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# Improving sustainability and quality of Sheep and Chicken production by leveraging the Adaptation potential of Local breeds in the Mediterranean area SCALA-MEDI

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# SCALA-MEDI background

1. Dopo la domesticazione le razze locali delle specie zootecniche si sono adattate a condizioni ambientali diverse per selezione naturale e antropica.
2. Nel sud Mediterraneo l'adattamento è a climi estremi → interessante per il nord in periodi di rapidi cambiamenti climatici.
3. Nel sud non esiste un programma di breeding e di conservazione organizzato e le popolazioni non sono caratterizzate.
4. Le razze locali sono alla base della sussistenza di molti piccoli allevatori



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# obiettivi SCALA-MEDI

## Topic 1.2.1

### Subtopic A: Conservation and valorisation of local Animal Genetic Resources

1. Sfruttare tecnologie sviluppate in progetti EU precedenti (sensori, analisi genomiche ed epigenomiche).
2. Capire le basi biologiche dell'adattamento delle razze locali a climi estremi.
3. Conservarne la biodiversità *in-vivo* (valorizzazione caratteristiche) e *in-vitro* (biobanca).
4. Promuovere l'inizio di programmi di breeding per la conservazione della biodiversità e dell'adattamento e per il miglioramento delle performance delle razze locali.
5. Trasferire al sud tecnologie, conoscenze e strumenti per il loro utilizzo



# Il bando

## Challenge

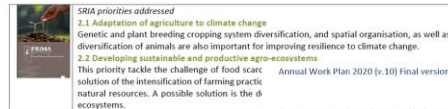
## Scope

## Expected results

## KEY CONCEPTS

### Thematic Area Farming systems

#### Topic 1.2.1-2020 (RIA/IA) Genetic conservation and animal feeds



Annual Work Plan 2020 (v.10) Final version

6.12.2019

#### Challenge

The Mediterranean's population will reach 560 million people by 2050. It is set to climb steeply as the population increases. It is an important challenge to develop sustainable systems respecting the environment, while providing a fair income and good working conditions.

With increasing demands for animal products by an ever-growing population, animal breeding needs to evolve to increase response and increase productivity and quality in context of genetic diversity and conservation programs to make production systems more resilient.

At the same time, sustainable livestock production in the Mediterranean is facing challenges. The lack of local alternative feeds and/or the inadequate management of herds can have a negative impact on the competitiveness and the sustainability of the livestock production systems in the Mediterranean Area.

#### Scope

Proposals should address only one of the following sub-topics:

##### Sub-topic A) Conservation and valorisation of local animal genetic resources

Knowledge of animal genetic resources for food and for development and conservation of these resources. Proposals shall consider mapping, genetic characterization of local breeds, tolerant to heat stress and drought, and the links between epigenetic, genomic and the reliability of genomic breeding with the goal of increasing doing so, proposals shall take advantage of existing databases and breeding programs to avoid duplications. Proposals should local breeds promoting the use of these breeds which can (meat, milk...) and with high added value for the farmers (local products) or platforms shall be established around the Mediterranean of adapted breeds bringing economic benefits to the farmers.

good practices. Decision-making tools for the end users are encouraged, to select the most appropriate breed according to the specificities of the production environment (agro-pastoralism, extensive or intensive production systems, mix crop livestock systems, ...).

##### Sub-topic B) Alternative animal feeds (IA)

Projects shall capitalize on what has been done in research programmes and EC projects and assess alternative feed resources based on local agricultural production. Proposals shall evaluate the impact of using alternative animal feeds on animal productivity and on the quality of the product. Environmental impact of alternative feed resources should also be considered. Proposals should analyse the socio-economic impact of the use of alternative animal feeds and promotion of the adoption of these new feeds by the end users. Proposals should be in line with the development of national and/or regional strategies testing, demonstrating and/or piloting in a (near to) operational environment, in partnership with the main stakeholders including farmer's institutions and the private sector (mainly SMEs).

Proposals for both sub-topics A and B should fall under the concept of TRL 3-5. Proposals shall be submitted by all the stakeholders, from farmers to consumers and regulators, will co-develop production systems to further add value to EU Mediterranean food systems.

