Phase de présélection

Acronym of the project	**PSL★**
Titre du projet en français	**PSL★ Rendons possible le nécessaire**
Project title in English	**PSL★ On the move**
Project manager	Nicolas Sennequier Contacts: +33 (0)689322251, nicolas.sennequier@obspm.fr
Institution leading the project (Project leader)	Fondation de Coopération Scientifique Paris Sciences et Lettres
Capital grant requested	1 208 000 000 euros including LABEX demands and based on a 3.4% interests rate

Structure of the IDEX partnership

Etablissements d'enseignement supérieur et de recherche	Organismes de recherche	Autres
Collège de France	CNRS*	FCS PSL
Ecole Normale Supérieure Ulm (ENS)	INSERM*	Institut Curie
Ecole Nationale Supérieure de Chimie de Paris (ENSCP ParisTech)	INRIA*	Institut Louis Bachelier (ILB)
Ecole Supérieure de Physique et de Chimie Industrielles (ESPCI ParisTech)		
Observatoire de Paris		
Université Paris-Dauphine (UPD)		
Ecole Nationale Supérieure des Arts Décoratifs (ENSAD)		
Ecole Nationale Supérieure des Beaux-Arts (ENSBA)		
Conservatoire National Supérieur de Musique et de Danse de Paris (CNSMDP)		
Conservatoire National Supérieur d'Art Dramatique (CNSAD)		

**: CNRS, INSERM and INRIA have officially expressed their support to PSL★*

Key words

- Research University, Cutting-edge, Transformation, Creation, Innovation, Empowerment, Reactivity, Transdisciplinarity, Collegiate, Assessment

- For update on the project, see www.parisscienceetlettres.org

1. AMBITION AND STRATEGY OF THE PROJECT

The PSL★ proposal is presented by twelve of the most prestigious French institutions of higher education and research, including the five charter members of the Pôle de Recherche et d'Enseignement Supérieur (PRES) Paris Sciences et Lettres (PSL), namely the Collège de France, Ecole Normale Supérieure (ENS), Ecole Nationale Supérieure de Chimie de Paris (ENSCP ParisTech), Ecole Supérieure de Physique et de Chimie Industrielle (ESPCI ParisTech) and Observatoire de Paris, along with the Institut Curie, Université Paris-Dauphine (UPD), Institut Louis-Bachelier (ILB), and four schools of creative arts, the Ecole Nationale Supérieure des Arts Décoratifs (ENSAD), the Ecole Nationale Supérieure des Beaux Arts (ENSBA), the Conservatoire National Supérieur d'Art Dramatique (CNSAD) and the Conservatoire National Supérieur de Musique et de Danse de Paris (CNSMDP).

The target of PSL★ is to create a highly visible Research University, which is capable of rapidly becoming one of the top 20 Universities in the World. To achieve this ambitious target, PSL★ will focus on four key goals:

1) To upgrade PSL★ performances in research through ground-breaking projects and a constant enrichment and assessment of topics, methods and processes.
2) To empower and promote French assets in research and education and to turn them into resources for innovation.
3) To change the way scientific and intellectual elites are trained by stressing the utmost importance of orienting students' mindsets towards innovation and creation.
4) To ensure that education and research are in profound synergy with socio-economic needs, and develop links with the business world in all domains, thus turning PSL★ into a motor for economic growth.

PSL★ aims to reach these objectives within the timeframe of the IDEX project and will define precise targets on a yearly and a 4-year horizon. The size of the partnership and above all the clearly defined perimeter of excellence make PSL★ comparable to leading global universities. Its flexible collegiate structure and the efficient decision chain already at work within each partner institution guarantee its reactivity and will enable it to evolve rapidly in the face of new challenges. Its autonomous governance structure is largely open to representatives of the corporate world. A high standard of management with a strategic board, a shared scientific policy and a progressive pooling of resources will ensure the long-term sustainability of the project.

PSL★: A COMPREHENSIVE RESEARCH UNIVERSITY

PSL★ complies with the most stringent international definition of a Research University: high quality research, high ratio of graduate students, leading role for innovation. Together, the institutions of the PRES PSL form a consistent group which demonstrates excellence in all the main academic disciplinary fields. They are perfectly complemented by the Institut Curie (medical and clinical research), Paris-Dauphine University (social sciences, economics, business and management) and ENSAD, ENSBA, CNSMDP and CNSAD (creative and performing art).

PSL★ will be unique in France, thanks to the combination of:

- Cutting-edge research in all academic fields (formal, natural, cognitive and social sciences and humanities), with special emphasis on research at the interfaces between disciplines, and the articulation with creative and performing arts.
- Highly competitive processes in order to ensure the selection of the students with the highest potential for research and innovation from a wide variety of academic backgrounds.
- Outstanding performance in education characterized by one of the highest worldwide percentage

of graduate students (over 80%, including 31% in PhD) and the awards and positions obtained by former alumni.

- A unique research and education environment, offering optimal conditions for innovation and creation.
- A clear and unified territorial strategy with a highly visible Parisian campus located in the historical centre of scientific and cultural life and radiating outwards towards the *Grand Paris* (South and West).
- Strong relations with the main socio-economic and cultural actors in Paris, in France and throughout the world.

All the institutions involved in the project PSL★ share a set of common values and notably a specific and distinctive approach to education through research and an emphasis on graduate studies. This common orientation is both a key asset for PSL★ and a guarantee of dynamism since it implies that these institutions and scholars are engaged in a process of constant renewal, of transformation and challenge at all levels. In this, as in many other aspects, PSL★ will be a pioneer in France, a *laboratory* for innovation in research and formation. The size, selectivity and flexibility of PSL★ will ensure the necessary reactivity to thrive at the forefront of global competition.

A CLEARLY DEFINED PERIMETER OF EXCELLENCE

Within PSL★, the perimeter of excellence includes laboratories and programmes which satisfy a strict set of criteria in order to guarantee their scientific quality. Laboratories rated A+ by the AERES and demonstrating a high publication ratio as well as international distinctions are immediately eligible to the Excellence perimeter. Laboratories rated A with strong research performances are included only if they have both a transformative potential and close relations to a specific research project. Similarly, only training programs with the highest ratings are included within the IDEX perimeter.

Distinguished scholars active on PSL★ campus

- 2 Nobel Prize laureates
- 4 Fields medals laureates
- 4 CNRS gold medals laureates
- More than 30 ERC
- More than 40 fellows of French and foreign academies

Even under such stringent conditions, the excellence of PSL★ in research and education is such that more than 90% of researchers and students of PSL and Institut Curie will be included in the perimeter, along with 29 % of UPD.

Together, the partners reach a critical mass in all academic disciplinary fields. PSL★ is characterised by a diversity of identities, statutes and finalities, united around a community of values and practices. They are convinced that this is an optimal context for mutual improvement and are sure that the IDEX will rapidly tighten ties and connections between partners, thus insuring a strong synergetic and transforming effect.

The partners' potential in research and education is demonstrated by the 16 Labex and 9 Equipex projects presented by PSL★ institutions (9 Labex are directly carried by PSL institutions and 7 others by RTRA or other national initiatives of whom institutions of PSL★ are charter members). These Labex and Equipex projects cover all academic fields and fuel the ambition of PSL★ to become a world class Research University. They will have a beneficial effect on all partners which are associated in one way or another to PSL★ initiatives, due to the long-standing practice of research dissemination in France (alongside its own Labex, research groups of PSL★ are present in more than 60 Labex carried by other institutions).

TOWARDS A COLLEGIATE RESEARCH UNIVERSITY

PSL★ includes several "*grandes écoles*" and "*grands établissements*", a university, schools of creative and performing arts and private foundations for research. The institutions of PSL★ are the result of centuries of French exception and excellence, but they are aware that this is not enough for them be recognised on the international scene. PSL★ project is therefore a unique opportunity to capitalise on their strengths and create a coherent structure, which will enable them to gain international visibility.

The chosen structure, the Collegiate Research University, is ideally suited to the objectives. Each of PSL★ institutions will retain its identity and increase its reputation within the IDEX. Their strong identity will thus be an asset in a common venture. The institutions will remain self-governing and autonomous; each with its own property and income, but their synergies will enable them to establish a series of shared research and educative programmes, to pool essential infrastructures and equipment and to project a strong corporate identity out to the world.

Focus on international rankings

- In international rankings, PSL can capitalise on indisputable assets such as international distinctions, alumni performances, staff-student and undergraduate/graduate ratios and especially an outstanding publication per researcher ratio and unique score in terms of qualitative evaluation.
- This potential for immediate international visibility is specific to PSL since all PSL charter members, have a very high ratio of publications per researcher (Thomson Reuters base). Such homogeneity in quotation rate throughout a PRES is a key condition for a good positioning in international rankings (along with the percentage of graduate students. As a result, and according to our estimation, PSL★ will appear within the first 20 academic institutions on a worldwide level. One has to observe that in these rankings, the total number of students is not relevant. CalTech is thus currently rated number two in the world (THE), despite having only 2 300 students and the average number of students of the first ten institutions is around 15 000.

As a short term objective, measurable within the first four years of the IDEX program, PSL★ members will pool their facilities and equipments, and develop common structures such as new research and education resources (for example the Mesoscopic Biology Institute, the Environment Institute and the planning of a Chemistry Centre, a European thinktank in Economy and Finance). Simultaneously they will promote the use of PSL★, alongside their own individual names. Over a period of 10 years, PSL★ will progressively evolve towards a Collegiate Research University with a number of common projects, whose implementation will be guaranteed by an appropriate institutional structure.

ON THE MOVE

Research

The teams and laboratories of PSL★ already compete with the best institutions in the world. PSL★ is reference institution in major academic disciplinary fields including mathematics, astronomy, archaeology, cognitive sciences or finance. It is also a strongly dynamic group of institutions as demonstrated by the fact that PSL is the PRES with the highest percentage of Labex and Equipex projects per number of researchers in France.

However, research ambition in the framework of the IDEX goes well beyond the Labex projects and aims to reinforce a dynamic research environment. The objective is to increase team dynamics, accelerate dissemination and favour renewal of the research axis by ensuring synergies, reactivity and creating the necessary interfaces and incentive mechanisms for innovative actions (*i.e.* internal call for tenders, scientific committees, and regular international assessments). In this sense, PSL★ is a trigger for creativity and excellence.

Within specific disciplinary fields, PSL★ will reinforce and empower disciplinary research (such as Computer Science and Mathematics, Biology and Physics projects) and increase dynamism in fields such as Humanities and Earth Sciences. The launch of three major interdisciplinary programmes – 1) Environment, Energy and Universe, 2) Life Sciences/Hard Sciences Interfaces & Health; 3) Rationalities and Human Behaviour – will allow knowledge and skills to be pooled around transversal

topics. It will transform the existing disciplinary fields by enabling methodological transfers between them. These three programmes are expected to establish themselves as key international hubs in the emerging picture of global higher education. Each programme will be supported by a number of research projects, including not only Labex and Equipex but also ANR, ERC and other initiatives already active on campus.

PSL★ will thus create a comprehensive network of excellence, which will structure research practices throughout the different institutions.

Key research projects

- 16 Labex and 7 Equipex affiliated to PSL★ institutions
- 1 IRT Finance and Croissance Durable
- 2 new disciplinary Institutes: Institut des Hautes Etudes en Informatique Mathématiques, and Paris Institute for Chemical Engineering
- 3 transversal programmes: Environment, Life Sciences/Hard Sciences, and Rationalities and Human Behaviour

Education

The PSL★ educational model is based on the systematic practice of training through research and an emphasis on developing a critical approach to knowledge. It is highly selective but encourages equal opportunities and is open to students from other institutions. As soon as they enter the institutions of PSL, students receive their training in laboratories, libraries and research facilities and are strongly encouraged to become not only experts, but innovators. The unique ratio of researchers per students allows individual tutoring and a flexibility of curricula within disciplinary fields as well as at their interfaces. This pedagogical approach is shared by all PSL★ institutions: from mathematics to management and from the first year of undergraduate studies to the doctorate. It enables PSL★ to train researchers, scholars, managers, engineers, designers and artists, who share a commitment to innovation and are capable of creating new knowledge at the highest level.

The key ambition of PSL★ in education is to take full advantage of these unique characteristics to develop a coordinated educational strategy not only for research and innovation, but also for management and public administration. It will ensure a training of elites based on education through research; it will reward innovation, and allow the acquisition of excellent general skills. PSL★ will thus implement a new type of training for French elites, better adapted to the demands of contemporary societies, which require not only highly skilled experts, but also flexible and innovative minds, a key condition for the future economic growth of the country.

This general ambition will be extended to all disciplinary fields and all levels of training thanks to four key projects:

- The PSL★ Graduate Programme will offer common services for graduate students, including a writing centre, career services, and special courses in foreign languages, academic writing, management and finance, and facilitating campus life (lodging, health, leisure) and work spaces.
- A thorough and demanding Undergraduate cycle, with a focus on general intellectual skills and creativity, based on a principle of major/minor. It will offer the adequate basis for a training geared to innovation at the graduate level.
- Developing Executive Education through research not only for the academic world but also for managers and executives with an emphasis on promoting the interaction between the business world, academic research, high level executives and students.
- An original project of research programme for creative artists will develop interactions between creation and science.

A coherent territorial strategy

The location of the founding institutions of PSL at the heart of Paris is a key asset for the project which will strengthen both its inner coherence and its international visibility. The territorial strategy of PSL★ aims to reinforce a common identity by developing a clearly defined urban campus, closely related to other sites in Southern (Boulevard Jourdan, Montrouge and Meudon) and Western Paris (Porte Dauphine and La Défense). This strategy will enable PSL IDEX to promote a close relationship with both the traditional cultural and intellectual heart of Paris and the modern financial and entrepreneurial centres.

At the heart of the Quartier Latin, PSL★ partners have the ambitious project to create an academic and research campus deeply anchored within the urban fabric. The urban strategy will clearly identify the campus territory, with visible paths of circulation, meeting places and characteristic elements of urban design. It will focus in particular on improving student life and highlight the importance of the research community. Furthermore it will show the influence of academic entities on the surrounding economic and cultural neighbourhood and create a feeling of shared identity. All institutions of PSL★ will have a branch at the heart of the Campus.

The Campus will develop strong ties with 1) the Southern Paris branches (boulevard Jourdan devoted to social sciences, computer science and their interface; Meudon which hosts an important centre for astrophysics and unique observatory facilities; Montrouge, a residential students campus); 2) the Western Paris locations: PSL★ key partner, UPD Economics and business school, with a link with Paris La Défense, financial and entrepreneurial centre.

Beyond the current surface occupied by PSL★ institutions on its core campus, PSL★ will initiate a broad reflection on the organization of research locations. It will campaign for larger research surfaces for the ENSCP and the Institut Curie (with the prospect of moving into the AgroParisTech building) and implement strategic projects in order to create common ventures (as the Institut of Environment in the restructuration of the Jourdan Campus). PSL★ will be the ideal structure to develop a reflection on a real estate strategy adapted to research and education projects.

An intense link with business world and society

PSL★ institutions already have many connections with both the business world and civil society (research grants, start-ups, joint programmes, cultural events, education). Indeed, for PSL★ institutions, the interaction with society taken as a whole, including its economic, social and cultural aspects, is of strategic importance. Not only because it is today necessary for higher education and research institutions to pay attention to society and its needs, but also because the intellectual, scientific and educational values created by academic entities must contribute to the well-being of society and to economic growth.

Currently, PSL is at the origin of a start-up company quarterly and UPD has set-up several laboratories in cooperation with major private companies. In the framework of the IDEX programme, PSL★ partners will develop a large-scale coordinated strategy and will have an aggressive attitude in the domains of industrial property production and management, and value creation through ventures.

PSL★ will aim to match its scientific potential with innovation within 10 years, in order to reach world-class level. It will integrate its technology transfer value chain, from upstream public-and-private collaborative projects to start-up creation (IP licensing, by building on the Fondation Pierre-Gilles de Gennes model). It will replicate successful ventures to new fields and expand FPGG's experience to existing fields by marketing industry-academia contract research towards the business world. The objectives are to stabilise the number of patents in a range of 80 to 100 per year; to reach the objective of 8 start-ups and social ventures created within PSL★ per year; and to increase the value of research private contracts to 3% for the consolidated research perimeter.

PSL★ partners will also strengthen their relations with society and contribute to a better understanding and perception of social needs. This will notably enable an appropriate training of managers and

decision-makers and foster the necessary ethical assessment of scientific progress.

The connection between PSL★ partners and their economical, societal and cultural environment will be a decisive component of the programme. Thus, in the framework of PSL★, the ambition goes far beyond what institutions already do in terms of innovation and creation of economic value, formation, diffusion and dissemination of knowledge, social opening and fund-raising.

International strategy

All institutions of PSL★ already have a strong international presence thanks to 1) numerous relations between research teams on specific topics; 2) exchange programmes for students; and 3) numerous invited fellowships and professorships. This international network finds its expression in agreements and memorandum of understanding with the most prestigious universities such as Harvard, Oxford, Cambridge, and many more.

Aware of the fact that overall quality is the best asset of an international strategy and that grass-root initiatives constantly fuel international relations, PSL★ considers international relations as an area where the IDEX can have a major impact and will develop a coherent and truly ambitious international strategy. To achieve this objective, PSL★ can capitalise on dynamic international activities, a clear capacity of attraction and numerous research and educative agreements with institutions worldwide.

PSL★will thus start by creating an Office for International Relations which will coordinate the existing projects and develop major common initiatives. It will enhance ongoing partnerships, extend the educative offer in English, launch specific actions and provide international fellowships to outstanding students and post-doctoral researchers. It will set up a top-level international support services platform and open permanent joint-offices in collaboration with partner universities abroad. To ensure deeper PSL★ integration to the “European Research Area”, it will foster systematic application of European recommendations on higher education and research.

Secondly, PSL★ will establish a Centre for Advanced Research, dedicated to the organisation of intensive workshops, working on a yearly basis with scholars and fellows in residence for a semester on a specific topic.

CONCLUSION: PSL★: FROM ACADEMIC INSTITUTIONS TO A WORLD-CLASS RESEARCH UNIVERSITY

Unlike most institutions of higher education, all the members of PSL★ were created to meet the specific research and educational challenges of their times from 1530 (Collège de France) to 1968 (UPD). They aim to pursue this tradition and move from a national to a global scale. Indeed, PSL★ partners benefit from unique conditions (optimal size, selectivity of students, long heritage of excellence), which allow them to implement a research and educational strategy that has secured widely recognised results. PSL★ institutions have always been incubators both in terms of research and Education but this project offers them the possibility to optimize their potential.

PSL★ thus proposes a change of scale; with projects covering all disciplinary fields, all research approaches and all levels of education. This change of scale will also foster the knowledge transfers, the creation of companies and industrial partnerships. PSL★ thus embodies a transforming process, with ambitions adapted to the requirements of the 21st century, for minds able to innovate and participate actively in a world in which economic growth will depend first and foremost on the quality of research. In order to implement this ambition, PSL★ can rely on its existing excellence and on its commitment to openness and transformation. The “Investissement d’Avenir” is a tremendous opportunity for PSL★ partners to empower centuries of French talent and become a recognized world class Research University in constant improvement.

2. STRUCTURE AND CHARACTERIZATION OF THE INITIATIVE OF EXCELLENCE

PSL★ is larger than the PSL PRES. It is a common venture involving the five institutions of the FCS PSL along with the Institut Curie, the UPD, the ILB and four schools of creative arts (ENSAD, ENSBA, CNSMDP and CNSAD). It is a project based on shared values (formation through research and commitment to graduate studies), clearly identified complementarities, pooled resources and a commitment to a common future.

The PSL Foundation, given its legal existence approved by the government, will be the bearer of the PSL★ programt, and will delegate its governance to a specifically dedicated executive committee which will act independently from the Foundation PSL and will ensure and secure the reviewing of projects and the traceability of funds.

The statutes of the PSL foundation give PSL★ a clearly defined juridical status. The inclusion of additional partners has been carefully thought out and unanimously approved by all members of PSL★. It ensures that the program fulfils all the requirements of a world-class Research University. PSL★ will thus rapidly acquire international visibility and guarantee an optimal return on investment.

2.1 PRESENTATION OF THE PROJECT LEADER (INCLUDING THE LEGAL STATUS)

PARIS SCIENCES & LETTRES, CORE OF THE PARTNERSHIP

Created on July 8th 2010, Paris Sciences et Lettres (PSL) is a Foundation of Scientific Cooperation, which includes five institutions that have been contributing to the advancement of knowledge for centuries: the Ecole Normale Supérieure (ENS), the Collège de France, the Observatoire de Paris, the École supérieure de Physique et de Chimie industrielles (ESPCI ParisTech) and the École Nationale Supérieure de Chimie de Paris (Chimie ParisTech). The chairman of PSL board is Claude Cohen-Tannoudji, Nobel Prize winner in Physics in 1997.

Since 2008, these five partners have started collaborating on their educative offer, elaborating shared research projects and pooling their documentary and knowledge dissemination services and tools, so as to promote their scientific and cultural heritage. They form a coherent territorial entity, propose a continuum of high level training and research in all academic disciplines, from classical humanities to the most innovative sciences and regroup outstanding students and scholars. They are value-driven towards “training for research” and “innovative research”.

