TIRIS

Call for proposals – 2021
Appel à projets vague 2

EXCELLENCE SOUS TOUTES SES FORMES –
EXCELLENCE IN ALL ITS FORMS (EXCELLENCES)

Document de soumission / *Submission form*

Acronyme du projet / *Project acronym*	TIRIS	
Project title (in English)	« Toulouse Initiative for Research's Impact on Society »	
Titre du projet en français	« Initiative toulousaine pour un impact de la recherche sur la société »	
Keywords / mots clés ***(min 5 – max 10)***	Interdisciplinarity; Transformative research; Societal challenges; Sustainable transitions; Education for tomorrow's jobs; Innovation; Attractivity; Impacts	
Responsable du projet / *Project manager*	**Last Name, First name, Position, Organisation / Nom, Prénom, Statut, Organisation**	
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Établissement coordinateur / *Leading institution*	**Nom de l'établissement et statut** Université Fédérale Toulouse Midi-Pyrénées, Etablissement public à caractère scientifique, culturel et professionnel (EPSCP)		
Partner institution(s) involved in the project / Institution(s) partenaire(s) impliqué(es)	Université Toulouse 1 Capitole ; Université Toulouse 2 Jean Jaurès ; Université Toulouse 3 Paul Sabatier ; Toulouse INP ; INSA Toulouse ; ISAE-SUPAERO ; CNRS ; Inserm ; Inrae ; IRD ; ONERA ; Météo-France		
Project duration / Durée du projet entre 72 mois et 120 mois	120 months		
Requested funding / Aide demandée (minimum 5M€)	47 879 370 €	**Full cost / Coût complet**	616 327 520 €
Le cas échéant : Listes des projets PIA auxquels ce projet est éventuellement lié (notamment EUR, universités européennes, Equipex, Labex, Institut convergence, IDEFI, etc.) / *Project links with existing PIA entities (e.g. EUR, Equipex, Labex, Institut convergence, IDEFI, etc.)*	**Acronyme du(des) projet(s), préciser le type de *projet*** **8 EUR : BIOECO** Biotechnologie pour une économie bio-sourcée ; **CARE** Cancer, Vieillissement et Rejuvenation ; **MINT** Mathématiques et Interactions à Toulouse ; **TESS** Ecole Toulousaine des Sciences de l'Univers ; **TULIP-GSR** Ecologie et biologie végétale - Graduate School of Research ; **NanoX** Nanoscale, science and engineering ; **TSAE** Toulouse graduate School of Aerospace Engineering ; **CHESS** Challenges in economics and social sciences **7 LabEx : NEXT** Nano, mesures Extrêmes et Théorie (intégré dans l'EUR NanoX fin 2018) ; **IAST** Institute for Advanced Study in Toulouse (intégré dans l'EUR CHESS fin 2018) ; **TULIP** Vers une Théorie Unifiée des Interactions biotiques : rôLe des Perturbations environnementales ; **IAM TSE** Incitations, Acteurs, Marchés Toulouse School of Economics (intégré dans l'EUR CHESS fin 2018) ; **SMS** Structurations des Mondes Sociaux ; **CIMI/CIMI 2.0** Centre International de Mathématiques et d'Informatique ; **TOUCAN** Analyse intégrée de la résistance dans les cancers hématologiques. **1 3IA**-Institut Interdisciplinaire d'Intelligence Artificielle (PIA3) : **ANITI** Artificial and Natural Intelligence Toulouse Institute **6 ESR/EquipEx+ : DurabilitHY** Etude de la durabilité des technologies hydrogène : piles à combustible et électrolyseurs de fortes puissances de type PEM ; **ALADIN** Active Learning to Accelerate biocatalyst Development for INdustrial biotechnology ; **MetEx+** La métabolomique et la fluxomique de nouvelle génération, de la population aux cellules uniques ; **OBS4CLIM**		

	Système d'observation intégré pour l'atmosphère ; **TERRA FORMA** Concevoir et tester l'observatoire intelligent des territoires à l'heure de l'Anthropocène ; **ANVOLE** Acquisition d'un Nouvel aVion pour l'Observation à Long rayon d'action de l'Environnement **1 DPBS :** TWB Toulouse White Biotechnology **1 IRT :** IRT AESE Saint-Exupéry **1 SATT :** TTT Toulouse Tech Transfer **3 UE alliances: UNIVERSEH** European Space University of Earth and Humanity ; **ECIU** Consortium d'*Universités Européennes* Innovantes ; **Engage EU** The European University engaged in societal change **2 INBS : F-CRIN** French Clinical Research Infrastructure Network ; **MetaboHub2** Infrastructure nationale en métabolomique et fluxomique **6 MOPGA Junior Researchers : TROCODYN** TROpical Cyclone activity and upper-Ocean DYNamics : A Pacific-Atlantic Intercomparison ; **ASET** Atmosphere - Sea ice Exchanges and Teleconnections ; **RISCCI** Risques et incertitudes liés au changement climatique ; **CambioSCOP** Développement de la biomasse et gestion circulaire du carbone associé ; **PYROKINE** Pyrolise rapide de la biomasse des déchets : double cinétique **; KMImpacts** Kilometer-scale climate change impacts over Europe **2 MOPGA Senior Researchers : CCISS** Impact du changement climatique sur les espèces ; **EUROACE** Enhancing the Understanding of the Roles of Aerosols in Climate and Environment **PIA Hybridation** : THE Campus **Nouveaux territoires d'innovation pédagogique** : Dispositifs territoriaux pour l'orientation : ACORDA **Nouveaux cursus universitaires** : Aspie Friendly
Ce projet s'inscrit-il dans le cadre d'une Initiative d'excellence labellisée IdEx ou ISITE ? **Si oui, laquelle**	***No***

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***List of partner institutions* / Liste des institutions partenaires**

***Name of the research organisations* / Nom des organismes de recherche**	***Legal status* / Statut**
Centre national de la recherche scientifique (CNRS)	Etablissement public à caractère scientifique et technologique (EPST)
Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (INRAé)	EPST
Institut national de la santé et de la recherche médicale (Inserm)	EPST
Institut de recherche pour le développement (IRD)	EPST
Office national d'études et de recherches aérospatiales (ONERA)	Etablissement public à caractère industriel et commercial (EPIC)
Météo-France	Etablissement public administratif (EPA)
***Name of the institutions of higher education and research* / Nom des établissements d'enseignement supérieur et de recherche**	***Legal status* / Statut**
Université Toulouse 1 Capitole	Etablissement public à caractère scientifique, culturel et professionnel (EPSCP)
Université Toulouse 2 Jean Jaurès	EPSCP
Université Toulouse 3 Paul Sabatier	EPSCP
Institut national polytechnique de Toulouse (Toulouse INP)	EPSCP
Institut national des sciences appliquées de Toulouse (INSA Toulouse)	EPSCP
Institut supérieur de l'aéronautique et de l'espace (ISAE Supaéro)	EPSCP
Name of the Clinical Entity /	***Legal status* / Statut**

Nom des établissements hospitaliers (services, unités…)	
***Name of secondary schools* / Nom des établissements d'enseignement secondaire**	***Legal status* / Statut**
Other partners (Companies, Start-up, Associations, etc.) / **Autres partenaires (Industries, Entreprises, Start-up, Associations, etc.)**	***Field(s) of activity /*** **Secteur(s) d'activité**
Région Occitanie Pyrénées Méditerranée	

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SUMMARY

Abstract - English version (max. 4000 characters)

The "Toulouse Initiative for Research's Impact on Society" (TIRIS) is a ten-year strategic program that has two principal and complementary objectives: **1) Create, support and promote a clear academic identity through targeted incentives that are internationally visible and/or that create novel interactions between local partners; 2) Engage a proactive institutional transformation to create a world-class (ARWU top-100), recognized and attractive Research-Intensive University (RIU) within the next three years.** Strictly speaking, the funding request here concerns only the first of these objectives. However, the TIRIS initiative is designed to kick-start profound transformation in the ways partners work together, not only from an academic point of view, but from an institutional one too.

Based upon an objective assessment of the research potential of the site and in light of the urgent need to provide solutions to the transitions that modern societies are facing, **the choice has been made to focus our efforts and academic identity on three key societal challenges** (called pillars), for which our community has renowned strengths and credibility and which are in line with local private and public sector priorities:

- **Understanding and fostering living in good health and well being**
- **Understanding global changes and their impact on societies**
- **Accelerating sustainable transitions: mobility, energy, resources & industrial change**

The aim of the TIRIS initiative is to build upon and extend existing disciplinary excellence through a **pro-active strategy of supporting interdisciplinary and inter-science initiatives** (the latter corresponding to collaborations between Technological/Medical sciences and Social Sciences and Humanities). TIRIS thus **aims to transform "today's excellence" into a richer, stronger and more integrated "excellence of tomorrow"** that will contribute to the transformation of production and consumption activities, inspire renewal of public policies, and reply to the growing expectations of students and younger generations for a more inclusive and eco-friendly future.