##### Expected impacts

The project results are expected to contribute to:

##### For A proposals:

- Better knowledge of epigenetic and genetic processes leading to the Mediterranean environmental conditions
- Ensure the genetic conservation of local best adapted breeds and value
- Propose to the farmers new options of breeds adapted to the local epigenetic with environment
- Increase small farmers' incomes via the rearing of local breeds and the value added value

##### For B proposals:

- Development and adoption of new alternative feed sources
- Adoption of a circular economy approach in the livestock production
- Valorisation of local crops or adapted species to the local conditions
- Reduce the cost of production and improve the quality of the final product
- Favor mix crop-livestock systems

##### KEY PERFORMANCE INDICATORS

- Number of innovations in farming systems developed enabling sustainable systems
- SDG2: Indicator 2.5.1: Number of plant and animal genetic resources in medium or long-term conservation facilities
- SDG2: Indicator 2.5.2: Proportion of local breeds classified as being at risk of extinction

Table 3 Supporting information for the Section 1 Call for Proposals, Topic 1.2.1

Annual Work Plan 2020 (v.10) Final version

6.12.2019

Type of action	Research and Innovation Action (RIA) sub-topic A and Innovation Action (IA) sub-topic B
Total indicative amount allocated to this call	€ 10.7 million
Funding level	According to Horizon 2020 Rules. For the sub-topic A) RIA: 100%; For the sub-topic B) IA: 70% (except for non-profit legal entities, where a rate of 100% applies).
Technology Readiness levels (TRL)	RIA TRL 3-5 IA TRL 6-7 Proposals should clearly state the starting and ending TRLs of the key technology or technologies targeted in the project.
Budget and duration of the grants	PRIMA considers that proposals requesting a contribution up to EUR 1.75 million for subtopic A and up to EUR 2.30 million for subtopic B would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. Duration of the grants will be from 36 months to 48 months.
Submission and evaluation procedure	Two-stage application procedure. For the first stage, a short proposal (maximum 10 pages) must be submitted by the first deadline. Successful applicants in the first stage will be invited to the second stage to submit a full proposal (maximum 50 pages). A timeline for the submission and evaluation of applications can be found in <a href="#">table 6</a> .
Evaluation rules	The award criteria, scoring, thresholds and weightings for RIAs and IAs respectively, listed in part 5.1.6 will be used.
Grant agreement	PRIMA MGIA (multi-beneficiary), based on Horizon 2020.
Consortium agreement	Participants in projects resulting from this Call for Proposals will be required to conclude a consortium agreement prior to the conclusion of the PRIMA grant agreement.

<sup>12</sup> Only local Mediterranean breeds shall be considered.

<sup>13</sup> The multi-actor approach aims to make innovation more demand-driven, and therefore involves various actors (end-users such as farmers/farmer groups, advisors, basic research institutions, etc.) in the planning of work and experiments, to implementation, the demonstration phase.



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# Key concepts

- Growing Mediterranean population
- Growing demand of meat and milk
- Genomics to speed up response
- Climate change
- Local breeds investigation and conservation
- Livestock system resilience
- Heat stress tolerance
- Disease resistance
- Link between epigenetics, genomics and phenotype
- Advantage from existing databases and past EU project
- Link to national breeding programmes
- Characterize and valorize final products for consumers (quality) and farmers (labels, genetic certifications, new products)
- Establishment of Networks for conservation and valorization, capacity building, dissemination of good practices
- Development of end-user tools for more appropriate breed selection



