships, clients are nevertheless entirely satisfied with IC LISA's management of projects. Professionalization and contractualization are the two main objectives of the Institute.

SATISFACTION SURVEY



The strong point underlined by industrial players in the framework of socio-economic partnerships, is LISA's capacity to provide scientific and technological skills while evaluating specific needs.

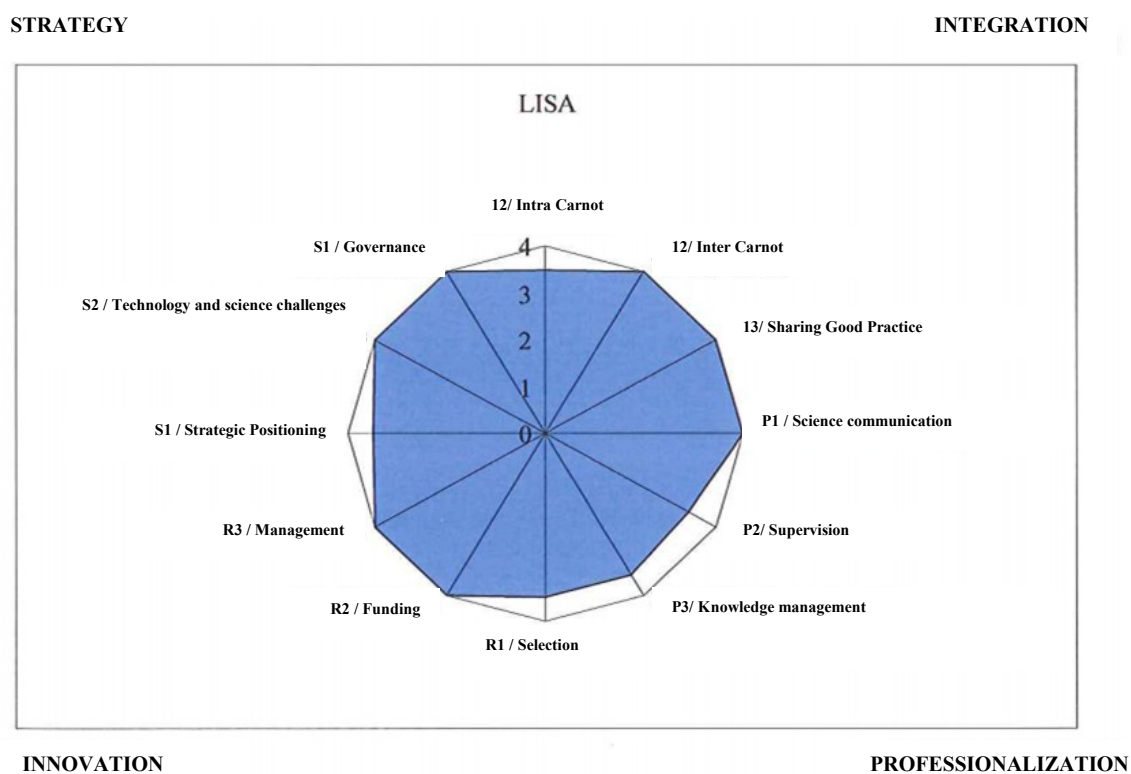


The results of this survey provide information which strengthens the institute's position and consolidates its development strategy.



3.2 Follow-up audit

In May 2009, after two years of activity, IC LISA was audited by the ANR (follow-up audit). The majority of the objectives the Institute set out to attain within four years have been fulfilled or are about to be.



'The LISA Carnot Institute very satisfactorily fulfils the requirements of the Carnot certification and must sustain its efforts while improving the points mentioned in the report issued by the Carnot Steering Committee, included with this document as an annex: intensification of prospective forecasting (on a national and international scale), establishing a stronger convergence between value adding structures and improved identification of technological bottlenecks.'

ANR evaluation report, 15 July 2009





3.3. Industrial Research Seminar November 2009

On 19 November 2009, IC LISA organized a seminar on Industry–Research relationship Seminar ». Admission was free for all participants involved in the field of lipid research and industry.

This unique event, which took place in the city centre of Bordeaux, was attended by a hundred participants and included plenary conferences, personalized interviews and poster sessions.

The conference, which featured presentations and constructive exchanges, emphasized:

- IC LISA's skills and expertise and the range of services it offers to industries,
- scientific and technological breakthroughs in the field of lipids
- developing interaction and exchanges between industrial players and researchers in order to encourage the emergence of new projects.

Programme for the LISA Industry–Research relationship Seminar

Title	Lecturer
LISA Carnot Institute : providing unique services to industrial customers	Jean-David LEAO, Head of Marketing, ITERG / LISA
Influence of fat and oil formulation on food properties	Maud CANCELL, Head of Food Biology ENSCPB, PRES University of Bordeaux / LISA
Molecular interactions in membranes: What analysis tools?	Agnès GIRARD - EGROT, Professor at the Claude Bernard University, merged with the UMR 5246, IMBL / LISA
Bioproducts : overview of the latest innovations and perspectives for the future	Carine ALFOS, Head of Lipochemistry-Technology-Formulation, ITERG / LISA
Health and Nutrition Research and Development for Saint Hubert	Anne RENAULT, Head of Research, SAINT HUBERT
Lipolysis and lipid formulation	Vincent JANNIN, R&D Project Director, GATTEFOSSE
Success story : new biodegradable lubricant for the UK rail industry - European Ibiolab Project	Andrew SPENCER, Technical Manager, Lubricants, RS CLARE&CO.



This event, which was greatly appreciated by all who attended, will be repeated every 2 or 3 years.



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