From a practical point of view, TIRIS is a set of targeted incentives that aim to address three complementary objectives: 1) **Stimulate networks of collaboration in Toulouse through specific actions that will target interdisciplinary progress centered on the 3 pillars of our scientific program. 2) Promote the brand-name "University of Toulouse" on the local, national and international scenes through identifiable and attractive research, teaching and outreach/innovation programs; 3) Trigger leverage effects to attract additional resources to the programs proposed.** These objectives will be put in action through a program that supports four different missions of a University: i) Research; ii) Teaching; iii) Innovation and iv) Citizen engagement. These four aspects will each benefit from a mix of funding, from the ANR, from the Occitanie Region, from the institutional partners of this project and/or external partners.

Finally, TIRIS will play a proactive and pivotal role in the overall transformation of the University of Toulouse towards more efficient and more integrated governance, increasing the coherence and cohesion of different partners and their capacity to make strategic decisions, **changes that are also essential to obtain recognition as a RIU.**

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Résumé en français (max. 4000 caractères)

L'« Initiative toulousaine pour l'impact de la recherche sur la société » (TIRIS) est un programme stratégique décennal qui poursuit deux objectifs principaux et complémentaires : **1) Créer, soutenir et promouvoir une identité académique claire par des incitations ciblées, visibles à l'échelle internationale et/ou qui crée des interactions inédites entre partenaires locaux ; 2) Engager une transformation institutionnelle proactive pour créer une université à forte intensité de recherche (RIU) de classe mondiale (ARWU top-100), reconnue et attractive dans les trois prochaines années**. Au sens strict, la demande de financement ne concerne ici que le premier de ces objectifs. Cependant, l'initiative TIRIS est conçue pour amorcer une profonde transformation dans la manière dont les partenaires travaillent ensemble, non seulement d'un point de vue académique, mais aussi institutionnel.

Sur la base d'une évaluation objective de notre potentiel de recherche et compte tenu de l'urgence d'apporter des solutions aux nombreuses transitions auxquelles sont confrontées les sociétés modernes, **le choix a été fait de concentrer nos efforts et notre identité académique sur trois défis sociétaux clés**, pour lesquels notre communauté a une force et une crédibilité reconnues et qui sont en phase avec les priorités des secteurs privé et public locaux :

- Comprendre et favoriser la bonne santé et le bien-être ;
- Comprendre le changement global et son impact sur les sociétés ;
- Accélérer les transitions durables : mobilité, énergie, ressources et mutations industrielles.

D'une manière générale, l'objectif de l'initiative TIRIS est de renforcer et d'étendre l'excellence disciplinaire existante grâce à **une stratégie proactive de soutien aux initiatives interdisciplinaires et inter-sciences** (ces dernières correspondant à des collaborations entre les sciences technologiques/médicales (STS) et les sciences sociales et sciences humaines (SHS)). En d'autres termes, **TIRIS vise à transformer "l'excellence d'aujourd'hui" en une "excellence de demain"** plus riche, plus forte et plus intégrée qui contribuera à la transformation des activités de production et de consommation, inspirera le renouvellement des politiques publiques et répondra aux attentes croissantes des étudiants et jeunes générations pour un avenir plus inclusif et plus respectueux de l'environnement. D'un point de vue pratique, l'initiative TIRIS est un ensemble d'incitations ciblées qui visent à traiter trois objectifs complémentaires : **1) Stimuler de nouvelles façons de travailler ensemble sur la scène locale par des actions spécifiques qui viseront une progression interdisciplinaire centrée sur les 3 piliers de notre programme scientifique. 2) Promouvoir la marque « Université de Toulouse » sur la scène locale, nationale et internationale par des programmes identifiables de recherche (attractivité), d'enseignement et de rayonnement/innovation ; 3) Déclencher des effets de levier pour attirer des ressources supplémentaires vers les programmes proposés**. Ces objectifs seront mis en action à travers un programme qui soutient quatre missions différentes d'une université : i) Recherche ; ii) Enseignement ; iii) Innovation et iv) Implication des citoyens. Ces quatre volets bénéficieront chacun d'un financement mixte, de l'ANR, de la Région Occitanie, des partenaires institutionnels de ce projet et/ou de partenaires extérieurs

Enfin, l'initiative TIRIS jouera un rôle proactif et pivot dans la transformation globale de l'Université de Toulouse vers une gouvernance plus efficace et plus intégrée, augmentant la cohérence et la cohésion des différents partenaires et leur capacité à prendre des décisions stratégiques, des changements qui sont également essentiels pour **obtenir la reconnaissance en tant que Grande Université de Recherche**.

1 *CONTEXT AND SCOPE OF THE PROJECT*

1.1 OVERALL OBJECTIVES

The "Toulouse Initiative for Research's Impact on Society" (TIRIS) is a ten-year strategic program that has two principal and complementary objectives: **1) Create, support and promote a clear academic identity through targeted incentives that are internationally visible and/or that create novel interactions between local partners; 2) Engage a proactive institutional transformation to create a world-class (ARWU top-100), recognized and attractive Research-Intensive University (RIU) within the next three years.** Strictly speaking, the funding request here concerns only the first of these objectives. However, the TIRIS initiative is designed to kick-start profound transformation in the ways partners work together, not only from an academic point of view, but from an institutional one too.

1.2 LOCAL CONTEXT: ACADEMIC STRENGTHS AND WEAKNESSES

Toulouse is home to a dense and vibrant network of higher-education establishments, an academic landscape that comprises three major and complementary universities, three selective engineering schools and several other more specialized schools and institutions, representing a community of over 105,000 students. Taken together these establishments offer a broad range of training opportunities, from high-profile programs to train senior executives to hands-on programs that directly feed the national job market.

There are currently 57 bachelor's degrees, 86 professional bachelor's degrees, and 124 Master degrees (of which 32 are co-accredited). In terms of research, ~9000 scholars are working in 143 research or support structures and the Toulouse University Hospital (CHU). This academic potential is second only to the Paris region in France and a majority of the research laboratories are supported by one or more of seven national research organisations (CNRS, INSERM, INRAe, IRD, ONERA, CNES, Météo France), all precious and essential partners for local action and strategy.

The vitality of the academic community is illustrated both at the individual level (with a number of prestigious individual awards including a Nobel Prize Winner, 34 members of national French Academies, 77 members of the Institut Universitaire de France, over 70 present or past ERC grant-holders…) and at the collective level, with teams that have been involved in 10 government funded "Labex" initiatives (leading 7) and, since 2019, lead the PIA-funded ANITI initiative in the field of artificial intelligence.

In terms of teaching we note success in competitive national and international programs including 8 PIA-funded "Graduate Schools" (EUR), the ANITI Graduate School, 4 PIA-funded IDEFI/NCU initiatives and three European alliances (UNIVERSEH an interdisciplinary alliance in the field of "space"; ECIU in the field of physical sciences; ENGAGE in the field of Social Sciences).

These individual and collective successes are distributed across all five broad fields of Life & Earth Sciences, Mathematics and Computer Science, Physical Science and Engineering, Biomedical & Health, Social Sciences and Humanities, as will be explored further below.

Despite these widely acknowledged strengths and successes, there is considerable room for improvement. In addition to the difficulty of linking teaching programs and research strengths, the most critical weakness is the poor level of institutional integration between partners. Not only does this lead to a serious lack of political impetus, but it led to loss of the French government's "Idex" label (and associated funding) in 2018.

Not only has this loss tarnished national and international credibility, but it has been a major setback, disqualifying local actors for substantial sources of national funding. This lack of sufficient institutional integration is all the more surprising given that on-the-ground structures such as laboratories are typically jointly operated by higher-education establishment(s) and at least one NRO and are efficient workhorses of scientific production, a parallel situation being true for teaching programs (one third of Masters being co-accredited).

The TIRIS initiative will aim to remedy these issues, firstly through the definition of (and actions in favour of) a clear academic identify and secondly through reinforcement of the overall organisation and coherence of local actors, as detailed below.

1.3 A CLEAR ACADEMIC IDENTITY AS A VECTOR FOR STRUCTURAL CHANGE, VISIBILITY AND ATTRACTIVITY

One of the cornerstones of an integrated RIU is a legible and common academic identity that can be deployed across all sectors of the university's activities (research, teaching, links to public and private-sectors). Thanks to the current "Excellences" call, the scientific communities in Toulouse have worked together to identify cross-establishment strengths and opportunities, in addition to common factors that may be used to forge a clear identity and academic signature. **TIRIS is the outcome of this bottom-up approach** that involves twelve partners and 9 associates[1].

1.3.1. Elements of context and objective analysis of strengths and weaknesses

To provide an overview of the academic landscape, an objective analysis has been performed to identify where the academic strengths of Toulouse stand out in the national/ international scene[2]. This has been performed using Shanghai disciplinary rankings (ARWU), refined by CTWS-Leiden indicators based on Clarivate publications (2010-2020**).**

The ARWU ranking places at least one higher education establishment of Toulouse in the world's top-100 in ten different subject areas, with a strong focus on the Earth and Environmental Sciences (Remote Sensing (6), Oceanography (22), Earth Science (30), Ecology (36), Atmospheric Science (51-75) and Water Ressources (51-75)), but also a top-50 place in Economics (22) and top-100 positions in Mathematics (51-75) and Agricultural Science and Veterinary Science (both 76-100).