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# Definire gli obiettivi

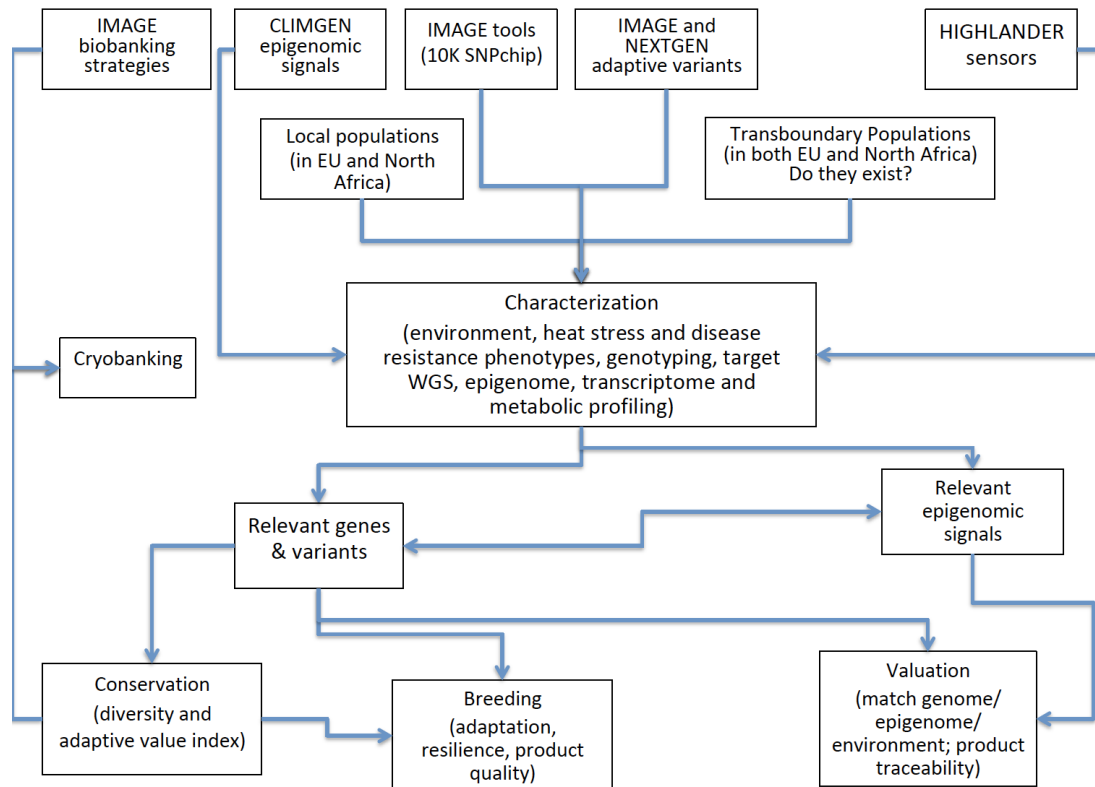
**GENERAL:** optimise the sustainable use and conservation of local genetic resources from the Mediterranean region, focusing on adaptation to climatic conditions and consumer preferences.

**SPECIFIC:**

1. Characterization to estimate phenotypic, genotypic and epi-genotypic diversity.
2. Identification of genomic signatures of adaptation
3. Establishment of selective breeding programmes
4. Assessment of the role of epigenetics in adaptation
5. Exploration of options to include epigenomic marks in breeding programs.
6. Definition of the specific features and benefits of local sheep and chicken s for *in vivo* conservation.
7. Development of strategies to add value to products.
8. Development of a network of existing genebanks.
9. Capacity building, knowledge transfer and dissemination.



# Schematizzare l'idea progettuale



1. Definito dal coordinatore o insieme a pochi 'core Partner'
2. Se non si riesce a creare uno schema coerente il progetto non funzionerà.
3. Lo schema aiuta nella scelta dei Partner adatti.
4. I Partner dovranno adattarsi al progetto non il progetto adattarsi ai Partner.