2.2 APPLICATION TO THE ACTIONS OF THE PROGRAMME « INVESTISSEMENTS D’AVENIR »

The perimeter of excellence is structured by the sixteen Labex and seven Equipex projects affiliated in an exclusive fashion to PSL★: 11 Labex are directly carried by PSL institutions and 5 others by RTRA or other national initiatives of which institutions of PSL★ are charter members.

9 EQUIPEX are included in the perimeter of excellence, directly carried by PSL★ Institutions

	Call for tender	*Acronym*	*name of the coordinator*	*consortium*
1	Equipex	PHOBIOL	Antoine Triller, ENS	ENS, Collège de France, CNRS, INSERM
2	Equipex	PARIS-EN-RESONANCE : RMN 800 MHz WB	Geoffroy Bodenhausen, ENS	ENS, Institut Curie CNRS, Institut Pasteur, IBPC Université Paris V, UPMC
3	Equipex	PLANAQUA	J-F Le Galliard, ENS	ENS, CNRS, UPMC, Université Paris XI, MNHN

	Call for tender	*Acronym*	*name of the coordinator*	*consortium*
4	Equipex	IPGGM	Patrick Tabeling, ESPCI	ENS, ENSCP, FPGG/ ESPCI, Institut Curie, CNRS
5	Equipex	ULTRABRAIN	Arnaud Tourin, ESPCI	ESPCI, CNRS
6	Equipex	GEOPAST	Katherine Gruel, ENS	ENS, Institut de France, CNRS
7	Equipex	D-FIH	Pierre-Cyrille Hautcœur, IC	ILB, EEP, GIS Quetelet, Pôle de compétitivité Finance innovation
8	Equipex	IMAGEX	Jacques Camonis, IC	Institut Curie
9	Equipex	ICGex	Olivier Delattre, IC	Institut Curie

11 LABEX are included in the perimeter of excellence, directly carried by PSL★ Institutions

	Call for tender	*Acronym*	*name of the coordinator*	*consortium*
1	Labex	WIFI	Mathias Fink, ESPCI	PSL (ESPCI), CNRS, Inserm Universités Paris VI, VII
2	Labex	METACEN	Philippe Marcus, ENSCP	ENSCP, CNRS, CEA, Université Paris Est Créteil
3	Labex	ENS-ICFP	Werner Krauth, ENS	ENS, Collège de France, Observatoire de Paris, CNRS
4	Labex	MemoLife	Antoine Triller, ENS	ENS, Collège de France, ESPCI, CNRS, INSERM
5	Labex	ChemVivo	Ludovic Jullien, ENS	ENS, ENSCP, Collège de France, ESPCI, Institut Curie, IBPC, CNRS, UPMC
6	Labex	IPGGM	Patrick Tabeling, ESPCI	ENS, ENSCP, ESPCI, Institut Curie, CNRS, UPMC
7	Labex	TransferS	Michel Espagne, ENS	ENS, Collège de France, Université Paris IV, Université Paris X
8	Labex	AASG	Daniel Egret, Observatoire de Paris	Observatoire de Paris, CNRS
9	Labex	Risques	Université Paris- Dauphine	Université Paris- Dauphine, Fondation partenariale Paris-Dauphine
10	Labex	IEC	Christian Lorenzi, ENS	ENS, CNRS, INSERM, EHESS, Université Paris V
11	Labex	TRANSIC	Daniel Louvard	Institut Curie

5 PSL★ LABEX Projects (national bearers or RTRA)

	Call for tender	*Acronym*	*name of the coordinator*	*consortium*
1	Labex	ESEP	CNRS (Pierre Drossart)	Observatoire de Paris, CNRS, UPMC, Université Paris VII, Université Versailles Saint Quentin Polytechnique, Université Paris XI, Université d'Orléans
2	Labex	FIRST-TF	SYRTE (Noël Dimarcq), et LNE-SYRTE (Philip Tuckey)	Observatoire de Paris, LNE, CNRS, UPMC
3	Labex	SMP	FSMP	ENS, Fondation de Sciences Mathématiques de Paris Centre (FSMPC), UPMC, Paris 7, CNRS

4	Labex	L-IPSL	INSU-CNRS	INSU-CNRS, IPSL
5	Labex	OSE	Ecole d'économie de Paris (EEP)	Membres fondateurs de l'EEP dont l'ENS

1 IRT Project carried directly by PSL★ Institutions

	Call for tender	*Acronym*	*name of the coordinator*	*consortium*
	IRT	Finance et croissance durable	Université Paris Dauphine	Université Paris-Dauphine, ILB

1 Bioinformatic Project carried directly by PSL★ Institutions

	Call for tender	*Acronym*	*name of the coordinator*	*consortium*
	Bioinformatique	DYALOG	Denis Thieffry	ENS / IBENS, CNRS, INSERM

2.3 EXCELLENCE PERIMETER, ENVIRONMENT, PROSPECTS AND ADDED VALUE

In the framework of the IDEX call for tenders, PSL★ has defined its excellence perimeter using selective criteria:

- Laboratories and programmes rated A+ by the AERES
- Laboratories and programmes rated A by the AERES but contributing to the transversal topics identified by the IDEX programme and having the potential to reach the A+ grade.

This results in a comprehensive and homogeneous perimeter, covering a very large part of the total scope of the institutions.

Contribution of each partner to the perimeter of excellence:

Collège de France	**Research** – UMR CNRS 7421 – Inserm U1050 Centre Interdisciplinaire de Recherche en Biologie – UMR CNRS 7152 Laboratoire de Physiologie de la Perception et de l'Action – UMR CNRS 7574 Chimie de la Matière Condensée de Paris – UMR CNRS 7130 Laboratoire d'Anthropologie Sociale – UMR CNRS 7192 Proche-Orient, Caucase, Iran : Continuités et Diversités – UMS CNRS 2409 Centre de documentation des Instituts d'Orient **Education** – 52 chairs in Mathematics, Physics, Life Sciences and Human/Social sciences
Ecole Normale Supérieure – Rue d'Ulm	**Research** – UMR 8553 Département de mathématiques et applications – UMR 8548 Laboratoire d'Informatique de l'ENS – UMR 8549 Laboratoire de physique théorique de l'ENS – UMR 8551 Laboratoire Pierre Aigrain – UMR 8552 Laboratoire Kastler Brossel – FR 684 Département de Physique de l'ENS – UMR 8550 Laboratoire de physique statistique – UMR 8112 Laboratoire d'Études du Rayonnement et de la Matière en Astrophysique – Participation à FR 2702 Sciences chimiques de la mesure et de l'analyse de Paris centre – UMR 8197 Institut de biologie de l'ENS – UMR 7203 Laboratoire des Biomolécules* – UMR 8640 Laboratoire Pasteur – UMR-S 960 Laboratoire de Neurosciences Cognitives – UMR 8554 Laboratoire de Sciences Cognitives et psycholinguistique – UMS 3332 Relais d'information sur les sciences de la cognition – UMR 8538 Laboratoire de géologie – UMS 3194 Centre de Recherche en Ecologie expérimentale et prédictive – UMR 7625 Ecologie et Evolution*

	– UMR 7618 Biogéochimie et Ecologie des milieux continentaux* – Participation à FR 636 l'Institut Pierre-Simon Laplace – UMR 8539 Laboratoire de météorologie dynamique – UMR 8129 Institut Jean Nicod – USR 3308 Centre international de recherche philosophie, lettres, savoirs – UMR 8094 Langues, textes, traitements informatiques, Cognition – UMR 8546 Archéologies d'Orient et d'Occident – UMR 8066 Institut d'Histoire moderne et contemporaine – UMR 8547 Pays germaniques : histoire, culture et philosophie – UMR 8132 Institut des textes et manuscrits modernes – UMR 8097 Centre Maurice Halbwachs – UMR 8545 Paris-Jourdan Sciences Economiques – UPS 3285 Respublica Literria ** pour les équipes hébergées à l'ENS* **Education** *Sciences* – Formation interuniversitaire de Mathématiques Fondamentales et Appliquées – Formation interuniversitaire de Physique – Formation interuniversitaire de Chimie – Formation interuniversitaire de biologie – Informatique – Géosciences – Concepts Fondamentaux de la Physique – Master Parisien de Recherche en Informatique – Master de chimie – Neurosciences – Biologie Moléculaire et Cellulaire – Ecologie, Biodiversité, Evolution – Sciences de la Terre, de l'Environnement et des Planètes – Océan, Atmosphère, Climat et Observations spatiales – Cogmaster (Sciences cognitives) *Lettres* – Master Analyse et poli*tique éco*nomiques – Master Histoire et philosophie des sciences – Master Lettres – Master Sciences humaines et sociales sciences du langage – Master Sciences de la société – Master Histoire – Master Sociologie Master Lettres et civilisations – Master Antiquité classique textes, méthodes – Master Arts du spectacle et audiovisuel – Master Etudes cinématographiques et audiovisuelles – Master Droit public et droit privé – Master droit administration publique
ENSCP	**Research** – UMR 7045 Laboratoire de physicochimie des surfaces – UMR 7574 Équipe ENSCP du Laboratoire de chimie de la matière condensée de Paris – UMR 7575 Laboratoire d'électrochimie, chimie des interfaces et modélisation pour l'énergie – UMR 7195 Equipe sciences analytiques, bioanalytiques diagnostic et miniaturisation, – UMR 7223 Laboratoire Charles Friedel – UMR CNRS 8151 - U INSERM 1022 Equipe ENSCP de l'Unité de pharmacologie chimique et génétique et d'imagerie **Education** – Engineer degree ENSCP – ENSCP shared masters:
ESPCI	**Research** – UMR 7083 Gulliver – UMR 7587 Institut Langevin "Ondes et Images" – UMR 7167 laboratoire Matière Molle et Chimie (MMC) – UMR 7084 Laboratoire de Chimie Organique – UMR 7637 Laboratoire de Neurobiologie

	– UMR 7636 Laboratoire de Physique et Mécanique des Milieux Hétérogènes, – UMR 8213 Laboratoire de Physique et d'Étude des Matériaux – USR 3149 Laboratoire de Spectrométrie de Masse Biologique et Protéomique – UMR 7612 (membre) Laboratoire Sciences Analytiques, Bioanalytiques et Miniaturisation – UMR 7612 (membre) Laboratoire de Colloides et Matériaux Divisés **Education** – Engineer degree ESPCI – ESPCI Advanced Master in Science and Technology – ESPCI shared masters: Sensors measures and instrumentation; Material Science and nano-objects, Material chemistry and physical chemistry, Chemical engineering, Nuclear Chemistry, Molecular Chemistry, Analytical Chemistry, Bio-engineering, Environmental Engineering: water, soils and waste
Observatoire de Paris	**Research** – UMR 8111 Galaxies, Etoiles, Physique et Instrumentation – UMR 8028 Institut de Mécanique Céleste et de Calcul des Ephémérides – UMR 8112 Laboratoire d'Études du Rayonnement et de la Matière en Astrophysique – UMR 8109 Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique – UMR 8102 Laboratoire Univers et Théories – UMR 8630 Systèmes de référence Temps-Espace – l'USR 704 Nançay, station de radioastronomie **Education** – Master "Astronomie Astrophysique et Ingénierie Spatiale"
Université Paris Dauphine (UPD)	**Research** – Laboratoire CEREMADE – Laboratoire LAMSADE – Laboratoire de gestion DRM – Laboratoire en science politique et en sociologie IRISSO – Autres contributions en économie LEDa – IRT Finance et Croissance Durable **Education** – Licence SHS – Licence Gestion – Licence Mathématiques de la décision – Magistère de Gestion – Master Informatique des organisations et Systèmes d'information – Master Maths de la Modélisation et de la Décision-Math Appliquées – Master Droit : – Master de Journalisme – Master Economie de la Santé et Politiques Sociales – Master Economie de l'entreprise et des marchés – Master Economie et ingénierie financière – Master de Dauphine Economie internationale et développement – Master Sciences de la Société – Master de Dauphine Contrôle de Gestion et Performance – Master Finance – Master Gestion du patrimoine – Master de Dauphine Mangement et Organisation – Master de Dauphine Marketing et stratégie – Executive MBA Dauphine
Institut Curie	**Research** – U 830 Institut Curie/INSERM – UMR 3344 Institut Curie/CNRS/UPMC – UMR 218 Institut Curie/CNRS – UMR 3348 Institut Curie//CNRS – U612 Institut Curie/INSERM – UMR 3306 /U 1005 Institut Curie/CNRS/INSERM – UMR 3347 U 1021 Institut Curie/CNRS/INSERM – UMR 144 Institut Curie/CNRS – UMR 3215/U934 Institut Curie/CNRS/INSERM – U 932 Institut Curie/INSERM – U 759 Institut Curie/INSERM

	– UMR 168 Institut Curie/CNRS/UPMC – UMR 176 Institut Curie/CNRS – U 900 Institut Curie/INSERM – Tumor biology department – Early clinical trials group
Ecoles doctorales de PSL★	**Support :** – 107 Physique de la Région Parisienne – 540 Ecole transdisciplinaire « Lettres/Sciences » – 127 Astronomie et Astrophysique d'Ile De France – 543 Ecole doctorale de Dauphine **Co-accréditées :** – 129 Sciences de l'Environnement d'Ile De France – 386 Sciences Mathématiques de Paris centre – 388 Chimie Physique et chimie analytique de Paris centre – 515 Génomique, cellule, développement, microbiologie – 472 Ecole doctorale de l'école pratique des hautes études – 142 Mathématique de la région Paris sud – 465 Ecole doctorale d'économie – 109 Sciences de la terre – 158 Cerveau – Cognition – Comportement – 267 Arts et Media – 286 Ecole des Sciences Sociales **Associées** – 406 Chimie moléculaire de Paris centre – 387 Interdisciplinaire pour le vivant – 389 La physique de la particule à la matière condensée – 397 Physique et chimie des matériaux – 391 Sciences mécaniques, acoustique et électronique et robotique de paris – 390 Génie des procédés et technologies avancées
Ecole Nationale Supérieure des Arts Décoratifs (ENSAD)	**Research** - EnsadLab (research program post-Master) **Education** - Diplôme de l'ENSAD (equivalent of Master)
Ecole Nationale Supérieure des Beaux-Arts (ENSBA)	**Research** - New research program (previously called La Seine) **Education** - Diplôme national supérieur d'arts plastiques (equivalent of Master)
Conservatoire National Supérieur de Musique et de Danse de Paris (CNSMDP)	**Research** - Centre de recherche et d'édition du Conservatoire (CREC) **Education** - Diplôme de 2e et 3e cycle supérieur (equivalent of Master and post-master)
Conservatoire National Supérieur d'Art Dramatique (CNSAD)	**Education** - Diplôme national supérieur professionnel du comédien

3. PROJECT AND PROSPECTS

PSL★ has defined a clear ambition to become one of the leading Research Universities. To fulfil this ambition, it can capitalise on many complementary assets, including its tradition of attracting excellent students through demanding selection procedures, its research performance and strategy towards innovation, as well as its location in the heart of Paris. With around 8000 of the best students in France and over 60 world class laboratories, PSL★ will be similar in size and research potential to leading world universities such as Princeton, MIT or Stanford. This combination of agility, powerful research and outstanding teaching, make it the only French institution truly capable of meeting the

forthcoming challenges of the global market for education and research, to which it is far better adapted than other, larger and less flexible institutions. PSL★ is thus ideally placed to guarantee a rapid return on investment and ensure a successful adaptation, implementation, and transformation of global processes to the French educational and academic space.

The partners of PSL★ are committed to this ambition and have endorsed a set of common values, such as education through research and a commitment to maintaining and developing the existing focus on graduate studies. Similarly, in order for this ambition to become a reality, the partners of PSL★ have established a clear and well structured strategy based on an awareness of the importance of constantly improving their achievements through incentives and a commitment to ongoing assessment and evaluations.

To achieve its goals, PSL★ will promote transdisciplinary research projects and common educational proposals as well as thematic projects of excellence in research, formation and valorisation. The quality of these proposals will guarantee immediate international visibility, both for PSL★ and for French research and education in general.

PSL★ and the national research strategy (SNRI)

Emphasis on the three key priorities of the national strategy (life sciences, environment, information technology):

- Emphasis on fundamental research (e.g. physics, mathematics) and in fields where France has a strong leadership (e.g. space sciences)
- Large place given to human and social sciences
- Emphasis on interdisciplinarity
- Strong visibility in the European research area, with more than 30 ERC grants
- Aggressive attitude towards valorization

3.1 RESEARCH

PSL★ is today one of the leading research centres in Europe. It encompasses the entire scope of academic disciplines (hard sciences, medical research, engineering, humanities, social sciences, management sciences, finance and creative arts) and in each of them includes several leading and pioneering research groups. Likewise, PSL★ can build on a strong and long-standing tradition of innovative interfacing between different disciplinary fields.

PSL★ can capitalize on the research potential of almost 4000 researchers and 3000 rigorously selected doctoral students, as well as 850 post doctoral fellows (most of whom are foreign). This significant research capacity enables PSL★ to play a leading role in fundamental research as testified by more than 3500 publication listed for 2009 alone in ISI web of science and the more than 30 ERC (both starting and advanced grants) currently active within the perimeter of excellence. PSL★ benefits from a strong support from the main French research institutes, CNRS, INSERM, and INRIA, which all consider PSL★ as a strategic partner.

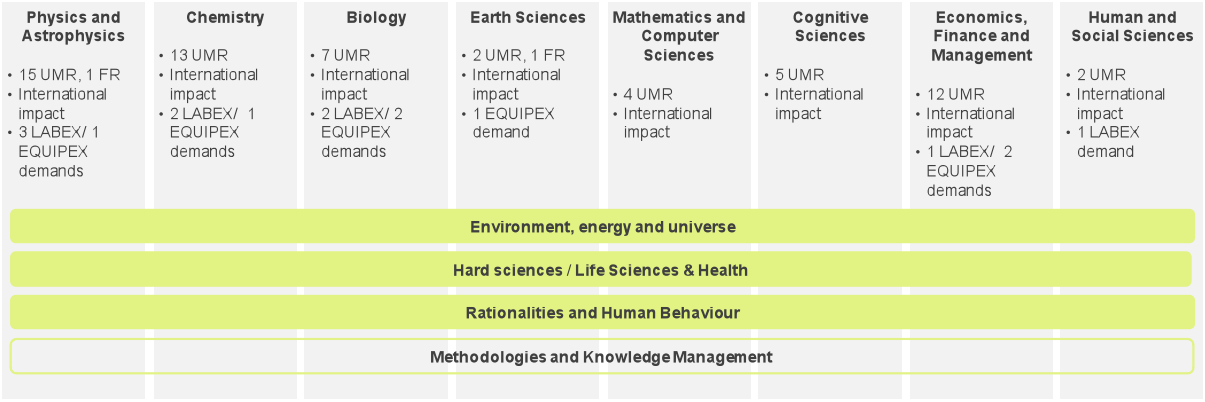
PSL★ benefits from a unique research ecosystem comparable to the best Anglo-Saxon Research Universities. It is characterized by a high density of researchers, a practice of tight relations and continuous exchanges between disciplines, and an active and challenging scientific working culture where research is constantly assessed and compared, favouring continuous improvement and innovation. Practices such as the tradition of 10-year turnovers in the Mathematics Department of the ENS ensure dynamism and renewal within the structures of PSL★ and facilitate the global circulation of researchers and dissemination and penetration of ideas. This ensures a strong feedback effect of PSL★ research. Additionally, this research ecosystem can capitalize on common platforms and an existing established and recognized scientific culture, with traditions such as the existence of international scientific committees and review boards in each discipline. This constellation of factors ensures that PSL★ is the adequate perimeter for fertilization.

The coordinated research strategy adopted by PSL★ aims at further strengthening its research profile and improving the existing research ecosystem by relying on the following three basic pillars:

- **Disciplinary Research Centres** – The existing research excellence of PSL★ will be channelled by maintaining and further developing leading Research Centres in all major disciplinary fields, notably by capitalising on the existing infrastructure of Equipex and Labex projects (as exemplified by its 16 Labex projects or beacons such as the Pierre-Gilles de Gennes Foundation) and complementing them with specific actions, coupled with a dynamic system of incentives to ensure adaptability.
- **Transdisciplinary Axes of Research** – The tradition of research interdisciplinarity within PSL★ will be developed in the form of transdisciplinary research axes around three structuring transversal research programmes, namely (1) Environment, Energy and Universe, (2) Life Sciences/Hard Sciences Interface and Health, and finally (3) Rationalities and Human Behaviour.
- **Implementation, best practices and technology transfer** – To support research both within and across disciplinary lines, PSL★ will adopt a strong set of instruments to facilitate research workflows. These include an emphasis of technology transfers from research to entrepreneurial innovation, a powerful strategy of institutionalised knowledge management, an emphasis on the valorisation and further development of international ties and exchanges, and a commitment to ongoing monitoring and evaluation.