[1] Details of the « Partners » (local education and national research) and « Associates » are provided in Annex 1.

[2] Full details are presented in Annex 2, including how to consider Social Sciences and Humanities. Annex 2 also includes an analysis of different 'topics' defined from a community detection algorithm based on citation networks that has been used to detect interdisciplinary research.

To complement this broad-brush approach**,** CWTS-Leiden indicators have been used to quantify the national and worldwide share of the University of Toulouse in 252 Web of Science disciplines (index of differentiation) and their number of citations compared to the worldwide average in that discipline (index of scientific impact)**.** Combining these indicators provides a precious objective window into where our strengths lie, highlighting, for example, that **Toulouse represents over 10% of national production in the fields of Aerospace Engineering, Remote Sensing and Water resources, and that scientific publications in the fields of Agronomy, Physics, particles & fields, and Reproductive biology are cited more than two times the international average (Annex 2)**.

This analysis confirms that the true wealth of Toulouse is its scientific diversity, with demonstrable strengths in all five of the overarching disciplinary fields mentioned above. **TIRIS will stimulate this unique potential to work across disciplinary boundaries in new ways.**

However, the Leiden analysis also sheds light on the fact that, as seen by ARWU, several disciplines suffer from the fragmentation of forces between different establishments, or worse, that certain sectors of activity are underrepresented. For example, almost half of the scientific publications in the field of Atmospheric Science produced in Toulouse do not appear in the ARWU analysis because they are not performed in a recognized higher-education establishment. We also note that in comparison to other academic sites of comparable size, the number of highly cited researchers that contribute to ARWU ranking is low (13). These are important motivations for increasing the visibility of research through TIRIS.

In addition to research excellence, TIRIS will act to increase the coherence of our academic identity with that of the local social and economic ecosystem, **local authorities** on the one hand (Metropolis of Toulouse and the Occitanie Region in particular – See Insert below) and **economic actors of the region** on the other. For the latter, existing interactions occur at a variety of levels, from one-to-one collaborations to institutional partnerships (e.g. the nine Carnot institutes in Toulouse). These activities generate research contracts representing tens of millions of euros per year and lead to patents, licenses and start-up creations, supported by the **Toulouse SATT** ("Société d'Accélération de Transfert de Technologies"), which is the local operator for tech transfer.

In terms of 'identity', the broad fields covered by leading economic actors may be appreciated by the national **"poles de compétitivité"** whose center of gravity is in Toulouse: Aerospace Valley (aeronautics, space and embedded systems) and Agri Sud Ouest Innovation (agri-food and agro-industry)[3]. The importance of the first of these two fields is also illustrated by the presence of the **Saint-Exupéry Institute of Research and Technology,** one of eight government-funded technological research institutes. The IRT-Saint Exupéry specializes in aeronautics, space and embedded systems, bringing together public and private-sector partners to develop world-class research activities, supported by technological platforms and high-level skills, making the most of the local presence of major private and state-funded actors (Airbus, Thales, French Space Agency…). Another differentiating initiative is **Toulouse White Biotechnology**, a pre-industrial demonstrator to develop new ways of

[3] The university also works closely with several other Pôles de Compétitivité, especially: Aqua-Valley (water) Safe Cluster (security and risk management in aerospace/defence), Viaméca (intelligent mechanical systems), Trimatec (ecotechnology), Cerameurop (ceramics and surface treatments), Derbi (energy), Optitec (photonics).

sustainable production by promoting the use of renewable carbon and which relies on a consortium of 53 partners (11 large companies, 10 SMEs, 16 VSEs, 7 investment funds and development structures, 9 public partners).

The "Key-Challenges" program of Occitanie Region

The regional council of Occitanie launched the **"Key-challenges"** program in 2020 to support regional policy and develop cross-disciplinary research and dissemination. "Key challenges" are 4-year programs of 2 to 3 M€, which aim to make regional research more collaborative, visible and attractive. The Region has currently selected 16 priority-topics, of which the following are of relevance to TIRIS: Green hydrogen; Biotherapy; Agro-ecology; Circular economy; Earth observation; Water; New mobility; Infectious risks & vectors; Past Science and Heritage, Biodiversity.

1.3.2. From objective analysis to academic identity

In addition to the objective factors just discussed, the academic community in Toulouse has expressed a subjective sense of urgency that the future University of Toulouse must assume its position as a cutting-edge actor in a rapidly changing world. The scientific community in Toulouse is already providing contributions to the highly imbricated technological and societal challenges faced by modern societies, including ***ecological, energetic and democratic transitions***. However, in view of our unique research potential and all of the considerations above, we wish to go further and make the notion of ***"science in and for society"*** a core element of the collective identity. In this context, the choice has been made to focus our academic identity on **three key societal challenges,** for which our community has renowned strength and credibility (cf. Annex 2):

- **Understanding and fostering living in good health and well being**
- **Understanding global changes and their impact on societies**
- **Accelerating sustainable transitions: mobility, energy, resources & industrial change**

For TIRIS, an interdisciplinary scientific project has been defined (described in detail in Section 2.1) that draws on combinations of our strongest research potential, while being in line with local private-sector forces and local decision-makers at large. Each of these three challenges (referred to as 'pillars' below) can count on a **common foundation of excellence which integrates: i) human and social sciences** to anchor studies in the real world, **ii) advances in engineering for the development of technologies and specialized equipment**, and **iii) sophisticated data processing tools based on approaches rooted in the fields of mathematics and computer science**. Beyond the choice of the three pillars, **it is the ways of working together and the values conveyed that constitute the foundation of the project and the common and shared identity.**

Overall, the aim of TIRIS is thus to go **beyond disciplinary excellence through a pro-active strategy of supporting interdisciplinary and inter-science initiatives** (the latter corresponding to collaborations between Technological/Medical sciences (STS) and Social Sciences and Humanities (SHS)). In this way TIRIS aims to be at the origin of conceptual and technological paradigm changes that treat key challenges and transitions faced by modern societies, today and tomorrow. From a practical point of view, TIRIS will contribute to the transformation of production and consumption activities, inform

public policies, and address the growing expectations of students and future generations of engineers, executives and researchers for a more inclusive and sustainable future.

1.3.3. TIRIS in the overall academic landscape and its role as a catalyzer of organizational change.

As alluded to in section 1.1, TIRIS has been conceived to have a certain number of direct and indirect transforming effects on how academic activities are organized between partners (and associates) of the project. Rather than adding complexity to an already complex multi-layered administrative structure, the aim here is to use TIRIS to clarify the academic landscape and propose a coherent and simple set of organizational structures that pool the partners' available financial and human resources in the most efficient way.

In terms of training, on-the-ground activities are naturally structured around the different teaching components of higher education establishments and this foundation must be preserved. However, **in the context of a trend towards more interdisciplinarity, more personalized programs, greater use of non-conventional teaching methods and the emergence of the University of Toulouse as a recognized brand, a clear center of gravity for cross-establishment initiatives must be reinforced**. TIRIS will contribute to this effort.

In terms of research, the overall vision is a simple two-tier organization, with a "disciplinary level" and an "interdisciplinary level". At the disciplinary level, laboratories will be grouped by family of principal research fields, in a similar way to the "research poles" that exist today[4]. **These poles will be significantly strengthened and play a clearer and more proactive role in how the future university is run**. These poles will be the place where laboratory directors discuss and define the collective strategy of their communities. Each pole will be free to identify strengths they wish to reinforce and opportunities to develop at their level. For each pole, relevant higher education establishments and NRO (at the level of different disciplinary institutes for the CNRS, for example) will follow and accompany the strategy of a given pole in a coordinated way, in annual or half-yearly meetings.

Each pole will ideally have a budget to stimulate activities between members of its community and the poles will be the place where priorities are discussed and ranked if necessary (in association with relevant partners of the project). These disciplinary poles may house one or more PIA-funded projects (Labex, EUR…) that contribute to how activities are structured. Each pole will have a director, and these directors will contribute to higher-level structures of the university (Section 1.4), bringing difficulties and opportunities that require higher-level intervention to the attention of the University's governing bodies. This strengthened disciplinary landscape is a necessary foundation for TIRIS's actions.

For the moment there is no equivalent of disciplinary research or teaching poles at the interdisciplinary level. **The project TIRIS can be seen as a constitutive element of such an interdisciplinary pole,** providing direct financial support to the creation of cross-partner activities (research and teaching

[4] The proposition is to start with the contours of the 6 poles that currently exist. In the mid-term these contours may evolve, but coherence between the scientific fields of Research Poles and Doctoral Schools will be a requirement to stimulate positive feedback between research and training by research strategies.

incentives), while maintaining support for the disciplinary level through support of university-wide attractivity programs and strategic activities (sections 2 and 4).