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# Partnerariato

Participant No *	PI name	Organisation	Country
1 <b>Coordinator</b>	<i>Paolo Ajmone-Marsan</i>	Università Cattolica del Sacro Cuore (UCSC)	Italy
2 <b>Partner 1</b>	<i>Alessandra Stella</i>	Consiglio Nazionale delle Ricerche - Istituto di Biologia e Biotecnologia Agraria (CNR-IBBA)	Italy
3 <b>Partner 2</b>	<i>Giovanni Chillemi</i>	Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC)	Italy
4 <b>Partner 3</b>	<i>Antonello Carta</i>	Agenzia Regionale per la Ricerca in Agricoltura - Sardegna (AGRIS)	Italy
5 <b>Partner 4</b>	<i>Riccardo Valentini</i>	Nature4.0 BC SRL (NAT4)	Italy
6 <b>Partner 5</b>	<i>Nacera Tabet Aoul</i>	University of Sciences and Technology of Oran "Mohamed Boudiaf" (USTO)	Algeria
7 <b>Partner 6</b>	<i>Nouredine Azzi</i>	University of Tlemcen "Abou Bekr Belkaid" (PPABIONUT)	Algeria
8 <b>Partner 7</b>	<i>Ghania Zitouni</i>	Technical Institute of Breeding /Tlemcen (ITELV)	Algeria
9 <b>Partner 8</b>	<i>Michèle Tixier-Boichard</i>	National Research Institute for Agriculture, Food and Environment (INRAE)	France
10 <b>Partner 9</b>	<i>Valérie Loywyck</i>	Institut de l'Élevage (SME) (IDELE)	France
11 <b>Partner 10</b>	<i>Badr Benjelloun</i>	Institut National de la Recherche Agronomique (INRA-Maroc)	Morocco
12 <b>Partner 11</b>	<i>Chaouki Jerrari</i>	Moroccan Poultry Federation (FISA)	Morocco
13 <b>Partner 12</b>	<i>Abderrahamane Jannoune</i>	Association Nationale Ovine et Caprine (ANOC)	Morocco
14 <b>Partner 13</b>	<i>Manel Ben Larbi</i>	High School of Agriculture of Mateur (ESAM)	Tunisia
15 <b>Partner 14</b>	<i>Naceur M'Hamdi</i>	National Agronomic Institute of Tunisia (INAT)	Tunisia
16 <b>Partner 15</b>	<i>Hichem Khemiri</i>	Office de Développement Sylvopastoral du Nord Ouest (ODESYANO)	Tunisia
17 <b>Partner 16</b>	<i>Haifa El-Hentati</i>	National Gene Bank of Tunisia (NGBT)	Tunisia

- Paesi: 3 Sud e 2 Nord Mediterraneo
- 11 Enti di Ricerca (ricerca)
- 1 SME (tecnologia)
- 4 Associazioni allevatori (applicazione)
- 1 Biobanca Regionale (applicazione)