PSL★ RESEARCH: A RESEARCH UNIVERSITY FROM FUNDAMENTAL THEORY TO ADVANCED ENGINEERING

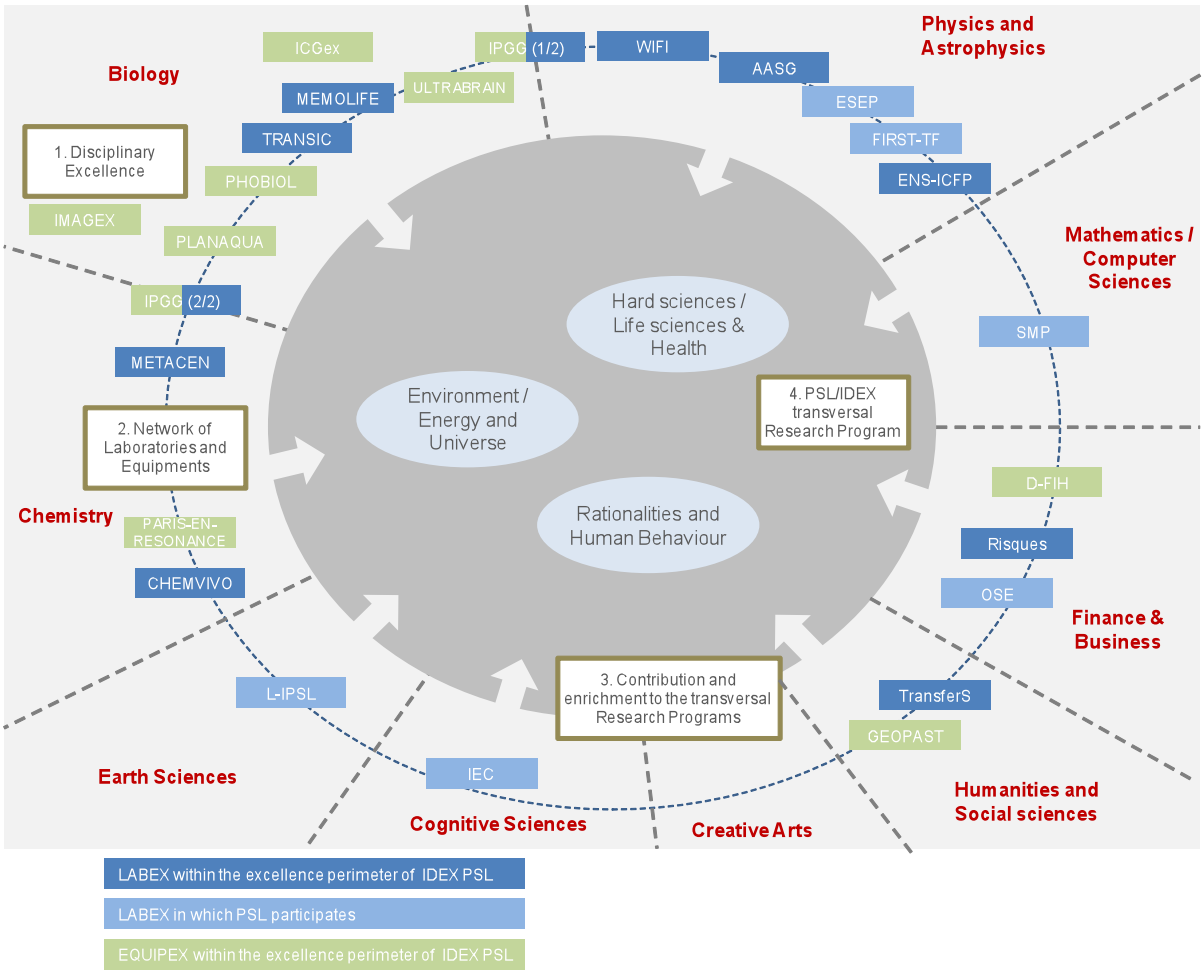
Based on the research capacities mentioned above, PSL★ partners have already established a number of innovative common actions such as 16 Labex projects (out of which 10 are carried by PSL★ institutions) or the Pierre-Gilles de Gennes Foundation:



The Excellence Initiative will trigger a common ambition at the disciplinary level and empower new value-adding projects which will have a strong transforming impact. In the course of these projects,

A key aspect of the IDEX support to the projects will consists in international research chairs. These chairs will for 5 years and renewable. They will include the scientist's salary and seed funds; a "package" for optimal attractiveness will be proposed, if needed. There will be three main types of chairs: the distinguished chair, the senior chair and the junior chair.

The pioneering research conducted in disciplines will thus necessarily contribute to the enrichment and development of the defined transversal programmes of the Initiative:



A WORLD CLASS CENTRE IN MATHEMATICS AND COMPUTER SCIENCES

Excellence in mathematics and computer science is of strategic importance. PSL★ scientists in these two domains come from world-class laboratories and institutions, widely known on the international scene. They include chairs at the Collège de France (chairs), the Department of Mathematics & Applications (DMA) and the Department of Computer Science (DI) at the ENS, the "Astronomie et Systèmes Dynamiques" group (ASD) at the Observatoire de Paris, and the CEREMADE (Centre de REcherche en Mathématiques de la DEcision) and LAMSADE (Laboratoire d'Analyse et Modélisation de Systèmes pour l'Aide à la DEcision) at Paris-Dauphine University.

PSL★ mathematicians and computer scientists distinctions

- 4 Fields medals
- 4 members of the French Academy of Sciences
- 1 member of the French academy of engineering
- 1 Fellow of the Royal Society
- 1 gold medal and 3 silver medals from CNRS
- 6 grand prizes from the Academy of Sciences

ENS has educated the best French mathematicians for decades, including all the French Fields medalists

Existing research profile

Current research at DMA is organized around three broad themes in mathematics: "Algebra and Geometry", "Partial Differential Equations", and "Probability and Statistics". The constant renewal of research themes at DMA is facilitated by the "ten-year rule" (no one can stay for more than 10 years at DMA), research areas are thus constantly

updated to keep up with the latest trends. At the Collège de France, the four chairs in mathematics are held by the most famous French mathematicians and concern fields similar to those of DMA. Research at CEREMADE is oriented towards applications and interactions with other sciences: evolution equations (in cooperation with DMA), quantum systems, economics and finance, risk, medical and biological imaging (in cooperation with the Biology Department at ENS).

Research at DI can be characterized as mathematical computer science ("Informatique Mathématique", or IM), with the dual goals of providing a mathematical understanding of fundamental computer science issues and using the insights gained by this analysis in better algorithms and systems. It is conducted by the nine teams of the LIENS ("Laboratoire d'Informatique de l'ENS", a joint ENS/CNRS/INRIA laboratory), and concentrates on four broad areas of IM: theory of computation, theory of programming, IM models of biological systems, and IM models of machine perception and inference.

The DMA and DI of ENS, as well as the CEREMADE and the Collège de France, are part of the Labex project proposed by the Foundation of Mathematical Sciences of Paris.

Structuring mathematics and informatics research within PSL★: the "Institut des Hautes Etudes en Informatique Mathématique" (IHEIM):

Hosted by the new ENS/INRIA building to be built in the Jourdan campus of ENS, the IHEIM will include the DI/LIENS teams as well as internationally renowned researchers within PSL★. A showcase for excellence in IM, it will also host the recipients of the research chairs in mathematical informatics. It will thus become an integral hub of the mathematics and computer science research centre within PSL★.

Mathematics and computer science projects within the framework of PSL★

Increased interdisciplinary collaborations between outstanding teams

Mathematics and computer science research within PSL★ is a classic case where research has been assuming a more and more interdisciplinary character over the last years. The decision to aggregate both disciplines within a single Centre will considerably extend the interactions of mathematics and computer science with one another and with applied mathematics, as well as with the humanities and the hard sciences.

Within PSL★, we therefore intend to focus on new, ambitious projects in fundamental areas of mathematics and computer science which will add to the core methodological strengths of PSL★ (e.g., in fields such as algorithmics), while reinforcing the interdisciplinary aspects of work in fields such as natural language processing (in partnership with the Humanities) and image processing, machine learning and computer vision where a partnership between pure mathematics at DMA, applied mathematics at the CEREMADE, and mathematical computer science at the DI already exists as part of VideoWorld, a ERC project. Some projects have the potential to result in major industrial applications such as those related to the interface of computer science, mathematics, and the study of the physical world (such as theoretical research aimed at a mathematical understanding of the architecture of the human brain, with direct applications in medical imaging on the one side and special effects in the entertainment industry on the other).

PSL★ will strengthen this interface between computer science and other disciplines and provide it with a solid institutional basis by creating a Research Centre in cooperation with the Institute for Cognitive Sciences. This Centre will provide expertise for the further development of the knowledge management infrastructure for PSL★ as a whole (see insert at the end of the chapter on Research). It will provide key inputs on the theoretical aspects of information modelling for knowledge management, a topic which extends to all disciplinary fields and as already resulted in close collaboration with the Social Sciences and Humanities during the preparation of the EQUIPEX GEOPAST.

A refined education strategy, broader cooperation and extended openings for prospective students

Mathematics and computer science are already an example of collaborative teaching within PSL★. DMA and DI are involved in collaborative teaching with other institutions, notably through the MS programme EDP-MAD with Dauphine in mathematics, the Paris MS programme in computer science (MPRI), and the MS programme in applied mathematics hosted by ENS Cachan (MVA).

In mathematics, the position of PSL★ is so strong that it already attracts almost all the top students in mathematics in France and many top foreign students. Our ambition is to build upon and extend this international recognition to attract more top-level international students (another 15-20 per year) and to encourage them to stay on in France through attractive doctoral and post-doctoral programmes.

In computer sciences, an increase in the number of PhD students is planned. The strategy here calls for recruiting top students at the undergraduate level (from 8 to 20) and retaining them for PhDs and careers in research, an approach which PSL★ is ideally equipped to handle, building upon established practice at institutions such as the ENS.

PSL★ also has a strong programme of chairs and visiting fellowships. This builds upon the existing yearly rotating chair sponsored by INRIA which has been created at the College de France; it attracts world class scientists and complements teaching delivered in other PSL★ institutions. The DMA is another such example; because of its central location in the French mathematical landscape, it has a strong tradition of receiving distinguished international visitors. The DI has likewise managed to attract and retain internationally renowned researchers from abroad including famous researchers on industrial chairs: A. Shamir (Turing prize) on a France Telecom chair, and A. Zisserman (Fellow of the Royal Society) on an EADS chair. Building upon this practice, the PSL★ proposal calls for the establishment of further chairs, and the continuing support of CNRS and INRIA, which will provide the means to continue and reinforce this strategy. Like prestigious institutions such as CalTech, Harvard, and Princeton, the ambition of PSL★ is to conduct world-class research in clearly defined research areas. Our international strategy and the collaborations afforded by the IDEX will be key in achieving this objective.

Detailed IDEX actions:

- Two international senior research chairs packages to attract prominent highly qualified scientists,
- One research Initiative on « Assessment of quantitative methodologies in Finance" aiming to contribute to a better scientific understanding of the systemic changes, risks, needs and challenges, induced by the massive development of quantitative modeling in Finance.
- Post-docs: In order to be able to attract top young researchers, the IDEX will fund two two-year positions per year in mathematics;
- Higher education in Mathematics : 15 three-year fellowships for outstanding foreign students preparing the ENS diploma
- Higher education in Computer Sciences: We aim at selecting every year twelve top-level French and foreign students interested in obtaining the diploma of ENS. We envisage a four-year programme, consistent with the duration of studies at ENS.

Key IDEX projects:

- Two international senior research chairs to attract prominent highly qualified scientists,
- Two post-doctoral positions to attract top young researchers,;
- 15 three-year fellowships in Mathematics for outstanding foreign students preparing the ENS diploma
- 12 four-year fellowships in Computer Sciences for top-level French and foreign students interested in obtaining the diploma of ENS.

Funding requested: 6 596 KEUR for four years and 16 490 KEUR for ten years

PHYSICS AND ASTROPHYSICS, FROM FUNDAMENTAL THEORY TO ADVANCED ENGINEERING

PSL★ institutions are leaders at the highest international level in several pioneering research areas in contemporary physics. The teams of the ENS, ENSCP, ESPCI, Observatoire and Collège de France have a century-long track record of excellence and a rich tradition of leadership on the national and international scenes (PSL★ institutions have trained or employed all 6 of the French laureates of the Nobel Prize in Physics since 1960).

The ambition of PSL★ for physics is (1) to maintain its leadership in basic science; (2) to explore ground-breaking new types of research; (3) to improve valorisation with the creation of innovative materials and devices and the creation of high-technology companies.

Current research

Tight networks of outstanding research groups are distributed among PSL institutions:

- Research in quantum mechanics ranges from atomic physics to applications in metrology using space-borne experiments. Applied work such as space-borne atomic clocks to test general relativity at an unprecedented precision builds on Nobel-winning research also carried out in the perimeter of PSL★. Test in the drift of fundamental constants with time combines lab experiments and astrophysics observations.
- Theoretical physics research encompasses pioneering insights in cosmology at the Collège de France, breakthroughs in statistical physics at ENS and ESPCI, including the physics of glasses, with important applications. Much of this work forms the backbone of modern fundamental physics.
- Soft condensed-matter research, including the physics of polymers which was spearheaded at PSL, stretches the entire spectrum from basic theory to industrial applications involving polymers, colloids and biophysics.
- Hard condensed-matter physics ranges from nanophysics and world-leading mesoscopic research, to studies of quantum phase transitions, electronic properties of single nano-objects, strongly correlated systems.
- Magneto-hydrodynamics and plasma physics, nonlinear physics: research groups at ESPCI, ENS, and Observatoire de Paris are pioneers in that field, with world-leading expertise in experiment, astrophysical observation, computational-physics and theory.
- All domains of astrophysics are present at the highest level at Observatoire de Paris which represents about one third of the national astronomical community acting in the fields of planetology, stellar physics and exoplanets, galactic and extragalactic physics and the physics of interstellar medium.

These research axes cover the forefront of physical theory, conduct pioneering work in instrumentation and in experiments, and share several world-renowned platforms for the fabrication of devices and for the exchange of information.

Projects in the framework of the IDEX

Research in physics finds its primary expression in four Labex proposals. The ambition of PSL★ in physics is to become the connecting hub catalysing these four major and transforming projects.

- ENS-ICFP is a project carried by the ENS Physics department, aiming at positioning itself durably as a world leading centre of research and training in fundamental physics. The actions will include the creation of an ENS Junior research chair programme, an ENS master/graduate school of Physics, and a dedicated technology transfer project.
- The Institut Langevin WIFI aspires to become the world reference in the field of wave physics and imaging, by combining in a multidisciplinary approach high-level fundamental research, applied

research, business creation and training of students who will be tomorrow's researchers and entrepreneurs. This activity has a very high potential for technology transfer and the creation of start-ups.

- Astronomy, Astrophysics and Gravitational Systems project builds on the growing potential of the Astronomical Virtual Observatory. Research objectives are oriented towards specific areas where significant achievements are expected in the forthcoming years: the GAIA space astronomy mission, the PHARAO space experiment, and the development of numerical simulation activities (in the framework of the EQUIPEX project EQUIP@MESO). An important aspect of the AASG project is the development of specific tools for making the scientific data collections accessible to the large public.
- Space Exploration for Planetary Environments (ESEP). The ESEP LABEX project is a scientific network among space laboratories coordinated by the Observatoire, devoted to the exploration of planetary environments. This project will allow the Observatoire and its partners to keep playing a leading role in this strategic field and develop their recognised expertise in remote sensing and *in-situ* space instrumentation.

Detailed IDEX actions: Connecting actions for an enhanced international visibility

- All the projects will take advantage of an important rehabilitation programme covering more than 25 000 sqm. within the perimeter of PSL★. The complete renovation of physics laboratories will boost a new life and a real potential for international visibility.
- Creation of a "Physics Centre" to animate the physics teams, organise common events, sharing best practices and centralising knowledge. This dedicated space for the physics research community aims to share progress between the four Labex projects and to create a programme dynamics.
- Creation of a prestigious senior research grant on the model of the Blaise Pascal Research Chairs, to attract a prominent international scientist, to work during twelve months on the PSL★ campus, on topics of common interest for the physics, astrophysics and space science field, including education and public outreach challenges.
- Invitation of professors from institutions all over the world to become PSL★ physics "observers" for periods of 6 months, guaranteeing challenge and questioning of the research teams.
- Organisation of common research events: (a) a physics week where researchers of the domain will present their activities and organise Q&A sessions open to the general public or focused on young students; (b) a common PSL★ seminar around the key research fields materialised by the four Labex proposals; (c) a summer school in physics.

Key IDEX projects:

- A "Physics Centre" to organise of common research events:
- A prestigious senior research grant to attract a prominent international scientist,
- Invitation of professors from institutions all over the world to become PSL★ physics "observers" for periods of 6 months
- Internationalisation of formations with courses delivered in English

Funding requested: 2 880 KEUR for four years and 7 200 KEUR for ten years

CHEMISTRY FOR THE MANAGEMENT OF ENERGY AND MATTER: FROM LIFE TO PROCESS

In the field of Chemistry, PSL★ institutions are active in both research and engineering: ESPCI-ParisTech and Chimie ParisTech are engineering schools with a strong emphasis on sciences and valorisation; the ENS is mainly involved in fundamental research and trains professors; and the Collège de France has two chairs in this domain.

The complementarities of PSL★ institutions are an undeniable strength for the research-industry continuum. The academic expertise, with its fine-grain approach, translates into new concepts and new tools that enable engineers to solve problems and therefore innovate. Moreover, the chemists of PSL★ will develop research and training programs with their colleagues in the humanities to develop transdisciplinary approaches around key issues such as, for example, resource management.

The chemists of PSL★ are thus in a position to answer new challenges for a sustainable chemistry, related to the management of resources and energy. Cosmetics, pharmaceuticals, nuclear energy, petroleum, energy storage: each of them is strategic for France and its industry, and face key challenges that cannot be solved by chemistry unless it is practised in synergy with other fields such as physics and biology. Every innovation in these sectors will have a direct impact on the economy.

The challenges include:

- design renewable raw materials, which do not require fossil fuels and ores;
- create or improve processes to minimize energy input and waste;
- develop new systems for the production and storage of energy

Thus the major themes of PSL★2020's chemistry will be:

- chemistry of resources: new raw materials, mixtures management;
- life cycle of materials and molecules: control of degradation processes, remediation, analytical sciences;
- original processes for chemical engineering;
- Chemistry and physical chemistry for life, chemistry in living organisms.

PSL★ has proposed two Labex to promote its goals.

- The LABEX METACEN will address upstream research on metallic materials, which are particularly important in France due to their major impact on energy policy. This Labex will focus on the study of material resistance, notably within the context of the lifetime extension of current nuclear power plants from forty to sixty years, the development of materials for the 4th generation nuclear power plants, the development of metallic materials for the emerging renewable energies in particular for fuel cells, and the development of materials resistant to corrosion in any country and any operative conditions.
- The LABEX ChemVivo is based on the idea that living microorganisms, which obey evolutionary principles that optimise management of matter and energy, will become common auxiliaries to achieve chemical tasks. We are indeed convinced that the approach of chemistry assisted by living organisms will allow researchers to solve real problems such as the ones listed above.

The projects in both Labex will also involve other researchers present in PSL (biology, physics...) and benefit from the creation of the Institut Pierre-Gilles de Gennes for microfluidics.

The chemists involved in the Labex ChemVivo and METACEN, with their expertise and innovative projects of research and research-supported education and their close relation to industrial partners, have the ambition to become the French leaders in their field and major international actors.

Detailed IDEX actions:

- Besides these LABEX, PSL★ defends a new structuring project: the Paris Institute for Chemical Engineering ("Institut d'ingéniérie pour la chimie de Paris"). This Institute will gather the entire ENSCP and the ESPCI chemistry laboratories in a common location in Paris. The ideal location is the building presently occupied by AgroParisTech, rue Claude Bernard, close to ESPCI, to become available when AgroParisTech moves to Saclay. The target is to design a low-power building in Paris that will be the most modern French facility for practicing safe and green chemistry.
- Priorities of ENSCP in the 10 coming years will be metallurgy, chemistry for energy, solid chemistry, and molecular chemistry for drug design; in areas concerned with this project, ESPCI has very active research in pharmaco-chemistry, analytical and environmental chemistry, physical chemistry and chemistry of soft and complex matter (for instance polymers), nano-materials. Both schools are and will be more and more involved in common projects in the four major themes mentioned above, with consequences on education programs (both schools plan to have common sessions, especially practical ones) and on laboratories organization (common technical platforms are planned).
- To achieve this, two new joint scientific groups will be set up, each with one prestigious senior chair, and new scientific equipment will be purchased.

Key IDEX projects:

- The Paris Institute for Chemical Engineering ("Institut d'ingéniérie pour la chimie de Paris").
- One distinguished senior chair and two new joint scientific groups
- Acquisition of new scientific equipment

Funding requested: 5 200 KEUR for four years and 11 500 KEUR for ten years

BIOLOGY: AN INTEGRATED APPROACH FROM GENES TO NEURONAL NETWORKS, CANCERS AND ECOLOGICAL SYSTEMS

Biology in the PSL★ perimeter is present at the ENS, College de France, ESPCI, and Institut Curie.