1.4 INSTITUTIONAL CONTEXT AND A NEW TRAJECTORY FOR THE UNIVERSITY OF TOULOUSE

While Toulouse has all the potential to rise to the challenges indicated in section 1.3.2, the current organization of the Federal University (UFT) has shortcomings that must be modified in order to increase the coherence and cohesion of different partners and their capacity to make strategic decisions. **Such changes are also essential to obtain recognition as a RIU.** TIRIS will play a proactive pivotal role in this transformation towards more efficient and more integrated governance.

Turning back the clock a few years, the current federal organisation of the UFT has led to the construction of shared infrastructures that are highly appreciated and that benefit the entire academic community[5]. UFT has also played a leading role in the excellent return in recent PIA-calls (selection of one of the four 3IA in Artificial Intelligence, 65% success rate in the EUR "graduate school" call). However, this federal mode of governance has not made it possible to build an internationally recognized "University of Toulouse" that is the key for strong international visibility and for national funding opportunities. The reasons for this are to be found in the complexity and unreasonable size of governing bodies (80 in the Board, 150 in the academic senate) and the weakness of their prerogatives.

To overcome these structural weaknesses, partners of TIRIS are ready to **create the conditions for building one of the best Research Intensive Universities of France thanks to a new trajectory that strengthens the members' level of integration.** Governance will be streamlined thanks to the simplification of governing bodies and through the implementation of efficient arrangements that prevent dilution of responsibilities and that foster trust and the desire to work together, with clear decision-making and evaluation processes in place.

Efficient and coherent governance is a critical factor in our objective to become a RIU. Efficiency requires, above all, a framework that facilitates and encourages bottom-up individual and collective initiatives for excellence, and therefore closer to scholars. Thus, the University of Toulouse will build upon shared values, combining research & education excellence, societal impact from local to global scale, and inclusion. Each of these values will be assessed, mindful of differences in disciplinary practices, from standard bibliometric to in-depth qualitative impact analyses. These values, as well as the common rules that convert them into consultation and decision-making procedures, will be summarized in a charter of the University of Toulouse.

[5] UFT has developed key cross-campus services such as the premium welcome of researchers and foreign students (the "welcome desk" and "Toul'box" initiatives and more recently the construction of the "Cité Internationale des chercheurs"), and it coordinates the Toulouse doctoral school that provides cross-disciplinary training for PhD students from all disciplinary doctoral schools. In addition, UFT provides strategic support for various cross-campus technological and research platforms, such as Calmip for high-performance computing, Genotoul for high throughput research in biology, and the MSH for projects combining hard sciences, social sciences and health. It provides support to international development, leads and coordinate actions in the field of science communication and citizen science. UFT is also currently coordinating the DROCC initiative for a shared datacenter and the CESO initiative for the promotion of open science.

The current structure of the UFT will be discontinued in January 2023, benefitting from the possibility offered by the government ordonnance of Dec. 2018 to create an Experimental COMUE. This new structure will be governed by:

- A **Board of Directors** ("*Conseil d'Administration*") composed of around thirty members. A majority of elected members will be scholars, administrative and technical staff, and students. The rest of the board will be composed of qualified external personalities, including representatives of local authorities.
- A **Management Board** ("*Directoire*") of about ten members (presidencies and directors of universities and engineering schools, representatives of NRO and the coordinator of TIRIS), will be responsible for coordinating UT's action, proposing and implementing its strategy, and supervise the major structuring projects.
- An **Academic Senate** and a **Parliament of Students** will allow active participation of all stakeholders of the University (scholars, administrative and technical staff, students) in the strategy and daily life of the University of Toulouse.
- A **Strategic Evaluation Committee** composed by a majority of external scientific personalities, as well as internal highly acknowledged ones (e.g. local members of the French Academy of Science). It will be set up to advise the UT Board of Directors, both on its trajectory and on major structuring projects, including TIRIS.

As mentioned above, the future University of Toulouse will benefit from a new research organization built around the **six research poles that inclusively represent all of Toulouse's research units**. These poles will play an instrumental role in the success of TIRIS by animating communities that encourage disciplinary excellence while stimulating the emergence of novel interdisciplinary actions.

Coming back to the objective to create a rankable Research Intensive University, **the governance proposed will involve major new responsibilities targeted at all six criteria used by the French government to define an "University", as per university ranking agencies.**

In this aim to accelerate the transformation of the University of Toulouse to international standards which typify Research Intensive Universities over the world, the following actions will be initiated:
- The name "University of Toulouse" will become the standard signature of publications;
- Once ranking agencies have confirmed that the University of Toulouse is a recognised University, members will abandon their rankings at the benefit of the University of Toulouse;
- The PhD and other degrees will be granted by the presidency of the University of Toulouse;
- Partners will share a common research strategy;
- Partners will share a common higher education strategy;
- While promoting the principle of subsidiarity, with the ability of its members to have their own budget and management of their human resources, the University of Toulouse will produce both budget and HR orientation letters, and define a process for monitoring the effectiveness of its implementation by the members. Each year, UT governance bodies will formulate ex-post opinions about commitments related to the HR and financial orientations.

Further details of all of these issues will be defined in the "Statutes" of the University of Toulouse currently in preparation. For example, it is planned that members commit themselves to pursue the

development of shared academic engineering services, such as the premium welcome service for foreign researchers and students, the engineering service for European project calls, the economic partnership service, and a service dedicated to measuring diverse forms of research impact.

This new format of an experimental COMUE is planned to start in early 2023, with a major milestone at the end of a 3-year period, stocktaking lessons-learned, highlighting the positive returns and/or intrinsic limitations of the organizational choices made, in order to refine the next steps of integration.

2 *PROJECT DESCRIPTION*

2.1 DETAILED OVERVIEW OF THE SCIENTIFIC AXES

Pilar 1: Understanding and fostering living in good health and well being
Description
Living well means living in good health at any age, benefiting from a healthy diet, a favorable environment and social and economic conditions, as well as an efficient health care system. To address this challenge, **UT will promote frontier research through a multi- scale approach, from molecular level to socio-ecosystems**. This will be instrumental for **producing new knowledge on the complex effects of environmental and social factors on the quality of life of humans, animals and plants**. UT will also promote novel interactions between basic life sciences, IA, applied disciplines (such as clinic, agronomy and engineering) and human and social sciences with the aim to contribute to new innovative solutions for fostering life in good health. Such solutions will tackle the key issue of healthy aging, as well as personalized medicine and agro-ecological transitions. The contribution of social sciences will be instrumental for understanding the conditions of adoption of such solutions and designing public policies.
Principal actors and tools involved
Toulouse hosts research labs at the forefront of research in infectiology, cancerology and inflammatory diseases, in the field of innovative therapies, ageing. The IUCT/CRCT association for oncology and the presence of the Toulouse Gerontopole provide international visibility for these research areas. It also hosts one of the four veterinary schools in France with laboratories at the forefront of animal health, and two agronomic schools. The Toulouse site is recognized for cutting-edge research in plant sciences, with research centers of excellence for an integrated approach, from genomes to production systems. Social Sciences field research labs have recognized expertise in health and well-being, particularly in the fields of mental health, cognition, vulnerability, precarity, nutrition and ageing. Innovative approaches have been developed in the fields of health and psycho-social risks, art therapy, and prevention of ageing (Blagnac Smart Home, Toulouse Gérontopole). The research carried out within the GIS BECO, the OVALIE experimental platform and the IFERISS federation, links the fields of human and social sciences with those of the life sciences such as the sociology of food, psychosociology, information sciences, psychology and medicine. This scientific wealth is based on research centers of excellence of international standing supported by major investments from the CNRS, INSERM, INRAE, UT3, INPT and INSA (e.g. the GENOTOUL network)

Two of these centers, one in the field of cancer and the other at the biology/ecology interface, have LabEXs and EURs. Finally, a major research center in the economics of health has just been created as a joint initiative between UT1 and UT3.

Detailed research content

a) Understanding the interaction of environmental and bio-psycho-social determinants on life and health: A comprehensive approach of exposures linked to the environment, in all its dimensions (exposome[6]), whether chemical, physical (heat, noise), biological (pathogens, allergens) or psycho-social (isolation, stress, diet, sedentary lifestyle), will make it possible to better understand pathological mechanisms (in particular molecular, genetic and epigenetic) in order to develop new means of prevention or treatment. Interdisciplinarity research (integrating high throughput biology, AI and social sciences) will be key for developing such approaches. The combination of strengths in human and animal biology as well as microbiology and ecology will allow Toulouse to pioneer EcoHealth research.

b) Challenges of "well-being":

- **Offering the keys to healthy ageing**

The keys to healthy ageing are to be found through research in Geroscience combining basic, clinical and population research. The objective is to modify prevention strategies and the care pathway by focusing on functions (physical, mental) and not diseases, to develop prevention strategies and personalized care, thanks to translational research in Geroscience. These strategies, tested in clinical research and further experimented through participatory research, will benefit from the links already established with researchers in biology, epidemiology, artificial intelligence (AI), social sciences and economics.