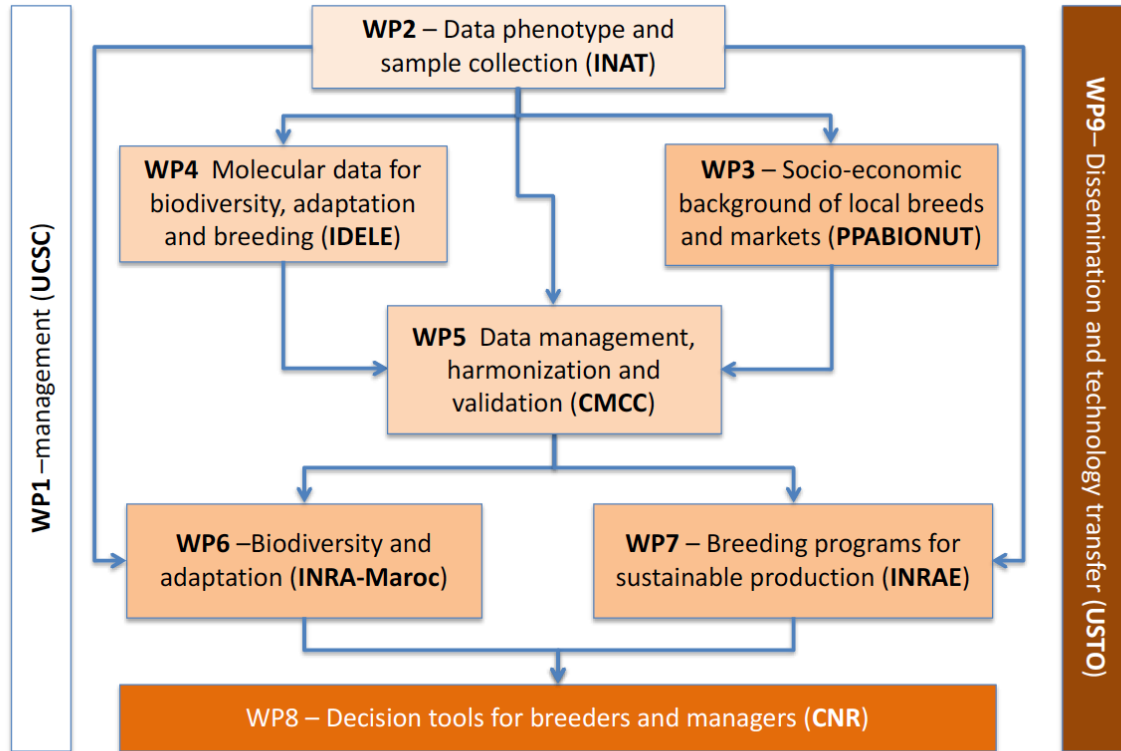


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graph TD
    Producers <--> Traders["Traders (meat, wool, ...)"]
    Producers <--> Tradespeople
    Producers <--> Veterinarians
    Producers <--> FoodSuppliers["Food suppliers"]
    Traders <--> Slaughterhouses
    Slaughterhouses <--> MeatProcessor["Meat processor"]
    Slaughterhouses <--> Butchers
    Tradespeople <--> MeatProcessor
    Veterinarians <--> VetProductSuppliers["Veterinary product suppliers"]
    VetProductSuppliers <--> FoodSuppliers
  
```



# Struttura in WPs



*SCALA-MEDI Workpakage structure*

- Specificare task entro WP
- Per ogni WP e task:
  - Definire i tempi
  - Assegnare responsabilità
  - Identificare un deliverable (ed eventuali milestone)



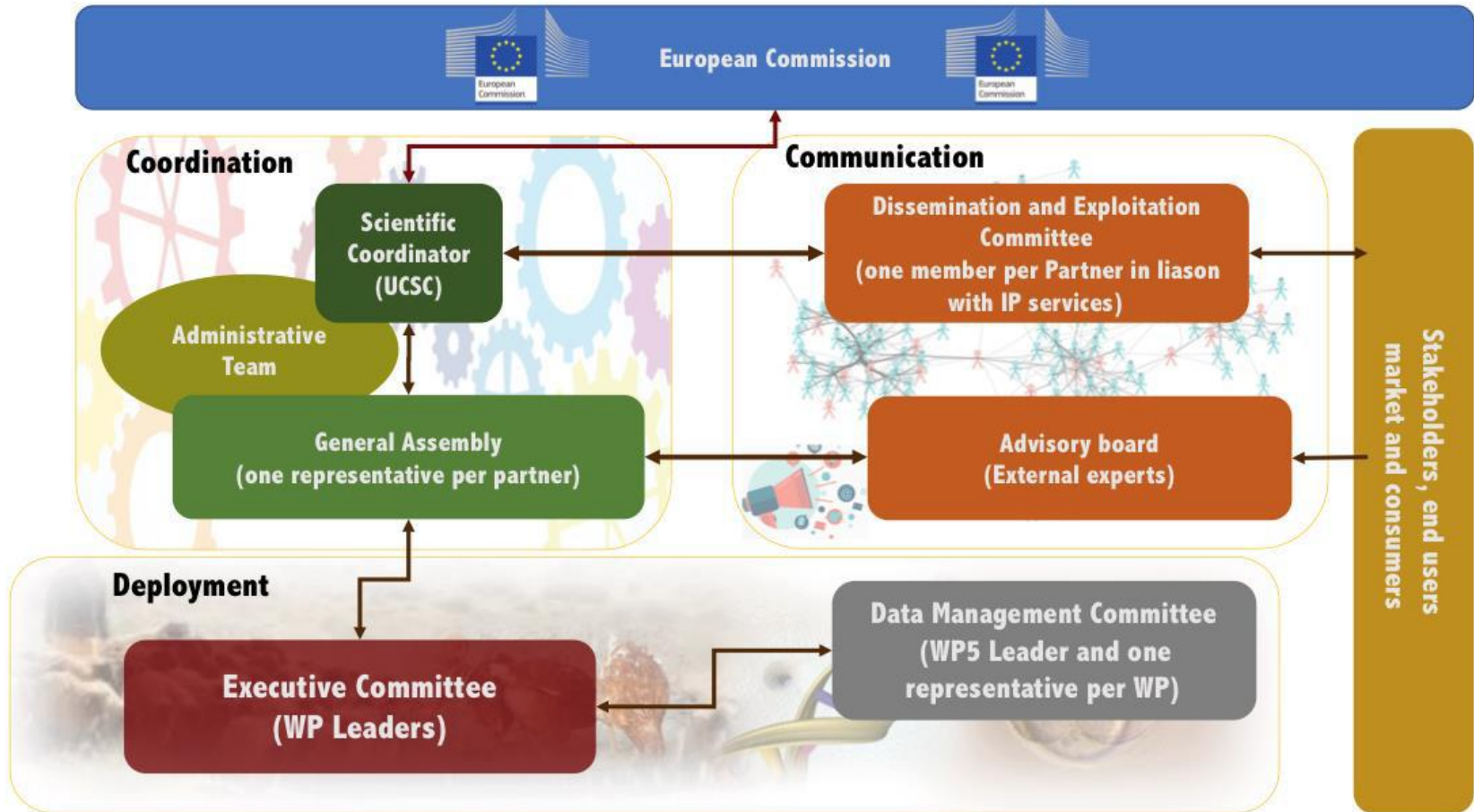
# Tempistica

MS=Milestone, D=Deliverable		Month																																																		
Task n.	Task title	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48			
WP1 PROJECT COORDINATION AND MANAGEMENT																																																				
T1.1.	Strategic steering			D1.1									MS1.1												MS1.1																										D1.2	
T1.2.	Project monitoring			D1.2									MS1.2												MS1.2																										D1.3	
T1.3	Administrative and financial support												MS1.2																																					D1.3		
T1.4	Data management plan						MS1.3																		MS1.3																										D1.4	
WP2 DATA, PHENOTYPE AND SAMPLE COLLECTION																																																				
T2.1	Strategy and logistics				D2.1																																															
T2.2	Metadata and data standards				D2.1																																															