The Institute of Biology of the ENS (IBENS), created in 2010, is affiliated to the ENS, CNRS and INSERM. The research staff (30 teams) is organised around 4 main axes: developmental biology; neurosciences; functional genetics; environmental and evolutionary genomics. All levels of biological research are represented: from molecules, genes, cells, and organisms to ecosystems.

Multidisciplinary research is a strong point for excellence, reinforced by local collaborations with the departments of physics, chemistry, mathematics, cognitive studies, and computing science at the ENS. Since 2006, 6 new junior groups and 3 senior ones have been recruited. IBENS excellence is well established as proved by both the AERES evaluation and prestigious prizes and honours received by team leaders. Bibliometrics illustrate the quality of IBENS research with 1029 publications over the past 10 years, almost 30% of which are in the top 10%.

The Centre of Interdisciplinary Research in Biology of College de France (CIRB) to be created in January 2011 will be composed of 14 research teams working around 4 axes: cardio-vascular, developmental biology, neurophysiology and cell biology. Since 2006, five new junior groups and two senior ones have been recruited. CIRB excellence is well established as proved by both the AERES evaluation and prestigious prizes and honours received by researchers. Bibliometrics illustrate the quality of CIRB research with 391 publications over the past 10 years, almost 27% of which are in the top 10%.

The Laboratory of Neurobiology (ESPCI) and especially the two teams "Genes and Dynamics of Memory Systems" and "Genetics and Physiopathology of Neurotransmission" address several related topics: neuroplasticity, neuromodulation and applied studies of various neuropathologies. Excellence is well established as proved by AERES evaluation and the prestigious prizes and honours received by researchers. Bibliometrics illustrate the quality of research with 80 publications over the past 10 years, almost 23% of which are in the top 10%.

The Institut Curie includes a multidisciplinary Research Centre, comprising 14 well rated research units and one department of clinical research. The goal of the Research Centre is to increase and disseminate knowledge about mechanisms underlying cancer biology (in particular, the molecular and cellular mechanisms of tumour initiation and progression). The Institut Curie also includes a Translational Research department, in order to reinforce the interactions between clinicians and researchers (Institut Curie's Labex project in translational research is described in the section "Hard Sciences / Life Sciences and Health").

The ENS, Collège de France and ESPCI have proposed within the PSL perimeter:

- The LABEX MemoLife which regroups all the teams of IBENS, CIRB and the two previously mentioned teams of the Laboratory of Neurobiology at ESPCI. This programme will reinforce interaction between scientists from all biological domains and foster multiple interactions with mathematicians, chemists and physicists with a strong interest for biological processes. The goal of MemoLife is to integrate all aspects of living memories from gene to consciousness. The MemoLife project will include a number of facilities such as ImaChem (an imaging IBiSA facility), PhoBiol (EQUIPEX project aimed at developing imaging techniques to monitor the dynamics of photonic and optogenetic manipulations), the Genomic, Sequencing and Proteomic IBiSA facilities. Besides, MemoLife has interactions with five other LABEX projects supported by PSL.

Key IDEX projects:

- Two distinguished chairs
- One senior chair
- Centre for Mesoscopic Biology (see hard Sciences/Life Sciences interface part)

Funding requested: 6 000 KEUR for four years and 15 000 KEUR for ten years

EARTH SCIENCES: GÉO-PSL TO GATHER COMPLEMENTARY SKILLS

The field of Earth Sciences within PSL★ will be organised under the disciplinary project Géo-PSL. It involves four of the partners: ENS (Département des Géosciences, Département de Physique), Observatoire de Paris (Laboratoires SYRTE, IMCCE, LERMA, LESIA), ESPCI (Laboratoire de Physique et Mécanique des Milieux Hétérogènes, Institut Langevin, Laboratoire de Physico-Chimie théorique), and Collège de France (Edouard Bard and Barbara Romanowicz Chairs).

GéoPSL includes 4 members of the Académie des Sciences, 5 members of the Academia Europaea, 13 laureates of silver or bronze CNRS medals and more than 20 laureates of other French or international scientific awards.

It unites a set of complementary thematic fields currently dispersed between multiple different institutions. Some teams study spatial or meteorological problems, others deal with geology and the physical makeup of the planet, while yet others develop innovative approaches towards geosciences and information systems. Géo-PSL is particularly active in domains of major importance for our society such as natural hazards (seismic, volcanic, meteorological), environmental studies (climatic change and its consequences; air, water and soil pollution, waste disposal and CO_2 sequestration), and prospecting and management of the energy, water and mineral resources for a green economy.

GéoPSL is well connected to other disciplines within PSL★, in particular biology, chemistry, physics, computer science and the social sciences, and offers a unique vantage point from which to develop

new research at the boundary of geosciences.

It has a strong tradition of cooperation with the public and private sectors, thanks to numerous collaborative projects with industry or public agencies (for example Total, Shell, Areva, EDF, BRGM, Météo-France, Astrium, Thales, AirParif, AXA, CNES, CEA).

Internationally, Géo-PSL members are active in several international networks and laboratories (LIA France-Chili, EU and COST programmes), participate in international panels or programmes (IPCC, WRCP, GEWEX, ESA and ECMWF) and in the editorial boards of numerous international scientific journals.

Within the framework of IDEX, GéoPSL proposes four major research tracks, three of them in cooperation with existing Labex within the PSL★ perimeter:

- In the field of **Seismology** (ENS, CdF, ESPCI, OP), GéoPSL aims to work towards two goals. One is a better understanding of the source and generation of earthquakes, in particular the role of microseismicity, direct measurements of tectonic deformation linked to the earthquake cycle using spatial techniques (GPS, InSAR), transient deformations, friction, dynamics of slip pulses, earthquakes and the rotation of the Earth and the imaging of seismic sources using time reversal techniques. The other broad goal is seismic imaging of the Earth using seismic waves: passive tomography from noise correlation, interferometry with coda waves, imaging the whole Earth using the complete wave field as well as numerical methods for 3D wave propagation. The latter topic will be coupled with the international laboratory Paris-Berkeley, and the Labex WIFI in the hard sciences/life sciences transversal axis is associated with this project.
- Within **Geodesy** (ENS, CdF, OP), we aim to improve the measurements of Earth rotation and our knowledge of the couplings between the fluid and solid Earth, sea-level variations, post-glacial rebound, terrestrial reference frame links between climate, rotation and the long-term deformation of the Earth. On the applied level, this includes geophysical applications of ultra-stable spatial clocks (developed through the Labex FIRST-TF “Réseau National temps fréquence”) as well as the study of tropospheric delays.
- The field of **Climate** (ENS, CdF, and OP) aims to develop innovative numerical methods for the next generation of climate models. Methodologically this area makes heavy use of modelling and simulation, creating tie-ins with computer science and mathematics, as well as the PSL★ knowledge management initiative. Climate studies here include modelling the tropopause region and the stratosphere, seasonal and inter-annual modes, meteorological modelling on the micro, meso and macro level, as well as the links and processing problems between satellite data and modelling. On the astronomy level, it includes the relations between solar activity and the climate as well as the study of the climate of other terrestrial planets. This research track is linked to the Institute for the Environment, in particular the Labex L-IPSL on climate change, and will benefit from the Equipex SOFRAEX, PAPRICA and EQUIP@MESO.
- Finally, **Complex media** (ESPCI, ENS) is active in the field of geology and aims to study porous and granular geological media, the mechanical properties of heterogeneous and stratified media with particular emphasis on instabilities. Apart from the pure science aspects, this research is closely tied into application problems for state and industry needs, such as risk assessment for natural hazards, CO_2 sequestration, geomorphology, erosion, nuclear waste disposal, oil exploitation and soil pollution.

Detailed IDEX actions:

- Common ANR applications on the above topics
- Development of the synergy on some satellite observations
- Creation of an international seismic laboratory (Berkeley, ENS, CdF, IPGP).

- New teaching modules to attract physics students and engineers to geosciences and sharing L3, Master and PhD modules between partner institutions.
- Creation of a Géo-PSL seminar and a Géo-PSL day for PhD students

Key IDEX achievements:

- Two distinguished chairs
- An international seismic laboratory (Berkeley, ENS, CdF,).
- New teaching modules to attract physics students and engineers to geosciences and pooling of L3, Master and PhD modules between partner institutions.
- Géo-PSL seminar and a Géo-PSL day for PhD students

Funding requested: 2 000 KEUR for four years and 5 000 KEUR for ten years

COGNITIVE SCIENCES: FROM BIOLOGY TO PHILOSOPHY

Cognitive Sciences within PSL★ currently represent an axis of cutting-edge excellence. The strengths of PSL★ in Cognitive Sciences are based on several high-level research laboratories, such as the Department of Cognitive Studies (DEC), institutional cooperations with the Institute of Biology of ENS, the Laboratoire de physique statistique and the Willow, Sierra and Classic teams of the DI/LIENS and DMA at ENS, the RTRA Ecole d'Economie de Paris (EEP) of the Department of Social Sciences at ENS, the UMR LPPA at College de France, the UMR Sigma and the Institut Langevin at ESCPI-ParisTech, etc.

This powerful existing tradition of interdisciplinary research in the Cognitive Sciences brings together the following six major fields:

- Experimental Psychology and Cognitive Developmental Psychology, Psychophysics
- Integrative Neuroscience, Cognitive Neuroscience, Neuropsychology, Neuropsychiatry
- Mathematical Modelling and Computer Simulation, Computational Neuroscience
- Theoretical Linguistics (phonology, syntax, semantics, pragmatics)
- Cognitive anthropology, economics and the social cognitive approaches
- Philosophy of Mind and Philosophy of Language, Philosophy of Cognitive Sciences.

The strength and interdisciplinary of PSL★ in Cognitive Sciences is also evident in teaching, exemplified by the existing high-standard disciplinary and interdisciplinary courses offered to students from very different backgrounds (arts, sciences, medicine, etc.). The Cognitive Sciences axis of PSL★ aims therefore to promote interdisciplinary symbiosis among training programmes and research units with diverse but complementary skills, encompassing diverse disciplines – from biology to philosophy – as well as a remarkable range of scales of observation – from the molecular level to the study of the human mind.

Within PSL★, Cognitive Sciences play a crucial role for two reasons. On the one hand, they are right at the interdisciplinary interface between hard sciences, life sciences, engineering as well as the humanities and social sciences. On the other hand, they provide a strong methodological basis. Mathematical Modeling and Computer Simulation play a key role in this area, with many applications in the field of engineering and biomedical sciences, but also the geosciences and social sciences. Therefore, the Cognitive Sciences are of crucial logistic and methodological importance for PSL★.

In the context of IDEX funding, a scientific committee and a teaching committee will be set up to coordinate scientific actions and teaching in Cognitive Sciences across the different institutions (ENS, College de France, ESPCI-ParisTech, etc). A Learning Centre in Cognitive Sciences will also be installed in the vicinity of the DEC (ENS). This Learning Centre will provide high-standard, audiovisual

and computer-assisted teaching systems & equipment, seminar rooms, computer platforms and administrative support to PSL* students in Cognitive Sciences and faculty. The Learning Center will be supported by the LiberLabo, Savoir & Multimedia and UMS RISC for fast access to scientific information (e.g., libraries) scientific dissemination, and various actions aiming to engage the public more broadly. It will therefore play a key role in the knowledge management strategy of PSL★.

Detailed IDEX actions:

- Funding fast-track annual research programmes (AAP) in five core themes (perception, learning & memory, language, decision making & rationality, social cognition);
- Creation of a learning centre
- Mutualisation of technical platforms and creation of “methods groups” (e.g., signal processing & data analysis group; modelling group; etc) across the different institutions ;
- Initiation of seminars and courses across partners
- Establishment of a coherent and individualised interdisciplinary training in Cognitive Sciences for PSL students
- Invitation of high-level foreign scientists;
- Creation of an interdisciplinary Ph.D. programme in Cognitive Sciences (Ph.D. programme "Frontiers in cognition") with specific Ph.D. grants in Cognitive Sciences

Key IDEX projects:

- 2 senior chairs
- A Cognitive Sciences learning center
- Trans-institutional seminars and courses
- Creation of an interdisciplinary Ph.D. programme in Cognitive Sciences (Ph.D. programme "Frontiers in cognition") with specific Ph.D. grants in Cognitive Sciences

Funding requested: 6 000 KEUR for four years and 15 000 KEUR for ten years

HUMANITIES, SOCIAL SCIENCES, AND CREATIVE ARTS

Humanities, Social Sciences and Creative Arts are key disciplinary fields because they enable a critical discourse on society, its history, evolution and modes of organisation. As such they provide tools and concepts for the analysis of contemporary social changes and make it possible to answer the major contemporary challenges at the origin of “*Investissements d’avenir*”.

Within PSL★ these disciplinary fields are particularly strong at the Collège de France, the ENS and the UPD and form two main sets of disciplinary approaches, in constant interaction: **Humanities, Social Sciences and Arts** on the one hand; **Political Science, Decision Sciences and Management** on the other.

The IDEX will enable PSL★ to further interdisciplinary initiatives and programmes between the various approaches and fields (archaeology, art history, history, languages, linguistics, literature, philosophy, but also anthropology, sociology, economics, law, political sciences, management and decision sciences, as well as theory and practice of the arts), in order to produce challenging and critical insights on societies and cultures.

I. Humanities, Social Sciences and Arts

- The ENS hosts: 2 laboratories in Social Sciences (PSE in economics, CMH in sociology and anthropology), 2 laboratories in Philosophy ("Pays germaniques" and CIRPHLES), 2 laboratories in Literature and Languages (ITEM for textual genesis, LATTICE for diachronic and synchronic linguistics on French language),1 laboratory in Archaeology and Science of ancient texts (AOROC), 1 laboratory in Modern History (IHMC).
- The College de France has 15 Chairs in Humanities and Social Sciences and hosts 3 laboratory (Laboratoire d'Anthropologie Sociale, Proche-Orient, and Centre de documentation des Instituts d'Orient);
- Université Paris-Dauphine hosts: 1 laboratory in Social Sciences (IRISSO); 1 laboratory in Sciences of Decision (LAMSADE), 1 laboratory in Management (DRM), 1 laboratory in Economics (LEDa).
- The ENSAD hosts the research program EnsadLab, created in 2007, the ENSBA a new research program created in 2010 (previously called La Seine), and the CNSMDP the Centre de recherche et d'édition du Conservatoire (CRIC).
- The Observatoire de Paris hosts a team in History of Astronomy (SYRTE)

1) Centres and peripheries: material and cultural circulations

a. *Studies on the Ancient Worlds*, including not only Classical Antiquity, but conceived more broadly as polycentric and multicultural, covering large parts of Europe, Asia and Africa. The approach includes a wide range of studies on both material and intellectual productions, with a strong focus on archaeology, epigraphy, papyrology, history, philology, philosophy and languages. Finally, it reaches beyond ancient cultures to investigate the crucial issue of their transmission and resonances in medieval and modern periods.

b. *History of cultural and intellectual circulation from the middle Ages to the Second World War*. This project will study the history of cultural circulations encompassing economic, material and intellectual aspects, as well as social representations in order to shed a new light on the construction of identities, ethnicities and cultures. The intellectual history of Europe is represented by different projects, such as the history of the book, intellectual circulations between France and Germany, or the process of structuring an intellectual and scientific community across Europe (Republic of Letters).

c. *Anthropology*. The ENS and Collège de France regroup important teams in anthropology, focusing in particular on the history of anthropology, and anthropology of contemporary globalisation, acting as a powerful instrument against ethnocentrism. In the framework of PSL★, the links between the unity of mankind and the diversity of human cultures will be studied, with a focus on the scientific impact of debates between Humanities and Natural Sciences. Social anthropology will thus be a key element of the Institute of Environment and of the Centre for the Study of Rationalities and Human Behaviour.

2) Concepts and theory, from ethics to history of sciences

a. *Ethics* is a major area of renewal of philosophical thought, where abstract and sophisticated theories meet everyday life issues. Topics stretch from moral realism, the relation between literature and philosophy, to issues of meta-ethics (cognitivism), ethical ontology (moral realism, theories of moral rationality) and to applied ethics and in particular bioethical issues.

b. *History of sciences and interfaces*. History of sciences is studied from the double perspective of the history of scientific sociability and of the epistemology of transfers of methods and concepts, from one established disciplinary field toward another, during the process of knowledge creation.

c. *Concepts and Semantics* is represented by cutting-edge research in phenomenology, based on a comprehensive historical study of manuscripts of the pioneers of the phenomenological school ; by the study of metaphysics ; and theoretical reflections on the conceptual frameworks implicit in all disciplinary fields (subject, action, responsibility, identity, etc.).

3) Aesthetics, Evolution of Forms, and Creation

a. Aesthetics, Genetics and History of Forms. Based on current research in literary genetics and aesthetics developed at the ENS and Collège de France, this project will extend research on translations and textual genesis and include extensions towards art and film studies as well as musicology. It will thus constitute an original and dynamic field studying the process of creation and notably the impact of the multiplicity of languages on thought and evolution of art forms.

b. Interfaces Arts/Science. This project will explore new paths of research at the intersection between artistic practices and science. It will be developed thanks to a reinforced collaboration between PSL★ institutions and the partner schools of creative and performing arts and through the common creation of an experimental Centre "*Science-Art-Création-Recherche*" (SACRE).

II. Decision, Management and Political Science

One of the strong assets of PSL★ in Humanities and Social Sciences consists in the articulation between social and political science on the one hand, and economics, management and decision sciences on the other.

Major axes of research focus on management, organisations and institutions, modelling and decision and are supported by transversal research programmes in economics. These axes fuel the five initiatives described below in the framework of the IDEX.

The two Labex proposals testify to the dynamism of these synergies:

* The **Labex TransferS**, coordinated by the Collège de France and the ENS, will study how cultural transfers have been shaping societies and cultures from Antiquity to the present day. It will develop the use of digital data in the humanities, and explore synergies between the methodological and conceptual frameworks developed in the humanities and social sciences, and those from the natural and formal sciences, and is directed not only towards the scholarly world but towards society as a whole.

* The **Labex "Risques"**, coordinated by the UPD combines several disciplinary perspectives (political science, sociology, law, economics, management, computer science) in order to identify issues and clarify the stakes linked to risk prevention and sharing. At a first level, scientific advances on models applied to specific issues facilitate the identification of effective strategic actions in an existing organisation and contribute to the emergence of organisational improvements. At a second level, research on risk modelling helps anticipate model abuses and provides a critical perspective.

On the basis of these disciplinary and interdisciplinary building blocks, PSL-IDEX will develop the following projects:

Project 1: Launching a new research topic "Humanities / Humanity"

From the late Middle Ages, humanities have not only been a set of disciplinary fields, but a way of life aiming at the humanisation of man and the realisation of humanity in each individual. However, such a model has been profoundly challenged during the last decades through a reconfiguration of cultural forms, a new way of conceiving the relation of the human being to nature and animality, and a thorough criticism of the ethnocentrism of the European narrative on civilisation and progress.

The ambition of PSL★ is therefore to launch a series of research initiatives in order to investigate the concept of humanity and its evolution. This answers an important social need and serves contemporary issues on the development of the human being.

The investigation of such issues can now be done in a new light thanks to the emergence of digital humanities, which offer a new organisation and access to data. Quantitative studies are therefore a tool to better understand the specificity of humanistic disciplinary fields.

The resources needed for such a project involve the creation of interactive tools and programming in the framework of the Institute for Advanced Research created by PSL★. During the first year, a one-week workshop will be organised to launch the research project and organise 6 months of study during the following years for four fellows. The research will lead to publications and to the organisation of international conferences.

Project 2: Structuring research teams on *"Norms and World"*

The evolution and transformations of social norms and political institutions are central to Social Sciences. Such a study will have (1) a conceptual dimension with a philosophical reflection on the concept of norm; (2) a historical dimension with enquiries highlighting the evolution of norms in time; (3) a sociological dimension with a study of the social realities of their implementation and their impact on governance, at all levels. It will require investigating case studies on many topics including security of persons; economic rules ; construction of rules for the market; political decisions; use of rules as a condition of reproduction of social groups, etc. The elaboration of moral norms is of particular interest notably in the context of the development of new technologies (numerous researchers of PSL★ are involved in the national ethics committees).

Project 3: Creation of 6 Research initiatives at the interface between Management, Economics and Social Sciences

6 institutes will be created in the framework of PSL★ in order to highlight social issues benefiting from the competence and methodologies of various disciplinary fields.

** International Migrations*

Development economics is well represented at UPD and ENS, with a particular focus on migrations, investigating their causes, consequences and modalities, and especially on the roles of education, remittances and local investments.

** Economic Decision and Behaviour Lab*

The lab will offer a widely accessible and flexible venue for experimental approaches to marketing. Applications to saving decisions, attitude towards risk, information treatment will contribute to the design of products, services and commercial strategies. The laboratory will notably rely on inputs from cognitive sciences.