- **Designing more precise medicine through therapeutic and diagnostic innovation**

New strategies for fighting pathologies (multi-scale AI in biology and health, personalized therapies, biotherapies, new antibiotics) will be developed through research that combine scientific and clinical approaches, and that share a unique mix of high-level technological platforms: intravital imaging, animal models, organoids or organs on a chip, the use of cells and antibodies as drugs. Such strategies benefit from excellence in material science, engineering (chemical engineering, fluid and solid mechanics, electrical and electronic systems, process engineering, etc.), mathematics and computer science.

c) Supporting agro-ecological transitions: Agricultural production systems must respond to the dual challenge of reducing the environmental impact of agricultural production practices and adapting to climate change. UT benefits from a unique set of competences for the study of complex interactions (between plants, micro-organisms and the environment, between crops and animals) and research infrastructures at various scales (genomic, phenotyping, agronomy -field trial, framing system-, remote sensing). State of the art research will be promoted through the integration of these approaches. Social sciences will contribute, together with engineering, to design and analyze pathways of transitions addressing the systemic lock-ins that hamper the changes of socio-technical trajectories that are needed.

[6] This thematic will be deployed through a clear and close partnership with the Montpellier University PIA4 ExposUM

Pillar 2: Understanding global changes and their impact on societies
Description
The consequences of human activities on climate-change, ecosystems, the environment and in turn society are at the heart of the global scientific debate. In order to contribute to predicting, mitigating and repairing the effects of global change, this pillar will employ a multi-scale and holistic approach. **The aim is to understand long-term phenomena, the changes they provoke, but also to guide public action, economic models and individual behavior.** The project thus considers government and its democratic institutions, human-technology and social media interactions, and the design and implementation of transition policies. This ambition implies optimal integration of the vast amount of qualitative and quantitative data produced by the Natural and Life Sciences and the Humanities and Social Sciences and their effective and efficient sharing with decision-makers, public institutions and citizens at large.
Principal actors and tools involved
The University of Toulouse has considerable qualitative and quantitative assets to deal with Global Change issues in a cross-cutting manner. Research in these disciplines benefits from a rare combination of support from national research organizations. For the CNRS-INSU, Toulouse is the leading centre outside of Paris in terms of research strengths. In addition to INRAE, whose Western Occitanie centre is the second largest in France in terms of staff, the IRD is also strongly involved in Toulouse, providing strong impetus towards sustainability science and unwavering support for the activities of the "National Observation Services" (SNO). Finally, this pilar will benefit from the strong presence and involvement of international players in the space field (CNES, ONERA, etc.) and research centers linked to operational services in the field of meteorology, oceanography and climate (Météo-France, Mercator Ocean International and CERFACS). Earth sciences are extremely well represented in international rankings (six ARWU “top-50” disciplines since 2017, including a fifth place in remote sensing) and Toulouse is involved in various PIA objects (EUR, Equipex+...). It hosts six main authors of the IPCC 6th cycle report and a winner of the Vetlesen Prize (considered as the Nobel Prize for the geophysical sciences). With these strengths, Toulouse's academic community enjoys excellent national and international visibility and has all the assets to develop interdisciplinary cross-disciplinary work on the challenges resulting from climate change and changing societies. TIRIS aims to further develop these interdisciplinary interactions through the three following complementary priorities.
Research content
a) From observation to modelling: For understanding how the Earth system works at various length and time-scales (from local territories to global) new approaches integrating physical, biological and human dynamics are needed. Toulouse benefits from a unique range of means (space, airborne, in situ measurements) to observe the planet in all its components (air, land, sea, ice) and at all scales. Social sciences are also instrumental for taking into account the social space in its various dimensions (territorial, economic, political and civic). These data feed numerical and theoretical models, whether they are designed to describe the physico-chemical functioning of the planet (e.g., climate models), biological systems or societal dynamics. The aim is to predict the future behavior of the Earth system, which is essential for evaluating and establishing the means of action and anticipating societal changes.

b) Adaptation and transformation of social worlds: Shifting from knowledge to action requires the production of actionable knowledge for public authorities and stakeholders involved. This need will be addressed through the development novel diagnostic and prognostic tools. These "digital twins" will be constrained by multi-source data describing possible scenarios and their impacts at the scale of a territory, a region, or even on planetary scale, and by the most advanced methods of social sciences (network analyses, textual analyses, qualitative and mixed methods). This theme will also aim to study the dynamics of social and technical structures (norms, legislative and regulatory framework, technical systems, imaginary dimensions) and the ways of living and constructing territoriality.

c) Long term context: The third priority of this pillar recognizes that the representation of futures is based on the understanding of the dynamics and processes of the near and distant past. Placing the present in the long-term context will be performed from various perspectives : (i) the physico-chemical functioning of the planet and its place in the universe (astrophysics, geology, paleo environments, etc.), (ii) biological systems (evolutionary biology, paleoecology, etc.), (iii) the evolution of human societies (evolution of the human species, evolution of the environment, etc.), (iv) the evolution of human/non-human relations (ethology, psychology, paleo genetics and paleo genomics, etc.), (v) social and environmental responsibility of companies, consumers and markets, and finally, (vi) social organizations and tangible or intangible heritage through historical, anthropological, archaeological, literary, artistic and philosophical analyses. The identification of long-term processes and the articulation between different time-scales, different methods and different disciplines, will constitute a singularity of the future UT.

Pilar 3: Accelerating sustainable transitions: mobility, energy, resources & industrial change

Description

Grand societal challenges require profound and rapid **transformations in the modes and processes of consumption (sobriety) and production (sustainable use of resources, energy sobriety, circularity, treatment and reduction of waste and discharges, etc.) and the adaptation of mobility at the scale of a territory as well as at the global level.** The energy question, in all its aspects (production, capture, conversion, storage, consumption, waste, work organization, etc.) is at the heart of these issues. The appropriation of these issues by individuals and society (which raises the question of social uptake), and the changes in behavior that they induce, both individual and collective, are also an essential dimension of the work to come. Research in this pillar aims at better understanding the dynamics of transitions and producing actionable knowledge for fostering these deep transformations thanks to sustainable engineering that relies on hybridization of engineering and social sciences.

Principal actors and tools involved

The University of Toulouse has considerable assets to deal with these issues in a holistic way. It represents the largest national research force in the field of engineering and systems, covering all themes (chemical engineering, electrical and electronic engineering, mechanical engineering, biotechnology, fluid and structural mechanics, embedded systems, robotics, computer science, linguistics, psychology and cognitive ergonomics, etc.) and brings together several centers of excellence in theoretical and experimental material sciences (physics, chemistry, material sciences) and in the humanities and social sciences (CCU platform, etc.).

MDS/SPI research on these themes in Western Occitanie, whose excellence is recognized (Cf. annex 2), benefits from strong support from national research organizations: CNRS (INSIS, INS2I, INC, INP, IN2P3, INSHS), IRD, and INRAE.

Toulouse is the world's leading center for the Aeronautics, Space and Embedded Systems (ASES) sector, which therefore constitutes a very strong element of visibility. A global sector (scientific, technological, social, economic, political), of very high performance, requiring safety and reliability, ASES is an ideal "laboratory" for imagining and implementing solutions associated with energy issues as well as those related to the environmental impact of industry. It should also be noted that CNES, ONERA, ENAC, Météo-France, CEA-Tech, Saint-Exupéry IRT, the French Military Space Command and NATO all have centers in Toulouse.

The ASES sector represents the vast majority of industrial R&D in Western Occitanie and the links with the site's laboratories are already well developed, which may contribute to a strong leverage effect. The importance for employment makes it a priority and a showcase for the Region and Toulouse Metropole. The ecosystem is unique, with leading industrial groups (aircraft, drones, engines and systems, satellites) and hundreds of subcontractors (the Aerospace Valley global competitiveness cluster has more than 800 members), making Toulouse one of the most innovative cities in the world (60th, according to FINOM 2021).

Research content

a) Transport of the future: the first issue concerns air and land transport of the future, which requires urgent investment in research at the levels closest to industry (clean and silent propulsion, lightweight airframes, autonomous vehicles, cybersecurity, etc.) but also those closer to users (sustainable aviation, intelligent mobility).

b) Decarbonated energy: the second issue focuses on energy. The aim is to design, implement and study the use of processes, materials, devices and systems for the production of low-carbon energy (hydrogen, solar, etc.), the production of fuels and sources of renewable C-based materials as a substitute for fossil resources (green fuels, biomass, industrial / domestic waste, etc.), the conversion and storage of energy, the conversion and storage of CO_2, the decarbonization of energy carriers, and to measure their merits in terms of cost and societal benefits. A broader theme is that of Environmental, Social and Governance taxonomy, which should be used to direct investments towards actions with the greatest impact.

c) Resources, production and industrial change: The third issue is to study, with a view to implement in diverse territories, the different stages of a circular economy cycle (production, capture, storage, consumption, reuse, recycling) by integrating the concepts of materials by design, prevention through design (PtD), atomic economy, life cycle analysis, digital twins, digital design chain, AI contribution to operational systems, for all kinds of processes and manufactured products. The aim is to bring out, through the hybridization of heterogeneous sources of knowledge, new eco-designed paths towards an industrial ecology, allowing for a better management of the tension on natural resources, a reduction of the impact on the environment and health of the current modes of production and uses. New business models, the performance of the eco-industry, safety, global ergonomics, creativity and design are also included, as well as the role of public policies in encouraging and supporting change.