T2.3	Establishing remote phenotyping capability					D2.2																																														
T2.4	Sample collection and conservation																	MS2.1			MS2.2																															
T2.5	Collection of phenotypic data																	MS2.1			MS2.2																															
WP3 SOCIO-ECONOMIC BACKGROUND OF LOCAL BREEDS AND MARKET																																																				
T3.1	Preparation of socio-economic questionnaires for value chain stakeholders				D3.1																																															
T3.2	Collection of available socio-economic data												MS3.1																																							
T3.3	Collection and analysis of survey data																			D3.2																																
T3.4	Modeling of the socio-economic impact of the proposed "tools" on the value chain																			MS3.2					MS3.3																											D3.3
WP4 MOLECULAR DATA FOR BIODIVERSITY, ADAPTATION AND BREEDING																																																				



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# Management







# Le figure aiutano

400 animals from *Préalpes du Sud*: blood sampled, genotyped and LUMA assayed, monitored in different seasons with precise phenotyping.

sheep

1000 *Sardi* nucleus flock and 50/breed: *Timahdite*, *Boujaâd*, *D'man*, *Beni Guil*: phenotyping, genotyping and LUMA assay on blood

sheep

250 village chickens from 5 agro-environments and 200 ♀ and 50 ♂ purebreeding in multiplier herds: phenotyping, genotyping and blood LUMA assay

chicken

France



140 *Sarda* ewes and 10 rams climate challenged

- Year1 bred as normal, lactating during a temperate time of the year
- Year2 same animals lactating out of season when temperature is high
- Blood and skin from all ewes and rams: DNA methylation and LUMA assay.