** Managerial Practices and Innovation*

Research in managerial innovation examines the practices associated with management devices and tools, analyses their life cycles and evolutions, and describes their relation with managerial government. Changes in managerial practices suggest an organisational innovation in the way managers monitor and influence behaviours in order to insure goal achievement. It also focuses on the organisational impact of the information systems on which these tools and devices both rely. This approach is therefore tightly connected with political and social sciences.

** Corporate Governance*

Research on corporate governance will examine the mechanisms that may resolve the collective action problem resulting from dispersed ownership or from the wish of an outside investor to exercise control in a different fashion from the manager in charge of the firm.

** Public Management and Policies*

The researchers will rely on the variety of rules used over time or space to examine their relative performances, through approaches tightly connected with management sciences and labour sociology. Thanks to health economics research developed at UPD (LEGOS), the project covers comparative analysis of health insurance schemes, compensation scheme (ways payments to professionals and hospitals are calculated and insured), hospital organization. Employment policies

and public administration are also in the agenda.

** Real Estate*

The institute will gather researchers on the various aspects of the sector of real estate, which is the major investment for many households. The aim is to enhance research on the organization and functioning of the markets, on the role of mortgages and other forms of credit.

Beyond these three research topics, Humanities, Social Sciences, Management Sciences and Arts will form an essential component within the 3 transdisciplinary Centres conveyed by the project PSL IDEX (developed in the following sections):

- Environment, Energy, Universe
- Life Sciences/Hard Sciences Interface
- Rationalities and Human Behaviour

Key IDEX projects:

- Two senior chairs
- Six attractive post doctoral positions

Funding requested: 3 840 KEUR for four years and 9600 KEUR for ten years

TRANSVERSAL TOPICS OF RESEARCH: GATHERING EXPERTISE FOR INTERNATIONAL VISIBILITY

In addition to the disciplinary centres outlined above, the proposal of PSL★ aims to further strengthen and institutionalise the existing interdisciplinary outlook of much of the research taking place within its constituent and partner institutions. For this purpose, the proposal calls for the establishment of three major transdisciplinary research axes along the lines of transversal research programmes, namely (1) Environment, Energy and Universe, (2) Interface Life Sciences/Hard Sciences and Health, and finally (3) Centre for the Study of Rationalities and Human Behaviour. A fourth centre will focus on Knowledge Management and Methodological Frameworks.

KNOWLEDGE MANAGEMENT AND METHODOLOGICAL FRAMEWORKS

In order to implement the research agenda outlined above, PSL IDEX requires a strong and integrated Knowledge Management Infrastructure. This will ensure that data can be shared between research groups within PSL IDEX but also with the wider academic community and, just as importantly with the business world and society as a whole. This will boost research productivity, increase visibility and ensure interoperability. Within PSL IDEX two research groups will be created:

1. The working group on Scientific Knowledge Management will develop a strong common scientific toolkit (including semantic and self-governing approaches), for data extraction, processing and analysis.
2. The working group on Methodological and Theoretical frameworks will focus on the transfer of methodologies and theories between disciplines, the implications of this process and its potential value.

These groups will ensure the implementation and dissemination of best practices and techniques and assist researchers in developing knowledge-based approaches. They will work in close collaboration with industrial partners. This project will require a post of Knowledge Management Officer, as well as that of qualified technicians and researchers. It will be nourished by the strong existing expertise in these domains of the Institutions of PSL IDEX.

THE INSTITUTE OF ENVIRONMENT, A PLATFORM FOR INNOVATIVE TRANSDISCIPLINARY RESEARCH

The creation of the PSL★ Institute on Environment will contribute significantly to i) high-level research since it aims to become a meeting centre for the leading experts of the field, ii) high-level training thanks to new facilities, iii) high-level dissemination of knowledge in Environment and Sustainable Development (ESD) themes, and iv) start-up incubation in partnership with industrial or economic groups operating in the energy and environment sectors. It will thus answer one of the major challenges of the present day, highlighted by the Stratégie Nationale de Recherche et d'Innovation (SNRI). The Institute aims to be ranked after 10 years among the world leaders on Environment.

The consequences of the interactions between climate-biosphere-society

The main environmental questions nowadays require the analysis of complex systems which are still considered as isolated or analysed as such by traditional scientific fields, *i.e.* climate, ecosystems, economy and society. In fact, these systems influence one another and the analysis of the consequences of the feedbacks in environmental systems can be applied to fields are as diverse as mathematics, physics, chemistry, earth sciences and astronomy, life-ecology sciences and social sciences.

These scientific fields are investigated by internationally renowned researchers within PSL★ and include members of more than 20 PSL IDEX research laboratories situated at the Collège de France, ENS, ENSCP, ESPCI, and Observatoire de Paris.

In the framework of the IDEX, the following projects will be implemented:

The research agenda of the Institute for the Environment follows a series of tripartite structures. On the most basic level, research, dissemination and teaching govern the whole activity of the Institute. The projects themselves are broadly structured around the study of observations, models, and theory, with a temporal outlook concerning the past, present and future, at all time scales. They are linked by a common theoretical and methodological framework on the investigation, modelling and simulation of dynamic and complex systems, which is tied into the Knowledge Management architecture of PSL★. The research projects include:

- Ecosystems – Climate: this theme studies the feedbacks between Ecology & Climate: (links with EQUIPEX PLANAQUA and TGIR Ecotron Ile-de-France). Evolution & Climate, Soil moisture & precipitation feedback (link with L-IPSL LABEX), Present state of Planet Earth & Climate, Astronomy & Climate, Dust & Climate (link with L-IPSL LABEX).
- Ecosystems – Society: this theme studies the feedbacks between Vulnerability and adaptation of territories & Climate, Terrestrial ecosystem & management practices, Water resource availability & state of aquatic ecosystems: (links with TGE FT-ICR-Platform affiliated to the "Spectrométrie de masse FT-ICR à très haut champ"), Development of new energies & energy savings (link with VALTECX EQUIPEX)
- Society – Climate: this theme studies the feedbacks between Climate & Economy (links with IRT "Finance et croissance durable" and LABEX Risques), Constraints, Dynamics and Public policies & Climate (link with LABEX Risques), Sustainable development & a changing world, Human dimension of climate change

Some of the proposed activities are also associated to ODYSSEE and rely on infrastructures, such as the CEREEP-TGE Ecotron Ile-de-France which is PI of the PLANAQUA EQUIPEX, but also on the EQUIP@MESO EQUIPEX managed by Observatoire de Paris and the VALTECX EQUIPEX directed by ESPCI.

The Institute of Environment also aims at improving training, education, and outreach in the field of ESD. It will coordinate and rationalize present teaching curricula organized in different disciplines and will propose new ways of teaching such as virtual teaching rooms, similar to those mentioned in the L-IPSL LABEX proposal. Furthermore, it will develop outreach actions such as the extension of public

seminars to the existing ones at the chairs “Evolution du Climat et de l’Océan”, or “Equations différentielles et Systèmes dynamiques” of the Collège de France.

Key IDEX projects :

- Institute for Environment supported by:
  - One distinguished senior chair,
  - One senior chair
  - Two junior chairs
  - Doctoral and post-doctoral positions

Funding requested: 5 600 KEUR for four years and 14 000 KEUR for ten years

HARD SCIENCES / LIFE SCIENCES & HEALTH

PSL★ and its partner institutions are already a world-class place for scientific research at the hard sciences / life sciences interface. The Fondation Pierre-Gilles de Gennes (FPGG) was established in 2007 as a network for advanced research (RTRA) with the objective of providing an institutional environment for the existing scientific community in the area of overlap between biology, physics and chemistry, as well as with the aim of transforming technological breakthroughs and major innovations into marketable products for industry. It unites high-level research teams in a wide range of fundamental and applied fields, providing unique knowledge for applications in the health sector.

On the basis of the strong existing position of the Foundation in the hard sciences/life sciences continuum, PSL★ aims to expand this work into a total of three thematic directions along LABEX lines together with a new Centre on Mesoscopic Biology. Building upon the close-knit community of scientists from multiple disciplines in physics, biology and chemistry and the existing creative and vibrant research environment, these research agendas encompass both fundamental research as well as the development of medical devices, workflows and applications of biotechnology for treatment and diagnosis. In the context of IDEX funding, the following four high-impact domains are to be developed as projects within PSL★:

LABEX Pierre-Gilles de Gennes Institute for Microfluidics (LABEX IPGGM)

The aim of the project is to create a new institute dedicated to fundamental research in microfluidics and “lab-on-a-chip” applications. This is a recent field, characterized by an explosive rate of innovation and growth in the number of publications. This development is driven by a strong downstream demand from life science and medicine, chemistry and environment. Microfluidics is the main enabling technology for the development of lab-on-chips, which aim at integrating into a single miniaturized device a multiplicity of operations needed for chemical, physical or biological processes. Lab-on-chips are the equivalent for chemistry or biology of microprocessors in the electronics and computers industry. Its applied potential is huge.

The Institute will host more than 100 researchers and 12 highly classified UMR and serve as a nucleus for a community of several hundred researchers with expertise in “upstream” fundamental science, and end-users interested in applications. The field of lab-on-chips is highly interdisciplinary, requiring competences in physics (hydrodynamics, soft matter), technology (microsystems, micro-nanofab), chemistry (surface science, analytical chemistry, and biochemistry), biology and medicine. The project will be associated with a unique micro-fabrication platform proposed by an EQUIPEX programme. This will be the first national-scale platform in France, entirely dedicated to microfluidics and lab-on-chips and it will collaborate with the best world centres such as those of Stanford and Harvard.

It will have immediate outcomes in fields such as pharmaceutics and energy and has already resulted in the creation of half a dozen start-ups.

Imaging of Living and Inert objects – LABEX Langevin Institute "Waves and Imaging from Fundamentals to Innovation (WIFI)"

The LABEX WIFI aims to become the world reference in the field of Wave physics and Imaging, by combining in a very multidisciplinary approach high-level fundamental research, applied research, business creation and training of students who will be tomorrow's researchers and entrepreneurs. Numerous fields should benefit from this research including medicine (imaging and therapy), defense, biology, acoustic touch technology, geophysics and communications.

The project will exploit the synergies between acoustics and optics to learn how to manipulate waves in complex environments and to design new instruments for imaging and communicating in these environments. The Institute brings together researchers with a unique experience in sub-wavelength interaction and imaging in optics, as well as in acoustics and electromagnetism. The concept of multi-wave imaging will lead to significant breakthroughs in wave propagation and control in complex media, MIMO (Multiple Input-Multiple Output) imaging, sub-wavelength interactions and imaging and wave physics for medicine.

This project aims at rebuilding a French biomedical industry and at contributing to the development of new information and communication technologies as well as at training innovative engineers. Six start-ups have been successfully created by researchers of the Langevin Institute.

Redesigning Biological objects for discovery and processes (LABEX ChemVivo)

Biological systems evolution of living organisms is guided by transformation efficiencies, characterised by a minimum waste of energy. This is the main underlying idea of the project LABEX ChemVivo in which the microorganisms will be a « flask/tool ». The project addresses the choice of chemical reactives, analytical tools, and microorganisms to achieve transformations, presently performed by chemists. The development of chemistry assisted by living organisms involves multidisciplinary teams with complementary technical and scientific abilities and will make it possible to solve problems related to matter and energy management.

Translating science into cancer patients (LABEX Transic)

It is crucial to transfer scientific discoveries from laboratory, clinical and population studies into clinical applications, with a feedback effect, to reduce cancer incidence, morbidity and mortality. The success of translational research depends on the common work of theoreticians, and clinical and epidemiological researchers in order to solve problems focused on patient care. For example, basic sciences deliver biomarkers useful for diagnosis and prognosis of cancer, as well as valuable targets for therapeutic intervention.

The objective of Transic, presented by the Institut Curie, is to improve and implement structures with the aim of allowing a rapid and efficient translation of knowledge in cancer biology into medical cancer applications. TRANSIC also has ambitious objectives in education, notably through core courses in translational research. The ideal location for this ambitious project is the building presently occupied by ENSCP, which is to become available when ENSCP moves into the future Paris Institute for Chemical Engineering. New research facilities will be provided by the IDEX from 2017 on.

Detailed IDEX actions: creating a specific Centre of "Mesoscopic Biology"

- The aim of the project is to combine multiple scientific communities in a synergetic manner so as to study the molecular organisation of living beings. Direct visualization of molecular behaviour using molecular imaging has provided evidence for the unexpected but predominant role of stochastic processes and weak interactions in biological regulation. These phenomena, which occur over distances of a few nanometers, define Mesoscopic Biology.
- This research opens new perspectives in numerous fields of biology, in particular in the

understanding of the stability of genomes and regulation of gene expression but also for enzymology in cellulo, molecular pharmacology, immunology, carcinogenesis and neuronal transmission and signaling. Currently, no research structure exists in Europe that is dedicated to addressing in a multidisciplinary and systematic manner this new domain of biology between molecules and organelles. It would represent a centre of excellence in the development and application of new instrumentation. Such a structure would be original and innovative. To succeed, it is imperative for it to be situated in an environment where the multiple disciplines exist and to which the best researchers can be attracted. The potential partners of this centre are mostly members of the IDEX perimeter including the departments of Biology, Physics and Chemistry of the ENS. The Observatoire de Paris and the Ecole des Mines (for adaptive optics and image analysis), as well as INRIA (for signal analysis) will be natural partners.

Key IDEX projects:

- Creation of the Centre on Rationalities and Human Behaviour supported by:
  - One coordinator position
  - 4 invited professorships
  - Eight post doctoral positions per year
  - Creation of seminar rooms and offices

Funding requested: 5 040 KEUR for four years and 12 600 KEUR for ten years

CENTRE FOR THE STUDY OF RATIONALITIES AND HUMAN BEHAVIOUR

The third transversal research initiative promoted by PSL★ has for main object the study of human beings in societies. It is therefore at the interface between Humanities, Social Sciences and Management, but also Cognitive, Natural and Formal Sciences.

The Centre for the Study of Rationalities and Human Behaviour will be a light structure: the aim is by no means to supplant disciplinary research, but rather to create the material and institutional conditions to empower disciplinary research in a place devoted to work at the interface of disciplinary fields. The Centre will not impose themes but let researchers define, from the bottom, pertinent collaborations in order to study objects requiring the common effort of different disciplinary fields. In this way, the Centre is similar to initiatives such as the Centre for Humanities of Stanford University or the AHRC Centre for the Evolution of Culture Diversity of UCL.

The Centre on Rationalities and Human Behavior will be structured around topics of social interest requiring the attention and study of various disciplinary fields, with different tools, concepts and methodologies.

Empirical research will be based on four methodological approaches: modelling tools, experimentations, reflexive ethnography and historical methodology. Each of them raises ethical and epistemological issues. Are models useful to think human history? Which kinds of experiments are allowed within human populations? How could reflexive ethnography be generalized? Is historical knowledge specifically different from scientific study of processes and dynamics?

During the first four years, the main areas of research will be structured around the following topics, which are due to evolve according to the development of research and social needs.

1) Economic rationality and practical rationalities

The assumption of a universal and a-historical rationality is often an implicit premise in economics, even if the characteristics of human rationality have long been an object of debate. However, both economic history and economic anthropology have suggested either the succession or the coexistence of different practical rationalities. Empirical studies will be conducted in order to test the existence of different individual rationalities within different institutional frameworks and to describe cognitive boundaries and institutional boundary-work. At each moment of history, one of these

rationalities tends to be considered as a normative one and to overwhelm the very perception of other rationalities.

The research groups involved include 3 departments of the ENS (the department of Social Sciences, the department of Philosophy with the CIRPHLES and the department of Cognitive Studies) as well as the Paris School of Economics, economists at UPD, the Centre Maurice Halbwachs, the LAS at Collège de France and IRISSO at the UPD and the Collège de France.

The double dimension, both thematic and strongly methodological, of this research programme gives it an important role in the research project of PSL★. One of the applications of these research projects on rationality and decision, in particular in economy and finance but also in political sciences and in ethnographical case-studies, is the understanding of crisis as a moment of time where previous cognitive schemes are irrelevant.

2) Exchanges, organisations and networks

Exchanges are at the core of the processes of globalisation of economies, cultures and communications. A better understanding of this phenomenon and of its implications depends on a comprehensive study of its precise modalities and historical development at different periods in time. Such a topic requires a transdisciplinary approach involving economists, specialists of management, historians of technology, anthropologists, archaeologists, linguists, philosophers and sociologists. This research direction will expand on the two LABEX in Human and Social Sciences proposed by PSL★ institutions (TransferS and Risques).

The LABEX “TransferS” will be the core research-centre on material and symbolic exchanges in both a synchronic and diachronic perspective; it will put into light the process of cultural import and its reinterpretation/remodelling in a new context.

The LABEX “Risques” will study the many ways in which risk is displaced and shared. Through the association with UPD Laboratories and thanks to interactions with the Paris School of Economics, the IDEX will enlarge this research to economics and organisation theory, and other transversal research themes like Environment, in particular through a comparative analysis of economic tools for environment protection, and historical description of the ways these tools enter national and transnational organisations.

3) Perceptions, disabilities and socialisation

One of the biggest challenges for the research at the interface between Social Sciences and Cognitive Sciences is to understand how human bodies are both cultural and biological facts. Two main research directions will be chosen to improve our understanding of human perceptions and movements: competitive sports on the one hand, disabilities on the other. Social and cognitive anthropology is at the core of the study of these “techniques of the body”, where cognitive research is being used either as a way of achievement or as a compensation tool.

A first stage will be to find out how cognitive experiments could test sociological assumptions on sportive competition practices, in particular the existence of cultural differences between individual perceptions linked to more or less efficient movements. A second stage will be to grasp perceptions of disabled people through a comprehensive study of their everyday life experiences. If three kinds of disabilities have to be strongly differentiated (reduced mobility, sensory deprivation, cognitive deficits), the study of their interconnections could help to understand the links between perception, movement and cognition. Three partners will cooperate on these topics : the LAS (Collège de France), the Department of Cognitive sciences (ENS) and the Department of Social Sciences through the Chair on Mental Disability at the new Maison des Sciences sociales du handicap in Paris.

Key IDEX achievements:

- Creation of the Centre on rationalities and human behaviour supported by:
  - One coordinator position
  - 4 invited professorships
  - Eight post doctoral positions per year
  - Creation of seminar rooms and offices

Funding requested: 5 040 KEUR for four years and 12 600 KEUR for ten years

3.2 EDUCATIONAL STRATEGY

THE EDUCATIONAL MODEL OF PSL★: TRAINING THROUGH RESEARCH

PSL★ aims to define a new type of high level education, adapted to the specific needs of our time. This educative model will foster critical thinking, encourage well structured yet open minded professionals, train students to be innovative and give them the general intellectual skills necessary to adapt rapidly to new fields. PSL★ students will thus be able to respond in a creative and flexible way to the challenges of contemporary societies, whatever their professional orientation.

By encouraging such minds, our country will transform its scientific potential into a strength for innovation and a source for future growth.

The educational offer of PSL★ covers all the major academic disciplinary fields, from the Humanities and Social Sciences to the Natural and Formal Sciences, and beyond to Management, Cognitive Sciences and Creative and Performing Arts. However, in every one of these fields, all the institutions of PSL★ share a common approach, which can be defined as follows:

- A clear orientation towards graduate studies, with an exceptional graduate/undergraduate ratio.
- A demanding and carefully designed process of selection based either on competitive exams or on written applications and interviews, in order to screen and select the students who can best benefit from formation through research.
- A pedagogical method based on student tutoring, made possible by the very high student/professor ratio (1,2).
- A systematic and well-established practice of education through research, which encourages students to think in an innovative manner.
- A close relation between research teams and educative programmes.
- An emphasis on key intellectual and scientific abilities (argumentation and expression).
- A strong emphasis on the importance of a comprehensive education (characteristic for example of the Diplôme of the ENS and the ESPCI educative programme, which encourage students to take classes in other disciplinary fields).

These characteristics make PSL IDEX institutions extremely competitive on the international scene since they correspond to the main criteria of excellence in education, taken into account by the major international ranking systems, and clearly position PSL★ as a leading Research University.

PSL★ will take full advantage of this expertise to offer a comprehensive and innovative educative programme. It will be aimed at all the students within the excellence perimeter of PSL★, that is at all the students of ENS, ESPCI, ENSCP, Observatoire, Collège de France, as well as students enrolled in selected curricula of Paris-Dauphine University, and graduate students from the Schools of Creative Arts.

PSL★ institutions consider equal opportunity of access to the best higher education as one of their missions. A consistent effort will therefore be made so as to promote students from socially and culturally underprivileged areas notably by proposing bridges between curricula in order to attract and

enrol them, without this implying a lowering of the extremely high standards expected. All students having the capacity to benefit from a high-level training through research will be welcome independently of their scholarly background.