2.2 OVERVIEW AND AMBITION OF THE INCENTIVES

The TIRIS initiative is a set of targeted incentives that aim to treat three complementary objectives:

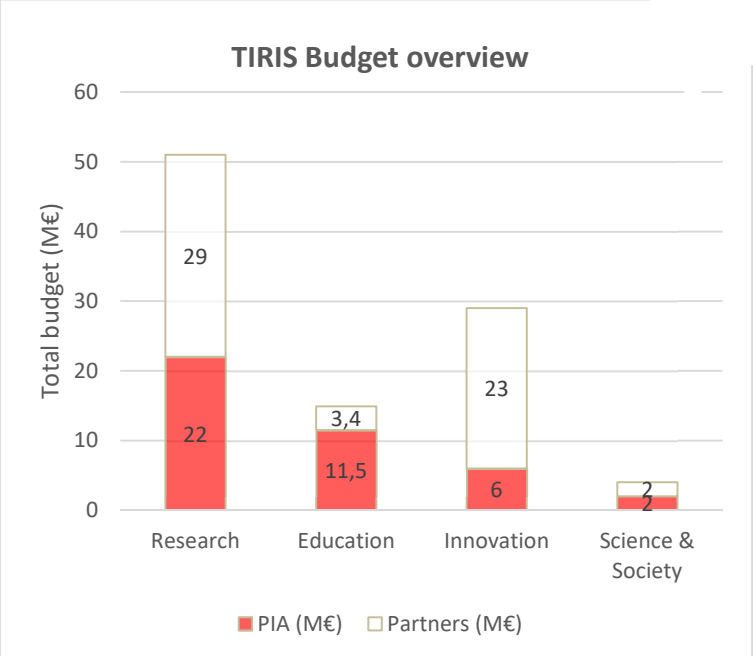
1) Stimulate new ways of working together on the local scene through specific actions that will target interdisciplinary progress centered on the 3 pillars of our scientific program.

2) Promote the brand-name "University of Toulouse" on the local, national and international scenes, not only the ambition to be ranked in the world's top-100 universities, but more generally through identifiable research (attractivity), teaching and outreach/innovation programs.

3) Trigger leverage effects to attract additional resources to the programs proposed.

These objectives will be put in action through a program that supports four different missions of a University: i) Research; ii) Education; iii) Innovation and iv) Implication of citizens. These four aspects will each benefit from a mix of funding, from the ANR, from the Occitanie Region, from the direct partners of this project and/or external partners, as illustrated in the figure just below. **Note that the Occitanie Region will provide particularly strong support, with matching funds promised, through a mix of identified funding mechanisms** (for example, but not limited to, the "Key Challenges" program mentioned above), European (FEDER) funding and additional non-targeted funding. Taken together, the region will thus provide a critical boost to both international attractivity and territorial impact

In terms of funding, we note that all partners of this project are eligible for funding (but they will also contribute to overall cost), whether alone or associated with another partner. The associates are also eligible for funding, but under certain conditions, notably that they are associated with at least one partner of the project in their funding request. Note that in more general terms, associates will be involved at the level of research poles if they have laboratories under their supervision.



Before entering into the details of the TIRIS incentive mechanisms, we draw attention to the fact that the "ExcellencES" call does not provide sufficient means to cover all aspects of the life of a University the size of that represented by the partners of this project (in contrast to former calls such as Idex). For this reason, choices have been made to orient funding requests to a relatively small number of priority actions that contribute directly to the objectives presented in the insert above and that are not accessible with existing sources of funding.

Despite these choices in terms of PIA-funding, a certain number of other actions will be the focus of attention, with strategies put in place to mobilize other resources. In addition to the case of shared academic engineering services described in section 1.4, one may note:

i) Stimulating a new dimension and a new ambition to the Doctorate of the University of Toulouse (through the "Ecole des Docteurs de Toulouse") by setting up systems aimed at developing the 3'I's: Internationalization (through mobility), Interdisciplinarity and Intersectorality, all three perfectly in line with the objectives of TIRIS.

ii) Elaboration of ambitious strategies to attract the best students from around the world (e.g. in the framework of our European alliances and EUR). For the best French students, the creation of a new school labelled ENS (Ecole Normale Supérieure) is a mid-term project conceived in collaboration with the universities of Toulouse. For these students, the planned curriculum includes a major—up to a Phd level—and a minor devoted to inter-sciences, again, perfectly in line with the objectives of TIRIS.

iii) Recognizing and promoting the associative and civic commitment of students, including, for example, certification of the skills acquired.

iv) Extending current activities of science mediation and science for local decision makers, relying on local forces (the Science & society teams of UT, those of research organizations such as INRAE, INSERM, CNRS, the "Quai des savoirs", the Science Museums of Toulouse…). Activities will be directed at young citizens on the one hand (focused on controversy and public debate) and local decision makers on the other (benefitting from the support of Occitanie Region through the program "Laboratoire des transitions").

2.3 INCENTIVE MECHANISMS

2.3.1 Research

The first two mechanisms concern attracting talent from elsewhere to come to Toulouse, the second two to support novel research between local teams and the final one to support strategic investment.

The University of Toulouse Fellowship program

The objective of this program is to **reinforce international visibility** and contribute to the creation of the University of Toulouse's identity. A high-profile Fellowship program is proposed to attract external talent. The program will be heavily advertised internationally, promoting the brand-name "University of Toulouse". On average 10 scholars will be selected per year, with two complementary formats proposed to attract a broad range of talents: *Junior Fellowship (*Typically for young researchers, up to PhD +4) & (*Advanced Fellowship:* Typically for more experienced researchers, PhD >4). Candidates

must first and foremost demonstrate academic excellence. Preference will be given to applications that have the potential for ground-breaking results and that demonstrate how they will contribute to one or more pillars. In case of selection, candidates will be encouraged to apply to other sources of funding (e.g. EU-Marie Curie) to free-up PIA funding for other worthy applicants.

The University of Toulouse Blockbuster program

The second mechanism will **reinforce key markers of the excellence of the University of Toulouse** and promote common strategy. This program aims at providing Toulouse with a capacity to pool its assets in a coordinated way to attract high-profile colleagues. There will be no specific call for this program. Laboratory directors / research poles will bring opportunities to the attention of the University's governing bodies who will organize cross-establishment negotiations with NRO and the Occitanie Region. Candidates must demonstrate an exceptionally high level of academic excellence that will contribute to the University of Toulouse's international visibility (e.g. Highly Cited, ERC Advanced…).

The TIRIS "Scaling-up" program

This mechanism will **take interdisciplinary projects from Proof of Concept to mature ideas** capable of external funding (ANR/ERC…) engaging a virtuous circle in which future overheads can finance the program. It will involve an annual call for projects that can last up to four years. Interdisciplinarity will be a requirement, with preference given to teams of 2-4 researchers working in different disciplinary poles. Novel ways to treat interdisciplinarity will be encouraged (e.g. 2 PhD subjects run in parallel but animated scientifically in a coordinated way), as will be teams who propose geographic mobility (i.e. researchers are welcomed in another local laboratory). Attention will be paid to boost the involvement of teaching staff to benefit from this program (dedicated CRCT and/or recruitment of ATER) to alleviate teaching duties during all or part of the program. Note also that this initiative may be linked to the Fellowship program with the possibility to support teams mixing local and international talent.

The TIRIS "Getting going" program

This mechanism will **bring local researchers together in new ways to foster interdisciplinary initiatives and test preliminary proofs of concept**. It will support short (18 months) interdisciplinary projects, typically for Master students. Forty such projects will be possible per year promoting scientific intermingling. This program will also provide small-scale funding for interdisciplinary scientific animation (organization of informal meetings, workshops with an external invited expert…) that will be opportunities for people to meet. At higher level, an annual summer school and a "TIRIS Key Thinker Program" will be initiated that each month will invite an expert for a couple of days, increasing national / international visibility. For this program, there are no external calls, the scientific animation being organized internally.

The University of Toulouse "Strategic booster" program

This program will provide a **critical helping-hand for investments** with strong short- or mid-term benefits. Certain opportunities require an investment in the short-term, but that generates resources in the mid-term. There will be no constraints on the type of investment, although it is expected that requests for equipment may dominate. For this program, there will be one or two calls per year. The criterion for selection being the demonstrated return on investment in the short-, mid-term.