- Semen and oocytes from rams and a subset of 10 ewes: DNA methylation, RNA and microRNA expression.
- Comparison with *Sarda* in the Tunisian experiment

sheep

Italy

Tunisia

50/breed from *Barbarine*, *Noir de Thibar*, *Queue Fine de l'Ouest*, *Sicilo-Sarde*, *Tunisian Barbarin* and *Sidi Tabet* cross: phenotyping, genotyping and LUMA assay on blood

20/breed: *Barbarine*, *Sicilo-Sarde* and imported *Sarda* rams: environmental swap (temperate and hot): phenotyping, genotyping, LUMA assay on blood, epigenotyping on blood and skin. Comparison with *Sarda* in the Italian experiment

sheep

chicken

250 village chickens from 5 agro-environments and 250 chickens to test the terminal cross with females developed by the SASSO company: phenotyping, genotyping, LUMA assay on blood

50 animals/breed: *Ouled Djellal*, *Rembi*, *Harmra*, *Taadmit*, *Sidaoun* and *D'Men*: phenotyping, genotyping and LUMA assay on blood

sheep

250 village chickens from 5 agro-environments and 200 ♀ and 50 ♂ to establish 2 parental lines that will be used develop a dual-purpose chicken: phenotyping, genotyping and LUMA assay on blood

chicken

Algeria

Morocco

WESTERN SAHARA

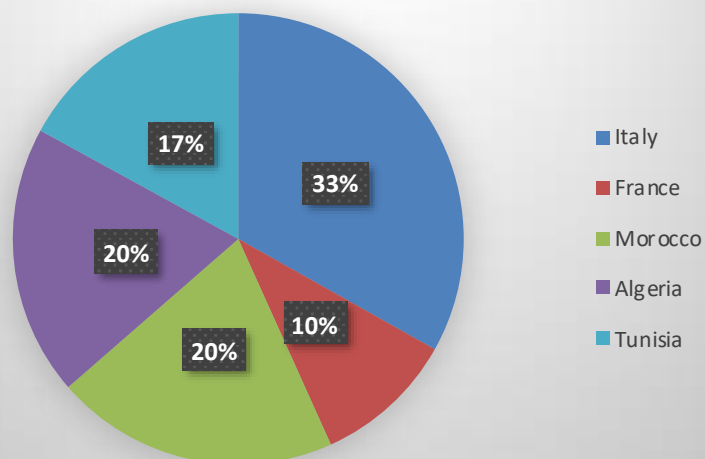
Fig.1. SCALA-MEDI experiments at a glance.



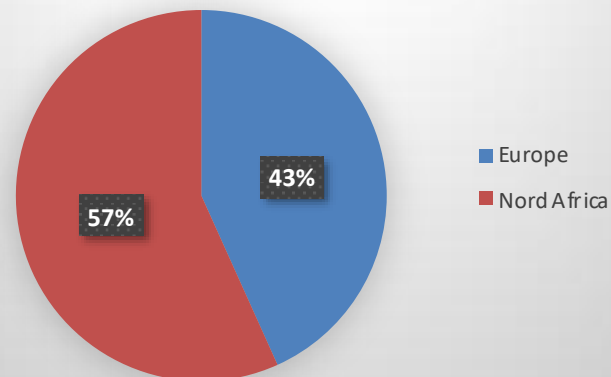
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# Costruzione del budget

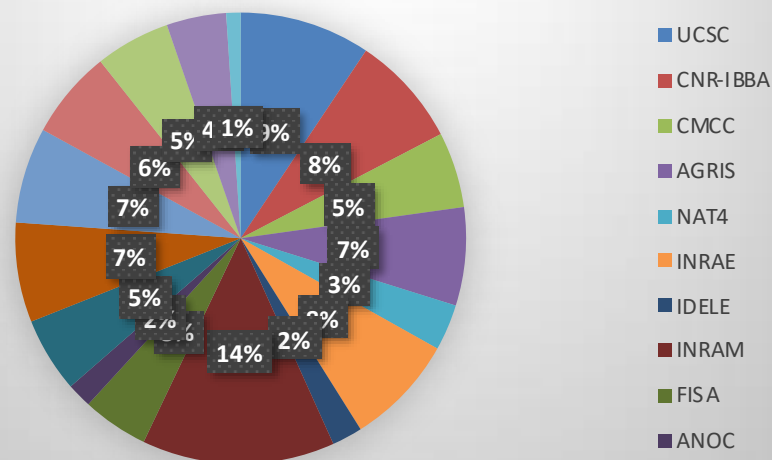
## Budget per Country



## Budget per Region



## Budget per Partner





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# Chiavi del successo

- Coerenza con quanto chiede la call
- Scelta del partnerariato
- Misurabilità dei risultati
- Chiarezza
  - Programma
  - Responsabilità
  - Espositiva
  - Uso risorse