The educative programme will thus affect a diverse student population, the total number of which corresponds closely to that of leading world-class universities (8200 students within the perimeter of excellence). Its transformative effect will be visible in the short term since it will also encompass all levels from undergraduate studies to doctorate and all academic disciplinary fields represented in PSL IDEX. Furthermore, it will impact on the career strategy of students and in the mid-term on a wide range of professions since the different institutions of PSL★ train: (a) researchers and innovators in all fields; (b) engineers (ENSCP, ESCPI); (c) highly qualified public servants, managers and administrators (ENS, UPD); (d) creative and performing artists (ENSAD, ENSBA, CNSMDP, CNSAD).

Finally, the new educative model of PSL IDEX will answer a number of major challenges by giving a clear coherence to the educative offer, increasing its visibility on the international scene and focussing it in an explicit way to the social and economic needs of the country.

The educative programme of PSL★ is articulated around four main projects:

- Creating a Leading Program for Graduate Studies.
- Creating a Pluridisciplinary Undergraduate Degree.
- Developing Research Education for Executives
- Offering a Research Diploma in Creative Art / Science

These projects will notably involve creating a Graduate Program encompassing PSL★, offering new courses and developing existing relations with the business world and no-profit economic sector and increasing in a targeted manner and in specific disciplinary fields the total number of students. They also require a strong concerted effort on five transversal principles: equal opportunity, quality evaluation, international strategy, campus life and online educative offer.

PSL★ MAIN PROJECTS

Project 1. A leading Graduate Programme (Masters and Doctorates)

Ambition:

Like all Research Universities, PSL★ focuses primarily on graduate education. It is already characterised by a high proportion of graduate students, a unique ratio of professor/student and a privileged scientific environment, but needs to maximise this potential. This will be achieved by ensuring coherence between the educative programmes of the different institutions, creating graduate programmes encompassing the existing masters and Écoles Doctorales active on the PSL★ perimeter and giving them additional value, focusing on increasing visibility so as to attract the best students, increasing relations with the business world and society and providing common scientific services and utilities services. In order to achieve these aims, PSL★ will focus on the following actions:

A new common educative programme

The PSL★ framework will propose new inter-institutional curricula and will also allow students to profit from the synergies between institutions by enabling them to combine existing educative offers.

Courses offered by the institutions of PSL★ will progressively be opened to students from other institutions and, in certain cases, directly integrated into their curricula. This will give students access to a wide range of complementary courses from other disciplinary fields. The coherence of their individual educational curricula will be guaranteed by close individual tutorship and by the specific diploma for which they are studying.

- This increased flexibility will notably enable a much greater emphasis on courses in topics such as management, decision making, economy and law (offered by the UPD), which are a key

aspect of the training of elites and which were so far lacking in most institutions of PSL.

- A number of trans-institutional courses will be created, notably at the Master level, by pooling teaching resources between the different institutions. These courses will be designed specifically to profit from the dynamism offered by the Labex projects submitted by PSL★ and other research initiatives implemented in the PSL★ framework (examples include a Masters based on the Labex TransferS and ChemVivo).
- Priority will be given to new courses, with transdisciplinary perspectives, open to a wide public such as the Training in Cancer and Translational Research for students and physicians proposed by the Institut Curie.
- A common PSL★ board of graduate education will be created for concertation and review and so as to guarantee a maximal visibility of each initiative.

For instance, a student-engineer at the ENSCP Chimie-ParisTech, acquiring a major in Metallurgy, will be able to follow courses in Social Sciences offered by the ENS or the UPD, about social impact and issues related to energy and resources.

PSL★ Graduate Centre

The Graduate Centre will be at the heart of the educative experience of all PSL★ students. It will offer a comprehensive range of services, ensure optimal integration into the PSL★ community and pool existing resources of individual institutions. Key services will include:

- Comprehensive information on PSL★ educative and research programmes as well as studying abroad and post-doctoral grants.
- A Research Centre with seminars in economy, management and finance aimed at developing the skills of decision-making, advice on writing papers and PhDs, material resources and a space in which students will regularly present and discuss their work.
- A Teaching Centre providing support for Teaching Assistants.
- A wide offer of foreign language courses.
- A Career Service providing advice on general career strategy, writing curriculum vitae and applications, mock interviews and placement committee.

Life on Campus services including: health resources: doctors, psychologists; access to libraries, sport and leisure facilities; a cafeteria and convivial space.

The PSL★ Graduate Centre will collaborate closely with the business world and with public administration so as to offer students a direct relation with their future work environment and to ensure that business and administration actors are aware of what is happening on the PSL IDEX campus and of what kind of competencies they can find there.

It will be highly visible both online and in the PSL★ campus and will organise events (PSL★ graduation day) as well as give out distinctions such as a yearly PhD PSL★ award**.**

Matching student numbers to research potential and social needs

The excellence of Research Universities depends directly on the close articulation between education and research. It is therefore logical for PSL★ to define optimal student numbers both by the research potential and the career perspectives of specific disciplinary fields. Over the long term, PSL★ will therefore closely monitor student numbers, research potential and social needs so as to ensure that they remain as balanced as possible. Currently, the strength of PSL★ research teams allows for an increase in the number of students in fields such as computer science, physics, biology and economy, domains in which a critical number of creative students is decisive for future growth. During the first

phase of implementation of the IDEX, we therefore plan to:

- Increase the number of students in a targeted manner and in disciplinary fields identified as having a good potential for growth, such as computer science (where numbers will be more than doubled), engineering and economy (c. 50 students).
- Increase the educative offer in disciplinary fields with a high research output (certain domains of physics, geosciences, biology) and especially in emerging interdisciplinary fields (c. 50 students).
- Increase the educative offer at the interface of medicine and translational research, the number of students in medicine and doctoral students (c. 8 students)
- Other actions described below will secure the recruitment of c. 100 foreign students (mainly at doctorate level).

Depending on the success of these measures, the perimeter of excellence will be stabilised at around c. 9 000 students, maintaining the professor/student ratio at a level that guarantees the quality of the educative process. These measures entail an increase in the number of grants and an increase in the admission flux (notably for foreign students). In no case will they imply a lowering of our standards in terms of education.

Project 2. Creating a common pluridisciplinary undergraduate cycle

Ambition:

To create an undergraduate curriculum will enable PSL★ (1) to offer a complete university cycle, from first year through to PhD; (2) to test pilot programmes; (3) to develop equal opportunity initiatives with high schools throughout France.

This new undergraduate course, based on a comprehensive approach, will offer an alternative to the classical training by universities or "*classes préparatoires*". It will be perfectly adapted to students who do not want to specialize too rapidly, or enter the "*classes préparatoires*".

Aimed at a true *éducation de l'esprit*, this undergraduate cycle will be available in different modalities. It will rely on the same principles as the graduate cycles of PSL★ institution: the combination of disciplinary excellence, multidisciplinary approaches, and an education geared towards producing innovative specialists with critical mindsets. It will adapt the open pedagogical model of programmes such as the "Core Curriculum" at Columbia University to French higher education and will profit from the experience acquired by the UPD, thanks to their pluridisciplinary Licence "Sciences de la Société".

At the end of the cycle, students will obtain the PSL undergraduate diploma, one or two "Licence" in specific disciplinary fields and will be able to apply for admission to PSL★ institutions and affiliated schools. Besides, at each stage of the programme, bridges will be established to and from *classes préparatoires*.

Pluridisciplinary Degree

The main project will combine an education in human and social sciences with one in natural and formal sciences. It will allow students to acquire key skills thanks to original and individualized pedagogical methods relying on tutoring and the acquisition of a good general knowledge.

The curriculum will be basically structured as following:

- 2 semesters of foundation courses in sciences, humanities and foreign languages,
- 4 semesters of progressive specialization, organised around various curricula: (a) Life Sciences; (b) Mathematics and Computer Science; (c) Sciences of Matter; (d) Humanities and Social Sciences; (e) Management and Economy.

The student selection process will be based both on academic results in high school, and on

motivation and ambition. This requires working continuously with high school principals for a better screening of students, along with an equal opportunity concern.

The first year of implementation will function as a pilot phase and develop the project with a limited number of students. It will rely on professors of PSL★ institutions in the various disciplinary fields, as well as on graduate and postgraduate students for tutoring. During this first stage, the offer will be refined according to the needs and results.

During the second stage, after 3 years, the project will be enlarged, so as to reach several hundred students per year after 10 years. Branches will be developed in other cities such as Toulouse.

The principle of pluridisciplinary training will be reinforced at the L3 level of PSL★ institutions by (a) including other complementary disciplinary fields into the traditional curricula and in particular encouraging the extension of the interdisciplinary principle to the *Classes Préparatoires* (b) offering various double Licence diplomas between partner institutions, by pooling courses, for example with the licence cycle of the UPD on social sciences and management.

ESPCI and ENSCP students will be able to complement their education by following a secondary specialisation within their undergraduate cycle in one of the domains offered by the pluridisciplinary degree course.

Project 3. Research Education for Executives

Ambition:

To promote education by research not only for the academic world but for managers and administrators, with an emphasis on promoting the interaction between the business world, academic research, high level executives and students.

In France, Leading Executives, Managers and Decision Makers are traditionally trained by the "*écoles d'application*", such as the ENA or Polytechnique, which promote expertise in law, public finances, applied economy and engineering as well as public management. This educative programme has demonstrated its value. But the emergence of a knowledge-based economy, emphasising creativity and innovation also requires a new type of executive manager and decision-maker. This need is not yet met and PSL★ members considers that this is one of the reasons for the competitive disadvantage of France compared to the USA, where the best students are trained for innovation and a research PhD is a highly valued diploma in both the business world and public administration. PSL★ will therefore promote three major actions, which will be applied both in initial and continuing education. These actions will profit from the clear synergy between the research excellence of PSL institutions and the experience of the UPD, which trains every year 1300 executives in 12 different countries.

Intensive courses and Research for Executives

Highly selective intensive courses on specific topics will be offered to both PSL★ students and leading decision makers, managers and executives. These courses will change on a yearly basis depending on the rapidly evolving demand, and take advantage of the different fields of expertise of the PSL★ institutions. The programmes will enable the acquisition of precise thematic skills (for instance in chemistry, or energy); or the acquisition of methods (management). They will last from two days to one week and will cover topics such as:

- Challenges of environment and climate change
- Corporate responsibility (with theoretical courses in history, social sciences, management and moral philosophy along with practical modules and case studies)
- Research management (with courses on methodologies of research and management)

Course on "Corporate Responsibility"

The first decade of the 21st century revealed a gap in the training of elite managers and decision-makers, namely a training on responsibility. This programme will combine theoretical courses in history, social sciences, management and moral philosophy with practical modules and case-studies.

The courses will take place in PSL★ buildings and participants will be invited to observe the ongoing research conducted in the laboratories of the different institutions, thus fortifying the relations between research and the corporate world.

An office for relations with the business world will be created, so as to ensure that executives and managers can contact PSL★ institutions to answer specific requirements. This office will also serve to further develop relations with the private sector.

Specific Modules and courses

PSL★ members are convinced that the best students in the country should be more active in the economy. To encourage them to move from research towards the corporate world, PSL★ will offer course modules on management and administrative skills for all students.

PSL★ will thus propose a specific Master level course based on the UPD's Masters for continuing education in Management and Finance but oriented specifically to train creative minds and leading scholars (c. year 3 or 4).

PSL★ will also build on their expertise in continuing education to develop this offer. This will be possible notably thanks to the experience of the Collège de France for which it is a fundamental mission, but also the Université Paris-Dauphine, along with the Observatoire which has always been active towards high school teachers and students (for instance, internships in the framework of "Plans académiques de formations", or "Sciences à l'école" programmes).

Knowledge validation

Numerous former students and doctors from PSL★ institutions have a long experience in public administration, through internships or work experience. But they are too frequently limited in their career opportunities because they are not *alumni* of the "*écoles d'application*". PSL★ wants to challenge this state of affairs by validating their knowledge and competences acquired through experience, and thus showing that they are perfectly apt for all kinds of position in public administration or the business world, with the incomparable advantage of also holding a PhD.

A highly-qualified committee will be set up, with over half its members from outside PSL★. It will deliver both a validation of knowledge acquired and recommendations for short- or long-term courses to complement this knowledge.

Project 4. Experimental Centre "Science-Art-Création-REcherche" (SACRE)

Ambition:

To create a new transversal doctoral research curriculum at the intersection between the Creative Arts and Science.

Context: Over the past 15 years, the most important French schools of creative and performing art and design (ENSAD, ENSBA, CNSMDP, CNSAD) have developed ambitious research programs and a fruitful cooperation with the ENS, involving common projects, seminars and exchanges. Three of these schools (ENSAD, ENSBA, CNSMDP) have integrated the European "LMD" system (Bachelor-Master-Doctorate). The four schools want to deliver doctoral diplomas comparable to the PhD's in Creative and Performing Arts of Northern European and American institutions such as Saint Martins College in London, Berkeley or Stanford.

Project: PSL and the four major schools of creative and performing arts have decided to reinforce their cooperation within PSL★ by creating a new experimental Centre "*Science-Art-Création-REcherche*" (SACRE). SACRE will create a research program which will deliver a Diploma in Creative Art/Science, equivalent to a PhD. It will thus bring together French and international doctoral students, post-docs, professors and highly qualified persons in Creative, Performing Arts, Design and Science. It will be based on interactions between creative practices and theoretical reflection, and will cover all artistic fields (intermediality) as well as their interactions not only with the humanities and social sciences but also with natural, formal and cognitive sciences. The Centre's objective is therefore to develop a new kind of research at the interface between Art and Science.

Implementation

- Development of cooperation and bilateral programs between PSL★ and the 4 major schools of Creative Arts located in Paris; preparation of a common transdisciplinary project (theme for June 2011: "Acceleration");
- Creation of an experimental Centre "*Science-Art-Création-REcherche*" (SACRE) for research in creative fields. Different possible locations have been considered in or around Paris.
- Common conceptualization of a Doctoral Research Diploma in Creative Art/Science equivalent to the PhD. Through this program, PSL★ will fund:
  - 27 doctoral contracts within 3 years: 8 to 10 each year;
  - 4 to 6 one-year contracts for French and international post-docs and highly qualified creative and performing artists in residence and scientists;
  - Conferences, seminars and workshops, necessary for fostering a common culture between creative artists and researchers in science.

The geographical proximity of PSL and the ENSAD will also contribute to the dynamics of the PSL★ Campus (see below).

PSL★ TRANSVERSAL PRINCIPLES

Each of the above described projects will be implemented in accordance with the highest international standards. However the real test for the success of PSL★ will be the development of a true educative spirit, geared by transversal principles which will ensure that all educative programmes are evaluated, equal opportunity access is reinforced, international visibility is optimized, that an integrated campus is created and online teaching is developed. As such, these principles will have an impact on the perimeter of excellence and beyond this perimeter, on the entirety of each institution.

Transversal Principle 1: Reinforcing Quality Evaluation

A common practice in major universities worldwide, the evaluation of teaching is too often a weakness in French Education. PSL★ will develop a common evaluation process improving on the already existing ones. This assessment policy will apply to all courses who are part of the Perimeter of Excellence. This will imply traditional tools such as standardised questionnaires but also more innovative ones for a French setting such as offering future students access to comments by previous students and implementing a systematic process of outside evaluation to supplement that already undertaken by AERES. It will take into account not only the educative programmes but also their value to society and their professional perspectives.

Transversal Principle 2: Strengthening equal opportunity.

Despite being highly selective, PSL★ institutions are strongly involved in programmes such as "Cordées de la réussite" (for instance TALENS at the ENS) and "Sciences à l'école", with numerous students implicated in tutoring high school students. They also organise summer schools so as to

promote contacts between less privileged students and institutions of higher education ("Paris Montagne") and work with high schools throughout France to promote equal opportunity of access.

PSL★ will reinforce these initiatives by pooling them at the level of PSL★, thus offering potential students a much wider range of educative programmes.

Transversal Principle 3: Developing International Relations

The promotion of PSL★ on a world level is essential for being recognized as a leading international institution. Even if a specific chapter on International Relations is included hereunder, it is important to recall briefly the two main projects, which will affect Education:

1. To teach courses in English from the Master level up.

2. To create privileged partnerships with a limited number of clearly identified major research universities such as MIT, Princeton, Imperial College, New York University, Cambridge UK, Oxford, Northwestern, U Penn, Beida, Doshisha, Kyoto, IIS Bangalore, etc.

Transversal Principle 4: Promoting Campus Life

The creation of an integrated campus is an important aim of PSL★ and is described hereunder in the chapter on Campus Life.

Transversal Principle 5: Creating Online Educative Programmes

The development of Online Educative programmes is an important PSL★ project. In the mid term, all teachers will be required to propose an online version of their lessons in English for all courses relevant to PSL★. This topic is described hereunder in the chapter on LiberLabo.

3.3 KNOWLEDGE DISSEMINATION: CONNECTING KNOWLEDGE, RESOURCES AND SOCIETY

AMBITION

The individual institutions of PSL★ have all had a long standing role in the process of Knowledge Creation (as leading Research Institutions), Preservation (in their archives and libraries) and Transfer (both between scholars and between the academia and society), but have so far followed individual policies of Knowledge Dissemination.

As part of PSL★ they will pool their resources and projects in order to implement three initiatives, which will increase knowledge dissemination: 1) a common network, the "LiberLabo", which will provide multi-support resources and innovative services, 2) a common exhibition and valorization space, the "FaberLabo" and 3) a shared web portal.

These three initiatives are based both on a number of shared concepts such as the existence of an essential *continuum* between academic research activity, reading, writing, prescription and assessment and the importance of taking into account all possible uses of knowledge from the conceptual (new perspectives or attitudes) to the instrumental (new or modified practices).

They will enable a better connection between the institutions and the research community and ensure an optimal data, information and knowledge. They will also provide researchers and students with resources to face the rapid evolution of scientific publication forms and outcomes (such as open access initiative, metadata and hypertext quality, assessment process, etc.).

DETAILED PROJECTS

<u>The "LiberLabo"</u>

The libraries and archives of PSL★ are extremely rich (more than 2 million books, over 3km of archives and 30 000 numerical resources) but their use needs to be optimized by reinforcing the link

between users and staff, between scholars and the general public and by offering state of the art services and technologies.

The first aim of the LiberLabo is to implement well-established interoperability standards for catalogues, which will enable the creation of meta-catalogues encompassing the holdings of all institutions and enable published information to be linked with archival material and with research data produced by PSL★.

This will make it possible to provide unified virtual access to all resources of PSL★ (see below) and to ensure a much wider access for the scientific community and the general public. These initiatives will logically be based on international standards so as to fully integrate the libraries of PSL★ into common European initiatives such as OPENAIRE (Open Access Infrastructure for research in Europe), LIBER (Association of European Research Libraries) and the digital platform Europeana. Archives of all digital material will be preserved through collaborations with large scale initiatives such as the TGE Adonis and Cap Digital initiatives

The LiberLabo will also promote a common corporate image for the libraries and archives of PSL★, such as a materialized path in the Quartier Latin to guide users within the documentation corpus of the PSL Research University.

Within the libraries themselves, spaces will be open to encourage the read-write-select-diffuse process amongst users, by adapting and developing the well established Anglo-Saxon model of Writing Centres. New services based on “just-in-time and just for you assistance” will be provided both *in situ* and on line.

The “FaberLabo”

In order to capitalize on its heritage and research activity, PSL★ will create an exhibition space, open to the General Public. This new space will fulfill the following objectives:

- Present the rich heritage (35 000 objects) of the different institutions (in particular the unique historical astronomical instruments of the Observatoire).
- Host temporary exhibitions (2 to 4 per year) linked to the scientific activity of PSL★.
- Develop research projects with the Schools of Creative Art.
- Host events and conferences to promote scientific culture and research.
- Undertake education actions with primary and secondary schools, in collaboration with the local authorities.

Common Web Portal

The Web Portal of PSL★ will provide a platform for knowledge dissemination by providing a unified virtual access to all numerical resources, institutional information and news and a selected description of cutting-edge research projects.

It will also promote the definition of quality standards for on-line knowledge (scientific guarantee for digitisation processes, indexation and new editorial contents) in order to consolidate the reputation of PSL★ and establish a coherent editorial policy.

The Web Portal will maintain relations with the Cap Digital initiative, in terms of content production/broadcasting standards and archiving issues and CLEO (Centre pour l’édition électronique).