2.3.3 Education-related programs:

TIRIS aims to improve accessibility to educational content, promote appropriation of that content and more generally to build upon the scientific advances of the TIRIS project as a whole to strengthen the transdisciplinary skills of our students and arm them to face the challenges of the 21st century. The project will contribute to the educational transformation of the site in the context of trends towards adaptable and personalized offers, and the emergence of novel forms of educational interaction, based, or not, on digital technology, two considerations that are common to all higher-education partners. Two incentives are proposed, the first to create the conditions for new ideas to emerge and the second to transform those ideas into concrete and visible content.

The TIRIS Training Think Tank

This first training incentive will **enhance the pedagogical transformation of our education programs**. A new **think tank** will carry out activities of monitoring and program engineering and, encourage exchanges and reflections between teacher-researchers on technological, societal and scientific challenges. These reflections will lead to **calls for projects** which will be launched each year (e.g, a call for proposals on the implementation of new practical training, on the implementation of new minors (see below), on the pedagogical transformation of existing courses, etc.). It will be supported by inter-university workshops that will organize exchanges of experience, expertise and cooperation on educational, scientific and technical subjects. Finally, **experimental platforms** will complete the initiatives for the exchange of practices and expertise. A part of this call for projects will also be co-constructed with the students (via the student parliament) making it possible to promote associative actions carried out by the students and to develop new ones.

The TIRIS pedagogical innovation unit

This mechanism will support teaching teams to **implement new inter- and trans-disciplinary training programs**. It will be a thematic unit dedicated to monitoring innovative pedagogies and adapting them to the needs of target courses.

Its missions will be to set up innovative approaches and experimentation platforms in support of projects for the hybridization of teaching and pedagogical transformation, and to strengthen skills for innovation by setting up hubs (science and technology front-end platforms) in interaction with the socio-economic world. One of the first actions will be to set up **“Minor Programs”**. Several types of “Minor Programs” will be offered at the three levels of Bachelor's, Master's and Doctorate within the framework of interdisciplinary and inter science pathways, which are clear and highly coherent: i) Selective “Minor Programs” built as a progressive set of Teaching Units (e.g., 50h in total) at Master and Doctorate levels with a professionalizing aim (including research); ii) “Minor Programs” accessible to all as a complement to a diploma; iii) “Minor Programs” for reinforcement: mainly at Bachelor’s level for students who are not destined to go on to a Master's degree / insertion into a clearly identified professional sector. The definition of the Minor Programs to be developed will be the subject of calls for projects and discussions within the think tank.

2.3.4 Incentives for Innovation:

The Brave New Innovation program (BNI)

This incentive will provide **support for high-risk high gain scientific public & private projects with a high-level impact on economy and/or society**. BNI projects will concern new ideas that have not been proposed or matured before. Project progress will involve specific reviews or "stage gates" where go/no-go decisions are made about project continuation. This will allow multiple assessment of creation originality, technical feasibility or potential demand recognition. Consequently, the rate of project cancellation may be quite high. The BNI program will finance preliminary stages of investigation (from initial to design and test experimental prototypes). It will also finance graduate students, postdoctoral fellows and, where appropriate, external facilitators by exposing them to interdisciplinary innovation challenges. In subsequent stages, it may involve the appointment of multiple staff based on complementary expertise to meet the project goals and cofunding by TIRIS and partners (typically two PhD students including one financed by a "CIFRE" convention and/or other fellowships for postdoctoral/experts scientists, project mentors). BNI projects aim at triggering follow-up initiatives within the Regional Innovation System stakeholders ("maturation" or "pre-maturation" programs from the SATT-TTT our University TTO). For this program, an open call will be proposed throughout the year.

The TIRIS platforms program

The objective of this program is the development of an **organized and coordinated set of scientific and technological platforms based on the three pillars of TIRIS**. The program can be divided into four main parts: i) Development of multidisciplinary-platform partnership and delivery activities by recruiting staff and setting up a support unit; ii) Creation of a common communication towards the outside world to increase the visibility of skills and equipment; iii) Dedicated action to support education and innovation; iv) Upgrading of the platform's equipment through consultation and pooling of responses to calls for large-scale equipment projects; creation of a representative proposal force for organizations publishing calls for projects; co-financing of specific mid-range equipment with the Occitanie Region and with research or socio-economic organizations. Financial support in the frame of the program for the recruitment of additional staff on fixed-term contracts will gradually lead to the expected self-financing of the necessary remaining staff to be assigned to the platforms.

2.3.5. The Science and Society program

In a targeted effort to bring TIRIS into direct contact with citizens and to foster coproduction of knowledge with civic society organizations, four approaches will be developed:

Participatory research, defined as an activity of production of knowledge which actively involves non-professional researchers, individuals or groups. We will rely both on existing local initiatives (*e.g.* INSA's Local Partnership Arenas), but also on inspirational initiatives seen elsewhere (e.g., Mosaic of the Sorbonne University) to amplify participatory research projects, that can take different forms (e.g. Community-based research, Participatory action research, Citizen science, etc.).

Science shops. First created in the Netherlands with the objective to provide answers to questions raised by groups of citizens related to their living conditions, this initiative will help formulating research questions and help engage students that will be working on such questions as part of their curricula (over a period of one and a half years). The UT Science shop will benefit from the experience of other Science shops, such as those created by MSH-Sud (Montpellier), Lille or Lyon.

Participatory observatory of science-society interactions for transitions. UT will launch a participatory inventory on the basis of the experience of RESOLIS (https://www.resolis.org) that applies an observation and evaluation method inspired by the scientific approach to social and/or environmental initiatives and actions in the field of transitions. Case studies are produced by groups of students along this standard methodology with the active participation of actors concerned. The observatory will contribute to self-awareness of the Third Research Sector (TRS; i.e. actors engaged in non-profit activities for the common good: environment protection, healthcare, circular economy, urban development, social justice, education, etc...) and to its visibility for research and higher education organizations and its role in cooperation and co-production. The observatory will be complementary to the "Science with and for society" label which UT is applying for.

2.4 EXPECTED IMPACTS

TIRIS aims to stimulate in-depth transformations of how science and higher education are carried out in Toulouse, for the benefit of students, scholars, technical and administrative staff, and society at large. Measuring the impact of these changes will require detailed monitoring of the benefits of the project in the long term that are difficult to quantify. Despite this difficulty, a series of quantitative key performance indicators are proposed and described below, with the aim of comparing the impacts of TIRIS with respect to indicators and metrics which can be computed for other national and international universities. This quantitative benchmarking does not constitute the ultimate measure of the success of TIRIS, although achieving the objectives in the table below will be reflective of a vibrant, productive and impactful University of Toulouse.

Direct expected impacts from TIRIS		
Research	**T0 + 4**	**T0 + 8**
Number of Interdisciplinary projects within (and between) the three pillars	60 (10)	130 (20)
Number of junior and senior scholars directly involved	700	1500
Number of PhD students participating in TIRIS program	300	800
Share of WoS publications in journal indexed in different categories (≥3)	10%	20%
Share of WoS publications co-authored between SSH and others scientific fields (originating from TIRIS programs)	5%	10%
Innovation		
Number of labcom and demonstrator on societal challenges	4	10
Number of filing of patents coming from the project	4	8

Share of platforms organized within the three pillars	50%	100%
Number of academic-industry co-publications from the project	20	50
Education		
Number of minor programs created	20	40
Number of Teacher Researchers involved in the minor programs	240	400
Number of students involved in the minor programs	2000	4000
Number of masters concerned by major / minor	20%	40%
Science & Society		
Number of participative research projects with RTS participants (cumulated)	48	100
Number of actors (academic and RTS) registered on the participative research platform (Total)	500	1000
Number of queries (including not funded by TIRIS) dealt with by the Science Shop (cumulated)	280	640
Number of students involved in the science shop initiative (cumulated)	600	1600
Number of cases documented by the participatory observatory (Total)	400	1000

Indirect expected impacts for UT			
Research	**T0**	**T0 + 4**	**T0 + 8**
Shanghai ranking of UT		100-150	75-100
Number of Shanghai top 100 disciplines	10	14	18
Number of HCR of UT	13	20	25
Number of ERC	2010-2020: 66	2015-2025: 80	2020-2030: 110
Education			
Number of courses impacted by pedagogical innovations	1133	13000	20000
Number of students benefiting from educational innovations	11000	80 000	100 000

3 *PILOTAGE ET PARTENARIAT/ MANAGEMENT FRAMEWORK*

3.1 PROJECT MANAGEMENT AND GOVERNANCE

The **TIRIS** project will be under the supervision of a scientific coordinator – Michael TOPLIS (B.A Cambridge, UK; PhD Bristol, UK), senior research scientist (CNRS), author of over 130 peer-reviewed publications, mentor of 17 PhD students, associate and guest editor for major scientific journals since 2002. He has served on numerous local and national committees, including the French Space agency and private sector companies. Despite holding research positions, he has >1000h experience teaching in research-oriented and applied higher education programs and he leads a PIA-funded EUR Graduate

school. He is currently director of the Observatoire Midi-Pyrénées (UT3-CNRS-IRD-CNES-MétéoFrance) and coordinator of the "Univers-Planète-Espace-Environnement" (UPEE) research cluster at UFT.

The governing bodies of TIRIS will involve both specific structures dedicated only to this initiative, and other bodies that are precursors for governing bodies of the future University of Toulouse as a whole.

► Executive Committee (EC)

The EC responsibilities are to define the operating rules and selection criteria for the instruments of the project, to draw up the framework and timetable for internal calls for projects, to determine and monitor the commitments of the winners of internal calls for projects, to allocate resources and to evaluate the scientific, pedagogical, economic and organizational impact of the overall **TIRIS** project.

The EC will comprise the UT President and Research and Training VP, Research and Training VP of the three universities, representatives of the three schools, two representants of the UT's associate members and one representant for each of the six NRO – CNRS, INSERM, INRAE, IRD, ONERA, METEO FRANCE), one representant of the Regional Council of Occitanie and the **TIRIS** scientific coordinator.

At least once a year, the EC establishes the rolling budget breakdown by action for the PIA program, thereby providing a comprehensive budget for the resource allocation of all the project for approval by the governance of UT and the governance of its members. On the basis of the budget approved by the UT Board, all actions of **TIRIS** will be implemented by the Management and Monitoring Team.

► Management and Monitoring Team (MMT)

The MMT will be in charge of the project day-to-day management with the following tasks: (i) Organize et supervise the execution of the four programs ; (ii) Set goals and time schedule for each program of **TIRIS**; (iii) Set up quality procedures for the overall monitoring of the project progress and deliverables; (iv) Provide a contact point to ANR to which the project reporting is due and to prepare periodic management reports to be presented to UT board and board's members as well as to ANR; (v) Ensure the liaison and facilitate communication and cooperation between project participants and with other structures and agencies.

The MMT will comprise 11 members: the **TIRIS** scientific director, also leader of the Program 1 (Research & Innovation), two Program leaders (Training and Science & Society), the six disciplinary pole leaders who will be able to connect the UT scientific community to the project and a Project Manager and Financial assistant.

On top of these two governing bodies specially created to manage the **TIRIS** project, the governance and management of the project will **lean on the new governance bodies created through the transformation of the University of Toulouse**:

►The Academic Advisory Board (AAB) of UT

TIRIS will be supervised by the UT AAB represented by several external members, most of them international (academic and socio-economic partners) a few recognised UT scientists. As external

advisory Board of the University of Toulouse, the AAB will meet at least once a year to evaluate and make recommendations to the EC on the **TIRIS** results and trajectory in coherence with the ambition and trajectory of the University of Toulouse.

►The Student's Parliament of UT

The Student's Parliament is also a new body created with the UT governance transformation. The Student's Parliament will be a statutory body representing students. It will have a decision-making power on issues related to the policy of the University of Toulouse in terms of 'student life' and is consultative on other subjects, particularly training and campus life. It will have a dedicated budget. Once again, each year, the MMT will present the **TIRIS** project in front of the Student's Parliament for evaluation and recommendations.

►The College of External Personalities of the UT Board

This College will comprise representatives of public and private partners such as local authorities, companies, "pôles de compétitivité", cultural and social partners (RTS). This UT body will specifically meet once a year to evaluate and make recommendations to the Executive Committee and to the UT board on the **TIRIS** results and trajectory.

3.2 MANAGEMENT COMMITTED TO QUALITY & OPEN DATA SCIENCE

Quality management: Most of the **TIRIS** instruments are based on internal calls for research or educational projects, which follow a selection process that meets the requirements of international quality standards, objectivity, rigor and transparency. The process is as follows: i) Preparation of the call for projects by the MMT; ii) Recruitment of external experts; iii) Validation of the call for projects by the EC; iv) Launching of the calls for projects; v) Analysis and ranking of the projects submitted by MMT on the basis of the expert appraisals carried out by the relevant committee; vi) Validation of the selections by the EC; vii) Monitoring and evaluation of the projects by the MMT and associated committees.

Data management will build on an integrated approach to make the generated information and knowledge assets findable, accessible, interoperable and reusable according to the EU Guidelines on FAIR Data Management in Horizon 2020. This will be achieved in collaboration with the CESO initiative in Toulouse that has already defined three broad subject areas that can rely on local expertise, these three areas corresponding to the three pillars of the TIRIS scientific program. This service will provide help for putting together Data-Management Plans (DMP), services for attribution of Digital Object Identifiers (DOI), and other practical shared solutions for data storage using the regional UT datacenter.

4 *FUNDING JUSTIFICATION*

The requested grant is **47 879 370 €** costs, including the 8% overheads, for an expense base of 102 091 500 €. Funding justification are details in the Panel below:

Type	Amount requested (k€)	Expense base (k€)	Justification
Program 1: Research			
UT Junior Fellowship Program	5 940	10 260	54 junior followships cofinanced by the region. Researchers may contribute to Program 2 (training) on the minor program
UT Advanced Fellowship	3 510	10 530	13 senior fellowships cofinanced by the region. Fellows may also contribute to program 2. TIRIS members will cofinance the theses with the region.
UT Blockbuster	1 050	5 100	7 chairs for high-impact world-class talents, cofinanced by the region and TIRIS members
Scaling-up Science	9 600	21 120	64 interdisciplinary projects from Proof of Concept to mature ideas capable of attracting external funding, cofinanced by the region and TIRIS members
Strategic Booster	2 000	4 000	To co-finance strategic investments with short or mid-term returns. Cofinanced by the region and TIRIS members
Program 2 : Education			
The TIRIS “Getting going” program	4 150	5 300	Funding of internships for Master students and small-scale funding for interdisciplinary scientific animation (organization of informal meetings, workshops with an external invited expert…) and funding (50k€/year) for the organisation of an annual interdisciplinary summer school.
The TIRIS Training Think Tank	4 825	7000	Salary of a program manager to carry out an activity of monitoring and program engineering. Funding of calls for projects (3 to 5 per year with 150K€ per minor program – bonus for teacher-researchers involved in the construction of the new offer) and organization of inter-university workshops. Funding of experimental platforms. Program cofinanced by the region.

Pedagogic innovation implementation unit	2 620	2 620	Salary for 45 p.y for the support of pedagogical engineering activities with a strong emphasis put on the first four years of the project (decreasing from ten in year 1 to one in year 7). Engineers progressively recruited by UT members
Program 3: Innovation			
Brave New Innovation Program	2 000	13 280	Funding of a post-doc or master's degree to study the feasibility of working on a project, then funding of two theses, one of them financed by the socio-economic sector and the other by the Occitanie region.
Innovative Plateformes	4 000	16 000	Organisation and networking of the platforms by pillar and raising their quality, by financing human resources and equipment. 75% of this program is financed by the region and socio-economic partners
Program 4: Science & Society			
Participatory research	400	1 600	A call for proposal per year (2 to 4 projects selected) for a financial support of 50k€ for an 18 months period
Science shops	1 233	2 017	Salary for a program manager during the project. Participatory project with students (approx. 20 projects a year) : master's internship and small project funding, cofinanced with the region.
Participatory observatory of science-society interactions for transitions	354	604	Salary for the Observatory manager and a website, cofinanced by the region
Governance			
TIRIS symposium	500	500	For the organization of 10 symposiums gathering around 300 persons
Project Management	2 050	2 050	To ensure the overall management of the project, the management of the three programs and interactions with academic and non-academic partners
Communication	100	100	To ensure the overall communication of the project

The TIRIS funding scheme relies on three main financial sources:

- The TIRIS members, who are strongly involved in the programs through:
  - Their human resources involved in the projects and schemes to the tune of €510M
  - Contributing to the Research programme by co-funding 45.5 PhD contracts (€5.46M) and the Booster programme (€1M)
  - The commitment to progressively provide support for the recruitment of pedagogical engineers and teacher-researchers and researchers identified in the framework of the Fellowship and Blockbuster Programs
  - The mobilisation of internal mechanisms to support projects (teaching leave, visiting professors, etc.)
- The PIA4 "ExcellencES" program
- **The Occitanie Region who is committed to support TIRIS with matching funds equivalent to those of PIA4 ExcellencES according to the following general principle**: 1€ Region for 1€ PIA4 for research and science and citizens' programs, 1€ Region for 2€ PIA4 for training programs, 2€ Region for 1€ PIA4 for innovation programs.

The socio-academic partners will be involved by co-financing of 68 CIFRE theses and demonstrators. In 2021, 503 theses out of 2863 are co-financed by a company, i.e. 17.5%.

Global Resources for TIRIS over the 10-year period are 616 327 k€ :

	ExcellencES Support	**Occitanie Support**	**TIRIS Members Contributions**	**Socio-economic partners Contributions**	**TIRIS**
	7,8%	6,7%	83,9%	1,6%	100%
(k€)	47 879,5	41 408,5	6 710 of support 510 689 of HR	9 640	616 327
(8% ANR Mgt Costs)	3 547				
Net of ANR Mgt Costs (k€)	44 332	41 409	6 710	9 640	
Net resources for marginal costs (k€)	**102 091**				