3.4 VALORIZATION AND SOCIO-ECONOMIC PARTNERSHIPS

GOAL

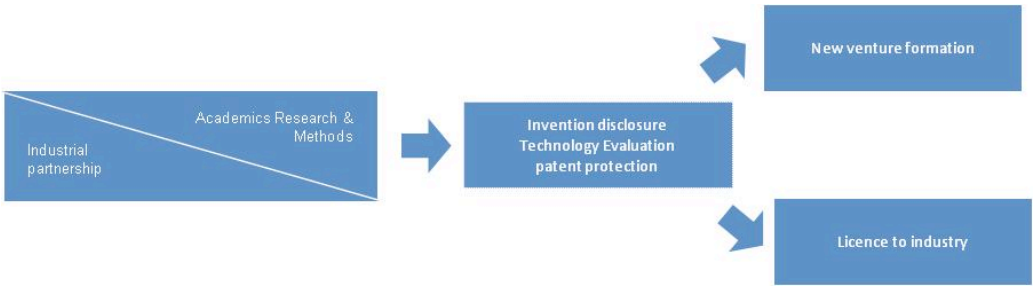
PSL★ will have an aggressive attitude in the domains of industrial property production and management, and value creation through ventures. Our scientific research has an enormous potential economic value and our current achievements give us confidence that we can successfully increase our results in this field:

- PSL and Institut Curie are at the origin of a start-up company quarterly and one patent per week.
- Fondation Pierre-Gilles de Gennes (FPGG) fosters public-and-private research projects in physics, chemistry, and biology, for the Institut Curie, ESPCI, ENS, and ENSCP. FPGG has validated this business model through the marketing of a contract R&D offer that generated €3.1 million of sales within the first 2 years of operation.
- ILB, the European center for research and development in Finance, has launched 22 chairs and research initiatives over the last 2 years for a total of €6 million/year, from private donors and government (through the philanthropy fiscal regime). 72 labels have been awarded to innovative start-ups and an accommodation program has been started.
- UPD has set up several labs in cooperation with major private companies, broadly dedicated to economics:
  - Institut pour le management de la recherche et de l'innovation (IMRI), a joint laboratory created by UPD and the Commissariat à l'énergie atomique et aux énergies alternatives (CEA) along with private partners such as Sanofi and Thales, studies research and innovation viewed as processes. This encompasses the economics and management of intellectual property rights, incentives, public policies, and venture capital.
  - Institut de Finance Dauphine (IFD) includes two chairs in finance and FiME (Finance et marchés de l'énergie), a joint laboratory of UPD - Electricité de France (EDF) – Ecole nationale supérieure de la statistique et de l'administration économique (ENSAE). FiME organises research on long lasting industrial investment in the context of changing market structure and regulation.
- Collège de France and ENS have respectively five and two sponsored chairs. These chairs are supported by socio-economic actors such Total, EADS, France Telecom, Fondation Liliane Bettencourt and Agence française de développement.
- PSL participates in the Agoranov public venture fund.

However, when compared with our potential, the level of achievement remains very uneven between different members of PSL★ and overall unsatisfactory. Our aim is to match within 10 years our capacity for scientific innovation with the creation of economic wealth, in order to reach world class level (the benchmark will be defined in the first year of the IDEX and will be based on the achievements of leading Anglo-Saxon research universities). We therefore intend to leverage the experience of the more advanced PSL★ members (e.g. ESPCI) so as to dramatically increase our global performance.

TECHNOLOGY TRANSFER VALUE CHAIN REPRESENTATION

PSL★ considers that public-and-private partnerships facilitate the transformation of discoveries into innovative applications.



A core aim of PSL IDEX is thus to induce its researchers to develop their links with private companies, from sponsored research to venture incorporation and/or licensing to industry.

This model was first promoted by some of the most prominent scientists of PSL★ such as P.G. de Gennes and G. Charpak, who both emphasised not only fundamental science but also industrial innovation. In recent years researchers such as J. Lewiner, M. Fink, J. Bibette, L. Leibler, M. Dutreix, J.L. Viovy and P. Marcus have followed their lead, thus paving the way for future expansion. This demonstrates that a true cultural change is currently underway and provides a strong incentive to younger researchers to be active in both aspects of research.

In the framework of the IDEX, PSL★ will implement this model thanks to an ambitious and dynamic policy aimed at strengthening the bonds between research and the economic world.

ONGOING ACTIONS TO FULFIL THIS OBJECTIVE

First, PSL★ will amplify existing initiatives:

- Strengthen the development of ILB: ILB's unique experience within the banking and finance arena will be leveraged by proposing sponsored research programs that will include PSL IDEX research chairs in collaboration with other PSL IDEX members.
- Capitalise on IMRI's experience: PSL★ intends to create a complete training offer in entrepreneurship for its students, teachers, and researchers. The laboratory's scope will also be expanded to include new scientific fields, for example on intellectual property in the life sciences, open source technologies, and public research policy.
- Scale up IFD's public-and-private research: IFD's research field is seen as experimental and knowledge will be extended and shared with other domains. IFD needs €300 000/year to scale up its public-and-private research, through the transformation of an existing 3-year chair into a senior chair and two additional post-doctoral positions.

NEW ACTIONS IN THE IDEX ENVIRONMENT

A number of ambitious initiatives will be launched by PSL★, or by its members in association with the IDEX. These actions will have a twofold integrative effect. First, they will integrate PSL★'s technology transfer value chain, from upstream public-and-private collaborative projects to start-up creation / IP licensing. Second, they will create synergies and/or pool resources between PSL★ members. This will leverage the experience of certain PSL★ partners and thus increase the capacity of the other partners.

- "Carnot Institutes": PSL★ is involved in two networks of laboratories that are applying for the "Carnot Institute" label from the Agence nationale de la recherche. Obtaining the label would make these networks eligible for extra government funding, based on industrial contracts, and have a transforming effect by speeding up their professionalization. The structures of both

"Carnot Institutes" are currently under study. In its minimal version, the first network will be formed by PSL IDEX labs active in chemistry – the Moisan Pole in ENSCP, and nearly all the labs of ESPCI – and will be strongly associated with the LABEX Chemvivo, Metacen and Institut Langevin. The second one will regroup PSL★'s research activities in the economy and finance fields – mostly at the ENS, ILB and UPD – along with that of other social sciences and humanities.

- Actively interact with the "Institut de recherche technologique" (IRT), Finance et Croissance Durable. This IRT is coordinated by UPD and ILB. Together with the innovation potential of PSL★, it will catalyze public-and-private initiatives and start-up creation by:
  - rethinking the way financial institutions account for the risk of scientific innovation, which is behind the current flat state of the venture capital market,
  - generating and reinforcing the ways scientists meet or become business savvy entrepreneurs,
  - supporting research and development start-ups in the field of finance, offering accommodation (nursery) and organizing or participating in fundraising.
- Setup three incubators: Three incubators will be created in the PSL IDEX environment, at the heart of its research laboratories. The Pierre-Gilles de Gennes Institute for Microfluidics will include a 1000 m^2 incubator. The Institute for Environment, to be set up in a future building in the Boulevard Jourdan site, will also include a significant share dedicated to start-up incubation. Dauphine also intends, through its own foundation, to create an incubator. These three projects will complement the existing Parisian incubator network, such as Agoranov.
- On top of these actions, PSL and Institut Curie will participate in the creation of a Parisian "Société d'accélération du transfert de technologie" (SATT). PSL actively supports the creation of a single joint venture of major universities in and around Paris aimed at managing and promoting intellectual property as well as maturing projects to give them a better chance of obtaining industrial licenses. PSL would play a major role in this joint venture.

The IDEX, catalyst of a new initiative

In addition to existing actions PSL★ will strongly reinforce its upstream public-and-private collaborative projects, by building on the FPGG and ILB models. This action will complement the creation of the two Instituts Carnot.

PSL★ will replicate FPGG's and ILB's experience in marketing industry-academia contract research towards the business world in new fields (e.g. Humanities, Mathematics, Computer Science), and extend it to all PSL★. It will similarly extend ILB's experience on building privately funded chairs to all its members. It will also coordinate the structures dedicated to this activity that already exist within PSL★ (e.g. at Institut Curie, Observatoire de Paris, ENS, UPD, ILB).

PSL★ will allocate €700 000/year from its IDEX funding to catalyze public-and-private research projects. A reasonable leverage target of public funds to the amount of private sponsored research would be a factor of 10.

Indicators of performance and objectives at four years:

- Stabilize the number of patents in a range of 80 to 100 per year for the PSL★ perimeter
- Reach the objective of 10 start ups and social ventures created per year within PSL★
- Increase the value of sponsored research to 3 % for the consolidated research perimeter

3.5 INTERNATIONAL

The institutions of PSL★ are well aware that the best international strategy relies in continuous improvement of their performances, which is the key of their international attractiveness and visibility.

As a result of their constant effort towards excellence, all institutions of PSL«already have a strong international presence thanks to 1) numerous relations between research teams on specific research topics, 2) exchange programmes for students and 3) numerous invited fellowships and professorships. This international network finds its expression in agreements and memorandums of understanding with the most prestigious universities such as Harvard, Oxford, Cambridge, Nankin, Fudan, Waseda and many more. Besides, each of the institutions of PSL★ has developed a number of more formal projects, including numerous joint degrees.

PSL★ can thus capitalize on dynamic international activities, a clear capacity of attraction and numerous research and educative agreements with institutions worldwide. In spite of these existing assets, there is a strong need to develop a coherent and truly ambitious international strategy at the level of PSL★ itself. The IDEX offers the possibility of changing scale and thus acquiring a visibility amongst the general public comparable to that of other prominent Research Universities.

In general, this overall strategy will profit from the bottom-up dynamic characteristic of current international relations which are the base of all successful initiatives of this type.

This explains why PSL★ considers International Relations as an area where the IDEX can have a strong impact.

- Almost 200 foreign professors invited each year on annual and short-term positions
- Almost 500 foreign students admitted each year including more than 120 doctoral students
- Almost 400 foreign post-doctoral fellows integrated each year in the laboratories
- Many European (ERC and others) and international research contracts active on PSL★ Campus
- International summer schools for senior undergraduate students
- Extensive exchange program (All the students of ENS, ESPCI, ENSCP and ENSAD make an internship abroad during their scholarship (ERASMUS, exchange programs 'Athens' and "Idea League') and similar numbers of foreign students spend time at PSL★ institutions.
- Several international diplomas (Erasmus programs, Master "Europhilosophie" Erasmus Mundus...)
- Graduating programs abroad such as the European Master of ENS or Masters with China for ENSCP and ESPCI
- Participation in European and international research programs (PCRDT, TGIR, LEA, LIA)
- Around forty professors on PSL IDEX Campus are members of foreign academies
- Memorandum of understanding with hundreds of institutions in countries worldwide (over 100 for the ENS, 180 for the UPD, etc.)
- Active fieldwork projects on all five continents

OFFICE FOR INTERNATIONAL RELATIONS

The other key project of PSL★ will be to create an **Office for International Relations**. In its initial phase, the unit will mostly draw its resources from the existing Offices for International Relations of the different PSL★ partners. Each of these Offices will remain in charge of specific projects, based on their expertise. The office will however rapidly be enlarged and reinforced, so that by the end of the first four years it will be responsible for PSL★'s international relations and everything connected with them. The office will notably coordinate the following major initiatives:

Partnerships and alliances for increasing international Visibility

- The International Office will coordinate, pool and broaden the existing partnerships with universities and research institutions throughout the world. It will ensure that initiatives are visible (website, network approach, etc.) and promote the PSL★ corporate identity abroad, in particular to potential students

- PSL★ will integrate a major alliance of Research Universities, like IARU, which gathers 10 of the world's leading research universities (ANU, ETH Zurich, National University of Singapore, Peking University, University of Berkeley, University of Cambridge, University of Oxford, University of Tokyo and Yale University).

Support Services Platform

The International Office will advise and mentor both incoming and outgoing students and staff.

- Incoming staff and students. PSL★ partners will aim to provide optimal conditions for living and working (studying or teaching) and a range of services meant to ease researchers and students everyday life. Services will notably include a "help and information unit" dedicated to administrative matters (housing, credits, grants, visas, etc.) and intensive French as a foreign language courses.

  Welcome sessions will be organized in July and August for foreign students and post-doctoral researchers offering French language courses, courses of methodology, visits to the campus, introduction to French culture and discovery of Paris

- Outgoing staff and students. The International Office will advise and mentor students on opportunities for study abroad and grants for foreign exchange visits as well as providing first-hand information on partner universities. It will also offer foreign language courses (or orient applicants towards existing ones)

Educative Activity

- PSL★ will increase the educative offer in English at a Master and Doctoral Level so as to be internationally competitive and to be able to attract students who do not speak French.
- Extend the ENS summer school program to the other PSL★ institutions; organize interdisciplinary sessions for undergraduate and graduate students to promote PSL★ masters and doctorate programs (for example, the INRIA-ENS project "Computer Vision and Machine Learning", in July 2011)

Diffusion of PSL★ Activities

PSL★ will open a worldwide digital campus offering academic contents in English and in other languages to the web community and based on the experience of the Collège de France (9,000,000 items downloaded on the website in 2009). This digital campus will be based on the Liberlabo and will notably offer content about state-of-the-art research and the latest debates in English; enable local and international partners to share their concern on research and education with the global community; display all the classes taught at the Collège de France on the internet within four years and documentation about all the classes taught at other institutions. With the aim of achieving a complete digital archive of all educative activity within 10 years, possibly with real-time screening.

Setting up specific actions abroad

Specific actions will focus on emerging countries and notably on the BRIC countries so as to ensure that PSL★ is optimally placed in what are already and will increasingly be key centres of research and education:

- Allocation of PSL★ funds to create 4 chairs for foreign scholars and lecturers (with a strong equal opportunities policy directed at emerging countries). These positions will be filled on the basis of a common PSL★ procedure.

- Allocation of 10 PSL★ international fellowships to be awarded to outstanding students (pre-doctoral and doctoral) and post-doctoral researchers on the basis of a common PSL★ procedure (with a strong equal opportunities policy directed at emerging countries).
- Open permanent joint-offices in collaboration with partner universities of the International Alliance on the one hand and other leading French Institutions of Higher Education and Research (such as the other recipients of an IDEX award) in key markets such as China, India and North America
- Participate in major international education fairs and annual networking conferences

Increase the presence of PSL★ in the 'European Research Area'

In the field of European research and education, PSL★ institutions will notably:

- Coordinate their skills and resources devoted to relations with the European Union institutions in Brussels in research, technology, innovation and training.
- Ensure deeper PSL★ integration into the "European Research Area" and systematic application of European recommendations on Higher Education and Research.
- Disseminate information about European programs and calls for proposals, and ensure that all PSL positions are widely advertised within the EU
- Provide help and guidance to potential applicants from PSL★ (this includes expertise in project writing and possible legal and administrative support), and assist applicants from the EU with administrative procedures
- Promote agreements with other EU institutions

PSL★ will also aim to join CLORA (Club of associated research organisations) with the objective of establishing a permanent representation of PSL★ institutions in Brussels.

CENTRE FOR ADVANCED RESEARCH IN PARIS

As a key action for its international strategy, PSL★ will create a Centre for Advanced Research on the highest international standards, whose mission will be to strengthen the links between PSL★ researchers and partner research teams all around the world. The Centre will be dedicated to the organization of intensive workshops, on a yearly basis with scholars and fellows in residence for a semester on a specific topic (*e.g.* moral realism, Mediterranean globalization, etc.).

3.6 CAMPUS LIFE

CREATING AN URBAN CAMPUS AT THE HEART OF THE LATIN QUARTER

An exceptional centre in the Latin Quarter, and two main extensions in the South and West of Paris

The institutions of the PRES PSL, the ENSAD and the Institut Curie are an essential part of the world-renowned "Latin Quarter" and have always contributed to its academic, social and cultural effervescence.

Beyond this perimeter, several PSL★ institutions also have locations and branches:

1. Southward, (1) on the site of Boulevard Jourdan (Paris 14th) where the Social Sciences and Economics departments of ENS are located, (2) in Meudon, where the Observatory is a major site for scientific culture in the Hauts-de-Seine area, (3) in Montrouge, where important projects are transforming the site into a residential students campus;

2. Westward, the UPD is close to La Defense. The IRT "Finance et Croissance Durable", will embody the link between both PSL★ locations, since its headquarters will be within the perimeter of headquarters, but most activities will take place at the UPD and La Défense.
3. Finally, the ENSBA, CNSAD and CNSMDP are located in the 6th, 9th and 19th arrondissements of Paris.

PSL★ will initiate a broad reflection on the reorganisation of research locations, in coherence with its research and educational strategy. It will campaign for larger research surfaces for the Institut Curie and Chimie-ParisTech (with the prospective of the AgroParisTech building) and implement strategic projects in order to create common ventures (like the Institute of Environnement on the Jourdan Campus and a Centre for Research in Creative Arts/Science).

Rue d'Ulm

Towards an integrated and highly visible territorial campus

A coherent territorial strategy is a key factor for the implementation and the success of common academic and research ventures. This "campus spirit" will also foster a sense of belonging to the neighbourhood. It will contribute to the economic revitalisation of the district (student-bookshops, cafés, restaurants, theatres) and increase the visibility of the campus. Aware of this fact, the ambition of PSL and its partners is:

1) To create an urban campus in the Latin Quarter. Well identified in the Parisian landscape, it will anchor the academic and research campus in the urban fabric, thanks to the following actions:

- Creating a physical identity with visible marks of affiliation to PSL★ Campus, and beyond, to all cultural activities affiliated to PSL★;
- Integrating the campus in the city's landscape, in partnership with the City of Paris with pedestrian roads, paths articulating one PSL building to another, identifying signs;

2) To relate this campus with the branches in Southern Paris (Jourdan, Montrouge, Meudon) and Western Paris by developing awareness of the activities that take place on them and opening PSL★ partners offices on the main campus.

This double strategy will ensure a close relationship with both the intellectual and scientific heart of Paris and the modern financial and entrepreneurial centres.

ANIMATING THE SCIENTIFIC COMMUNITY WITHIN THE CAMPUS OF PSL★

PSL★ will create a territorial community for students, researchers, staff and alumni of different schools and institutions, by creating shared spaces and activities outside classrooms and laboratories. The main actions will be:

1) Creation of a common office for PSL★ campus life, which will serve as a unique "help and information desk" for visitors, students and scholars dealing with administrative matters (housing, credits, grants, etc.) and coordinate campus events.

Place Alfred Kastler

2) Organisation of shared living spaces, such as a PSL★ faculty club and sport facilities.

3) Structuring of campus e-communication: through an internet website, mailing lists, Intranet, PSL★ newsletter with ongoing campus events, and student publications.

4) Organisation of community events, such as a "PSL★ Day" with a presentation of all PSL★

achievements and projects or meetings between doctors and researchers.

5) Creation of a unique ID card for all members of PSL★ giving access to the different services on the campus, so as to reinforce the feeling of belonging to PSL★.

CULTURAL LIFE ON CAMPUS

Culture, a showcase of academic excellence, emphasizing the heritage of centuries-old institutions

PSL★ will encourage and coordinate the various cultural actions developed by its different members, and often led by engaged students thanks to:

- Partnerships with cultural institutions (Théâtre de l'Odéon, Comédie-Française, Musée de l'Homme, Musée du Quai Branly, Cité des Sciences et de l'Industrie, Réunion des Musées Nationaux, and Centre Georges-Pompidou - several projects in discussion with IDEX-partner CNSMDP);
- Thematic workshops and conferences ("Ernest Conferences", "Les Invités d'Ulm", experimental conferences, workshops for the young public);
- Co-organisation of resident exhibitions (e.g. "Histoire scientifique de la Montagne Sainte-Geneviève") and public cultural events and valorisation of scientific patrimony (visits of the Observatoire de Paris' sites and observation of the sky).
- Organisation of a permanent exhibition on the Meudon site (in the castle) that will present the most recent results of astrophysics and other sciences, placed in their historical perspective. PSL★ as such will take part in national and European events like "Journées Européennes du Patrimoine", "Fête de la Science", "Nuit des Chercheurs" or "Nuit blanche", and will create landmark events of its own, like the "Nuit de la philosophie", or the "Nuits des Planètes".

PROMOTING SCIENTIFIC VALUES AND EQUAL ACCESS TO KNOWLEDGE

A tradition of combining opening and excellence

PSL★ will combine social openness and excellence by building on the experience in cultural dissemination of institutions such as the ENS, the Observatoire or the Collège de France in order to: (1) diffuse scientific culture and values; (2) promote equal access to science, culture and research.

- Diffusing scientific culture and values

In a world where information is widely available but unreliable, PSL★ will promote the diffusion of high quality, verifiable knowledge to a large public, thus ensuring a widespread diffusion of its core values, such as team work, scientific rigor, and rational argumentation. Amongst the projects PSL★ will organise "Portes Ouvertes" operations and develop continuous education.

- Promoting equal access to science, culture and research

PSL★ partners will promote a policy of equal opportunity thanks notably to programmes for high-school students from underprivileged backgrounds with tutorials and orientation monitoring, and the participation in programmes such as "Cordées de la réussite" (Talens programme of ENS).

Similarly, the association Paris-Montagne also contributes to the promotion of science and research by putting scientists and young people from underprivileged areas in contact. To do so, it provides high school students with lab internship opportunities, and organises a yearly Festival that gathers 1500 children at the ENS around scientific animations, exhibitions and presentations for a period of four days.

In the framework of the IDEX, this strategy of social promotion will be extended to the whole

perimeter, with specific goals.

Systematising and extending social programmes within the PSL★ perimeter:

- Creating a PSL★ "Office for equal opportunity", to unify the actions that are currently run by each institution;
- Widening the perimeter of the activities with the enrolment of more students (from 400 students to 1000 students within four years);
- Reinforcing the ongoing evaluation and assessment of equal opportunity programmes of PSL★;
- Developing in a systematic fashion the offer of conferences for a general audience;
- Widening the action of the association "La Main à la pâte" to all the partners of the IDEX.

4. GOVERNANCE, ORGANIZATION AND MANAGEMENT

4.1 GOVERNANCE

PSL★ will implement a sound, independent and efficient governance, so as to guarantee the traceability of IDEX funds, monitor the transformative effect triggered by the Excellence Initiative and an objective arbitration in case of specific disagreements.

One of the characteristics of PSL★ partnership is that it includes seven other partners in addition to the five charter members of the PRES PSL. PSL★ partners therefore propose a dedicated and independent governance structure, which will be composed in equal measure by representatives of the partners of PSL★ and representatives of the business world and society.

The proposed starting governance structure can be implemented immediately and is legally valid. The same is true of the final governance structure and of the proposed transition from one to the other, both of which have been reviewed by lawyers.

A PRAGMATIC GOVERNANCE, TO INITIATE THE IDEX PROGRAMME

During the first phase of the project, the governance will rely on the existing Fondation de Coopération Scientifique (FCS) PSL structure, which will be the administrative and legal bearer of the IDEX programme, since it is a recognized legal structure and has been approved by the Government.

The executive management of the IDEX programme will however immediately be delegated to a dedicated body: the IDEX Executive Committee, fully entitled to take all decisions with regards to the Perimeter of Excellence and its components. Half of this committee will be constituted by external members in order to guarantee an external review of the programme as well as to reinforce relations with the business world and society.

The IDEX Executive Committee will meet quarterly and will be assisted by the IDEX Steering Committee whose members will be chosen from within the Executive Committee. They will meet monthly and will be in charge of monitoring and taking decisions on operational issues.

Each project of the IDEX Programme (including the selected LABEX) will be overseen by an operational committee, which will ensure the operational management of the projects and the mobilisation of the necessary teams.

The management of the IDEX Programme will be ensured by the IDEX Programme Management Office led by an IDEX Programme Manager.

A Scientific and Advisory Board will meet yearly in order to ensure scientific control and assessment of the ongoing projects and formulate recommendations to the IDEX Executive Committee.

AN EVOLUTIVE GOVERNANCE STRUCTURE, AIMING AT REINFORCING THE LINKS BETWEEN PARTNERS

PSL★members have committed to transform the governance of the IDEX programme during the first two years of implementation of the IDEX. They plan to create a separate structure for the IDEX programme as the sole vehicle and governance body for the perimeter of excellence. The proposed structure will probably take the form of a dedicated *"Fondation Partenariale"*.

The advantage of this separate structure and the Fondation Partenariale model are numerous: it will legally allow a larger participation of representatives of the business world and will enable governance rules and voting to be fine-tuned and adapted. It will also formally guarantee the total independence of the perimeter of excellence from the PSL FCS and avoid any possible confusion between the two structures.

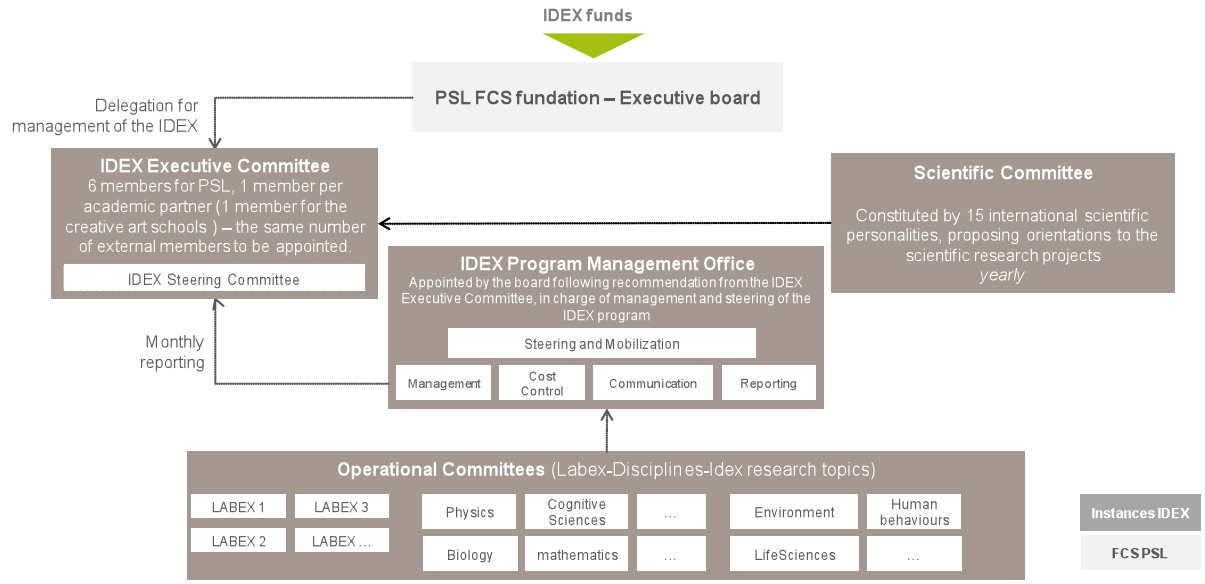
The transition period is planned to take place as follows:

- PSL★ year one: Creation of the new legal structure and definition of the transition process by the IDEX Executive Committee. Governance rules defined for the starting structure will apply to the new structure and key principles of representation will be maintained.
- PSL★ year two: Shift from the starting structure to the new structure in charge of managing the excellence perimeter. Synergies identified in the first year will be kept and reinforced in the definitive structure. Governance rules defined for the starting structure will apply to the new structure, and key principles of representation will be maintained.

The PSL★programme thus aims at building a pragmatic and reactive Programme management.

ROLES AND RESPONSIBILITIES OF THE DIFFERENT BODIES

Graphical representation of the governance (initial stage):



FCS PSL "*Conseil d'Administration*" (CA), legal recipient of the IDEX funds for the transitory period

Composed by the founding members of PSL, the *Conseil d'Administration* will delegate to the IDEX Executive Committee the responsibility and management of the IDEX programme via a change in ithe foundation's legal statuses.

The IDEX Executive Committee – quarterly meetings:

This committee is the central body of the IDEX governance. Fully empowered by the CA, it will act as the executive decision making entity of the IDEX. The IDEX Executive Committee will examine and arbitrate proposals made by the operational committees, define priorities in terms of research, formation and other projects of the excellence perimeter, manage the allocation of ressources and vote budgets. The IDEX Executive Committee will be entitled to launch new projects and to close existing ones.

The IDEX Executive Committee is constituted by the following members, each of whom will have one vote. External personalities will be nominated by the internal members

- Representatives of the IDEX partnership:
  - One representative of the FCS PSL (President of the Foundation)
  - One representative for each PSL academic institution
  - One representative for UPD,
  - One representative for Institut Curie
  - One representative for the schools of Creative Arts (ENSAD/ENSBA/ CNSMDP/CNSAD)
- External members (to be confirmed):
  - One scientific personality of international reputation : Pr Robert Darnton or Pr Detlev Ganten
  - Four representatives of the business world: Mme Béatrice Dautresme, M. André Levy Lang, M. Philippe Camus, M. Peter Thiel (tbc) or M. de Chalendar (tbc)
  - One representative of the CNRS
  - One representative of the INSERM
  - One representative of the Conseil Scientifique de Paris
  - One representative of the Conseil Scientifique de la Région Ile-de-France

The IDEX Steering Committee – monthly meetings:

The IDEX Steering Committee will be appointed by the Executive Committee and will be formed by members of this committee, including representatives all the academic partners of the IDEX. It will ensure the proper application of the decisions and guidelines of the Executive Committee.

The IDEX Programme Management Office (PMO)

Placed under the responsibility of the IDEX programme manager, the IDEX PMO will be in charge of overall management and monitoring of the programme. The IDEX programme manager, nominated by the IDEX Executive Committee, will be responsible for the actions of the excellence perimeter and coordinate information and the preparation of reports.

The Programme Management Office will:

- Organise monthly reporting to the IDEX Executive Committee and provide analysis and supporting documents to the Executive Committee.
- Be in charge of day to day management of the programme and of monitoring quality indicators and progress flowcharts of the IDEX projects;
- Attend the IDEX Executive Committee, Steering Committee meetings, and Operational Committees (with no voting rights) so as to ensure optimal overseeing of operations within the IDEX perimeter. On the basis of the budgets approved by the Executive Committee, and with the support of specific processes and tools, the Programme Manager will ensure a tight control of the expenses and the proper use of the allocated funds;
- Implement communication tools both internally and externally. It will also be responsible for the content of the IDEX website

The operational committees – monthly

The operational project committees will include representatives from the different institutions working on common projects. The committee will either correspond to the LABEX committees, or be created ad-hoc for transversal IDEX projects.

The Scientific Committee – yearly meeting

The Scientific Committee will be composed by International scientific personalities. This committee will give orientations and recommendations on scientific programs to the IDEX Executive Committee.

4.2 MANAGEMENT

The management of the IDEX programme will be centralised at the IDEX Programme Management Office. This office will implement project management tools in order to efficiently steer and monitor all actions within the perimeter of excellence.

- The IDEX programme "projects portfolio"

All the projects will be described in the IDEX projects portfolio, according to a common framework. For each project, a road map will be defined, detailing the planning, deliverables, resources and milestones towards achievement. This road map will be binding and approved by all participants. It will focus on the first 4 years of implementation and highlight the10 years target.

- Performance indicators

The IDEX programme will be managed in function of a series of performance indicators consolidated in a dashboard to be prepared by the IDEX PMO and shared with the IDEX Steering Committee on a monthly basis.

At the operational level, each project will define a set of five performance indicators, adapted to its field of implementation. These indicators will be submitted to the IDEX PMO for approval and reviewed by the IDEX Executive Committee. Indicators will include (non-exhaustive list):

  - Budget and cost monitoring: monthly reporting highlighting the expenses, estimated to completion costs, yearly forecast and cost distribution;
  - Research programmes: number of high impact factor publications, number of competitive grants (e.g. ERC);
  - Education projects: evolution of the percentage of graduate students, number of applications per position, number of student grants, quality evaluation of courses, professor evaluation;
  - Economical impact: number of private contracts, number of patents filed, number of sponsored start-ups, number of partnerships with the private sector;
  - International: number of international students, number of ERC and other international grants, signed memorandums of agreement with foreign institutions;
  - Campus Life and Social actions: number of accommodations offered, number of student and researcher grants, events organised;
  - Diffusion of knowledge: number of internet connections; survey of the internet users of the PSL Research University portal, number of library users, exhibitions.

- Programme and projects review

Based on the proposed committees, monthly, quarterly and yearly reviews will be organised, based on a clear escalation process managed by the IDEX PMO. The transparency of the process will be guaranteed by dedicated work flows and tools such as a Balanced Scorecard. The IDEX Executive Committee will be entitled to request external audits of any part of the project.

4.3 ORGANIZATION AND COMMON PROJECTS

Pooling and optimization of resources between the IDEX partners

Pooling of the resources in the fields of research and education, as well as common services are described in the relevant chapters of this documents.

- In Research, these resources optimization actions will occur for all the LABEX, for the structuring transversal programmes (Environment, Life Sciences / Hard Sciences, Rationalities and Human Behaviour) and for specific disciplinary programmes.
- In Education, pooling of the resources will concern the graduate level with the creation of a common Graduate Centre, delivering services to all graduate students of the perimeter and new master courses. At the undergraduate level, a common undergraduate cycle will be implemented. Finally various trans-institutional courses will be directed at the business world and public administration.
- In terms of services, PSL★ will pool documentation resources, international relationships, technology transfer, cultural life and social actions.

Real estate

- A common master plan for real estate will be defined in 2011, in connection with the « Plan Campus » and with major real estate operations such as the rue Claude Bernard project. This master plan, will aim at optimizing surfaces, identifying synergies and opportunities to reinforce optimal use of all available spaces. A preliminary version has already been prepared.

Information Systems

- In order to improve management and control, PSL★ will implement a dedicated Information system for the IDEX programme portfolio management so as to monitor progress and consolidate indicators into dedicated dashboards. This programme management tool will also allow detailed fund tracking.
- In parallel, a broader IT action will be set up in order to define a PSL★ IT master plan capitalizing on existing information systems. The objective is to ensure interoperability and benefit from the scale of the IDEX to implement optimal management software. The IT master plan will be defined in 2011 and implementation of common IT projects will proceed immediately afterwards.

5. MEANS

5.1 FINANCIAL STRATEGY

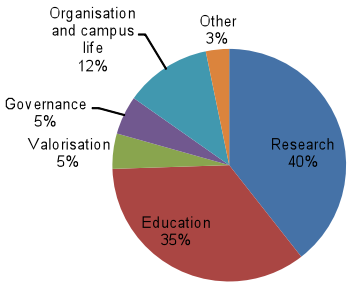
Key figures

- Capital grant requested for **IDEX actions: 263 MEUR** for ten years
- Capital grant requested for **LABEX** contributing to the perimeter of excellence: **136 MEUR** for ten years
- **Total capital grant requested: 399 MEUR**

The great majority of the IDEX budget will be allocated to actions concerning the perimeter of excellence (world-class research and training actions structuring the site).

Research and education form the core of the capital grant requested as shown on the chart. The Executive Committee will be attentive to respect this distribution.

All the projects funded by the IDEX will also benefit from existing resources contributed by the different partners. Indeed, PSL★ partners will provide 40% of the total cost of the projects that will be funded by the IDEX thus demonstrating their financial commitment.



Resources dedicated to IDEX actions

Finally, efforts made in the domain of valorization will enable research teams to increase the part of external resources in the project funding. 168 M€ are expected from external resources,

corresponding to 15% of total resources (CNRS, INSERM and INRIA resources given to partners and dedicated to IDEX actions are considered as part of internal resources).

5.2 TEN-YEAR FINANCIAL PLAN

TABLE 1: PRESENTATION OF THE RESOURCES AND EXPENSES OF THE IDEX EXCELLENCE PERIMETER CUMULATED ON 10 YEARS (IN EUROS)

	Ressources				Dépenses		
Action	Subvention Idex	Autres subventions Investissements d'Avenir	Apport des établissements partenaires sur leur budget propre	Ressources externes	Investissements dont immobilier	Fonctionnement	Personnel
Research - Mathematics and computer sciences	16 490 000 €	-	27 200 000 €	15 950 000 €			16 490 000 €
Research - Physics and astrophysics	14 200 000 €	-	67 430 000 €	18 000 000 €	1 000 000 €	3 800 000 €	9 400 000 €
Research - Physics - Labex WIFI	-	10 000 000 €	28 640 000 €	41 650 000 €	4 592 200 €	1 157 800 €	4 250 000 €
Research - Physics - Labex ENS-ICFP	-	9 755 142 €	8 148 081 €	- €	1 192 944 €	1 938 198 €	6 624 000 €
Research - Astrophysics - Labex AASG	-	8 646 976 €	- €	-	-	1 970 000 €	6 676 976 €
Research - Chemistry - Paris Institute for Chemical Engineering	11 500 000 €	-	59 855 400 €	16 000 000 €	1 500 000 €	4 000 000 €	6 000 000 €
Research - Chemistry - Labex METACEN	-	7 572 028 €	5 673 200 €	- €	1 150 000 €	1 493 028 €	4 929 000 €
Research - Chemistry - Labex ChemVivo	-	12 864 800 €	56 450 000 €	82 470 000 €	1 122 415 €	2 618 969 €	9 123 415 €
Research - Biology - Labex MEMOLIFE	-	14 411 690 €	91 899 910 €	213 371 457 €	1 461 690 €	3 160 000 €	9 790 000 €
Research - Biology - Equipex PHOBIOL	-	4 640 900 €	7 809 224 €		3 342 000 €	1 005 140 €	293 760 €
Research - Biology - Center of Mesoscopic biology	15 000 000 €	-	14 236 000 €	22 700 000 €	5 000 000 €	3 000 000 €	7 000 000 €
Research - Biology - Bioinformatique DYALOG	-	2 685 717 €	1 792 742 €		11 990 €	2 310 224 €	363 503 €
Research - Earth sciences	5 000 000 €	5 000 000 €	10 520 000 €			1 000 000 €	4 000 000 €
Research - Cognitive sciences	8 000 000 €	9 440 000 €	24 500 000 €	13 200 000 €	1 000 000 €	3 000 000 €	4 000 000 €
Research - Economics finance and management	12 500 000 €	-	34 517 992 €			2 500 000 €	10 000 000 €
Research - Humanities and social sciences	9 600 000 €	-	15 672 656 €			2 000 000 €	7 600 000 €
Research - Humanities and social sciences - Labex TransferS	-	16 190 079 €	129 243 480 €	26 035 680 €	80 000 €	3 248 695 €	12 861 384 €
Research - Humanities and social sciences - Labex Risques	-	14 016 077 €	31 280 300 €		522 240 €	4 345 000 €	9 314 885 €
Research - Humanities and social sciences - Equipex GEOPAST	-	2 455 638 €	5 560 076 €	210 735 €	2 132 138 €	323 500 €	
Research - Humanities and social sciences - Equipex D-FIH	-	3 986 060 €	90 000 €	877 520 €	64 000 €	2 522 060 €	1 400 000 €
Research - Transversal - Institute of environnement	14 000 000 €	-	8 974 440 €	12 700 000 €	1 500 000 €	3 000 000 €	9 500 000 €
Research - Equipex PLANAQUA	-	3 649 570 €	492 567 €	2 425 225 €	2 733 970 €	642 000 €	273 600 €
Research - Hard sciences / Life sciences Interface	9 300 000 €	-	18 830 000 €	5 000 000 €	6 000 000 €		3 300 000 €
Research - Biology - Labex TRANSIC	-	30 437 143 €	74 052 692 €	33 494 928 €	- €	6 002 039 €	24 435 104 €
Research - Equipex PARIS-EN-RESONANCE	-	7 605 986 €	3 900 524 €	7 085 981 €	7 250 000 €	332 240 €	23 746 €
Research - Equipex ULTRABRAIN	-	3 779 600 €	- €	10 302 060 €	2 930 000 €	62 400 €	787 200 €
Research - Labex IPGGM Microfluidique	-	12 317 760 €	21 435 345 €	31 962 034 €	1 033 760 €	2 473 120 €	8 810 880 €
Research - Equipex IPGGM	-	8 216 304 €	7 010 200 €	139 992 €	6 543 304 €	1 514 004 €	158 996 €
Research - Center on Rationalities and Human Behaviour	12 600 000 €	-	8 382 656 €	-	1 500 000 €	1 500 000 €	9 600 000 €
Education - Graduate program	14 240 000 €	-	46 318 600 €			800 000 €	13 440 000 €
Education - Pluridisciplinary undergraduate cycle	32 000 000 €	-	7 702 400 €				32 000 000 €
Education - Undergraduate program	3 000 000 €	-	7 500 000 €			300 000 €	2 700 000 €
Education - Executive education	3 000 000 €	-	5 474 400 €	2 500 000 €			3 000 000 €
Education - SACRE	9 000 000 €	-	13 200 000 €	-		1 000 000 €	8 000 000 €
Total	189 430 000 €	187 671 470 €	843 792 886 €	556 075 612 €	53 662 652 €	63 018 417 €	246 146 449 €

TABLE 2: PRESENTATION OF THE RESOURCES AND EXPENSES OF THE OTHER IDEX ACTIONS CUMULATED ON 10 YEARS (IN EUROS)

	Ressources				Dépenses		
Action	Subvention Idex	Autres subventions Investissements d'Avenir	Apport des établissements partenaires sur leur budget propre	Ressources externes	Investissements dont immobilier	Fonctionnement	Personnel
Knowledge dissemination - Liberlabo	6 650 000 €	-	15 655 220 €	100 000 €	1 500 000 €	150 000 €	5 000 000 €
Knowledge dissemination - faberLabo	5 000 000 €	-	12 820 400 €	215 000 €	5 000 000 €		
Knowledge dissemination - common portal	7 000 000 €	-	9 483 220 €	-	2 000 000 €	1 000 000 €	4 000 000 €
Knowledge dissemination - Publication "Organization & Decision Sciences"	1 000 000 €	-	2 500 000 €			200 000 €	800 000 €
Valorisation - Valorisation unit	9 700 000 €	-	4 624 000 €	1 000 000 €		2 425 000 €	7 275 000 €
Valorisation - IRT Finance et croissance durable	-	50 000 000 €	- €	60 000 000 €	32 500 000 €	7 500 000 €	10 000 000 €
International	11 800 000 €	-	14 022 880 €	1 000 000 €		3 000 000 €	8 800 000 €
Campus life	8 650 000 €	-	8 055 220 €	60 000 000 €	1 730 000 €	865 000 €	6 055 000 €
IT projects	14 180 000 €	-	7 126 820 €		3 920 000 €	2 360 000 €	7 900 000 €
Governance	2 000 000 €	-	- €	-		1 000 000 €	1 000 000 €
IDEX management (3% management fees)	7 662 300 €	-	- €	-		3 831 150 €	3 831 150 €
Total	73 642 300 €	50 000 000 €	74 287 760 €	122 315 000 €	46 650 000 €	22 331 150 €	54 661 150 €