MoSAR - Modélisation systémique appliquée aux ruminants

Rapport Hcéres

agence d'évaluation de la recherche
et de l'enseignement supérieur

Department for the evaluation of research units

AERES report on unit:

Systemic Modelling Applied to Ruminants

MoSAR

Under the supervision of the following institutions and research bodies:

AgroParisTech - Institut des Sciences et Industries du Vivant et de l'Environnement

Institut National de la Recherche Agronomique - INRA

January 2014

agence d'évaluation de la recherche
et de l'enseignement supérieur

Department for the evaluation of research units

On behalf of AERES, pursuant to the Decree of 3 november 2006[1]*,*

- Mr. Didier HOUSSIN, president
- Mr. Pierre GLAUDES, head of the evaluation of research units department

On behalf of the expert committee,

- Mr. Etienne JOSIEN, chair of the committee

[1] The AERES President "signs [...], the evaluation reports, [...] countersigned for each department by the director concerned" (Article 9, paragraph 3 of the Decree n ° 2006-1334 of 3 November 2006, as amended).

Evaluation report

This report is the result of the evaluation by the experts committee,the composition of which is specified below.

The assessment contained herein are the expression of independent and collegial deliberation of the committee.

Unit name:	Systemic Modelling Applied to Ruminants
Unit acronym:	MoSAR
Label requested:	UMR
Present no.:	0791
Name of Director (2013-2014):	Mr Nicolas FRIGGENS
Name of Project Leader (2015-2019):	Mr Nicolas FRIGGENS

Expert committee members

Chair: Mr Etienne JOSIEN, VetAgroSup

Experts:

Ms Corinne BAYOURTHE, ENSAT

Ms Laura BOYLE, Teagasc, Ireland

Mr Gilles BRUNSCHWIG, VetAgroSup (representative of CNECA)

Mr Andrew ILLIUS, University of Edimburgh, UK

Mr Yves LEFRILEUX, IDELE

Mr Charles-Henri MOULIN, SupAgro Monpellier (representative of INRA CSS)

Scientific delegate representing the AERES:

Mr Hubert LEVÉZIEL

Representative(s) of the unit's supervising institutions and bodies:

Mr Cyril KAO (Director of the Doctoral School n°435)

Mr Benoit MALPAUX, INRA

Mr Daniel TOMÉ, AgroParisTech

1 • Introduction

History and geographical location of the unit

The research unit MoSAR (for Modélisation Systémique Appliquée aux Ruminants) was created on January 1st, 2010 under the supervision of AgroParisTech and INRA.

Previously, it was called PNA (Physiologie de la Nutrition et de l'Alimentation). PNA has long experience in ruminant nutrition physiology and alimentation, mainly with goats. It has also developed a strong expertise in animal systemic modelling.

The change of name in 2010 corresponds to a scientific evolution, stressing animal modelling and focusing on phenotypic variation in the acquisition, transformation and allocation of nutrients to the different life functions.

MoSAR is situated in AgroParisTech (Paris). It has an experimental farm (120 dairy goats and young stock) at Grignon (40 km West of Paris; 50 minutes at the best).

Management team

The creation of MoSAR in 2010 was accompanied by a change in the management team; Mr Nicolas FRIGGENS (directeur de recherche, INRA) became director and Ms Christine DUVAUX PONTER (Professeur, AgroParisTech), deputy director.

AERES nomenclature

SVE2_LS9

Unit workforce

Unit workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	7	7
N2: Permanent researchers from Institutions and similar positions	5	6
N3: Other permanent staff (without research duties)	13.5	12.5
N4: Other professors (Emeritus Professor, on-contract Professor, etc.)		1
N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.)	1	
N6: Other contractual staff (without research duties)	1	2
TOTAL N1 to N6	27.5	28.5

Unit workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	9	
Theses defended	9	
Postdoctoral students having spent at least 12 months in the unit	2	
Number of Research Supervisor Qualifications (HDR) taken	1	
Qualified research supervisors (with an HDR) or similar positions	4	6

2 • Assessment of the unit

Global assessment

MoSAR is a small unit which is in a positive dynamics and has some assets for the next period: the scientific outputs are in an upward trajectory, in quantity and especially in quality; the level of academic recognition and reputation is good and seems to be increasing, both nationally and internationally; the number of funded projects is going upward; the experimental farm is a good support to develop the scientific activity and to sustain relationships with the economic sector.

The scientific project, which was reshaped at the beginning of the reference period for assement, is now redefined around the relationships between productive and non-productive functions of the animal, from short term processes to animal lifespan. It is original, it reveals a clear scientific strategy and suits very well with current issues in ruminant livestock domain. However, it covers a very wide field and the committee recommands to break it down in operational works and prioritized research objectives, types of output (research models, decision support tools,…), and steps to be performed.

Considering doctoral education, the MoSAR involvement is quite good, but can still be enhanced with a higher number of HDR, which is a major point to increase the number of doctoral supervisions.

The group is functionning in a good ambience but this should not dispense to improve the formalization of the unit governance. This lack of formalization could be a potential weakness in case of tensions with in the unit.

The unit, and its supervising institutions, should take care of the renewal of the competences (due to retirements), mainly in modellling (scientists) and laboratories (technicians).

In conclusion, the committee encourages the unit to continue its efforts to structure the project and to improve its results, and wishes its recommendations could help to reach this goal.

Strengths and opportunities related to the context

The main strength of MoSAR is the positive dynamics installed during the reference period for assessment: significant increase in scientific production in quantity and quality, success in calls for national and European projects, and development of transfer activity.

This period allowed the integration, in a new scientific project, of the guidelines that were given at the beginning of the reference period, namely to strengthen modelling and phenotyping activities.

The small size of MoSAR can be considered as a strength, given that: i) it is organized around an animal model, the lactating goat, supported by the facilities of its experimental farm and laboratories and ii) it focuses its researches on clearly defined issues. The experts committee considers this as an advantage because it facilitates the flow of information between researchers, the allows complementarity of approaches and the possibilities for upscaling and downscaling (rumen, herd, whole animal).

MoSAR has an established reputation in meta-analysis skills, system modelling combined with experimentation, and feeding behaviour. Based on multidisciplinary approaches (physiology, nutrition, ethology, mathematics), these skills are an advantage for the unit's coherence, as well in the realization of its aims, as for its attractiveness (for students, for recruitment).

The investment unit in phenotyping is an opportunity to develop collaborations with animal genetics which should be exploited.

The unit is favorably viewed in the professional sector (goat breeding, animal feed industry, expertise for administration as the French Ministery of Agriculture or the French Agency for Food, Environmental and Occupational Health & Safety (ANSES). Moreover, it is involved, in collaboration, in the transfer of its results through contributions to the evaluation of the nutritional value of feed for ruminants (*Systali - an INRA project to update the feed unit system for ruminants*) and dissemination of standard values for many plant products used worldwide (*Feedipedia - an online animal feed resources information system*).

MoSAR has a strong project which both suits with the unit's skills and adresses very well some major interests in the ruminant sector (livestock precision farming, animal welfare,…).

Finally, MoSAR's aims and objectives fit very well into the programs of the institutions and research bodies (Phase (Physiologie Animale et Systèmes d'Elevage) department of INRA and AgroParisTech). The unit has the support of the authorities.

Weaknesses and threats related to the context

Governance in the unit is based on the quality of exchanges between its members and seems to work well without actual formalization of modes of organization and decision rules. The committee emphasizes that, in case of relational difficulties, this lack of formalization could be a weakness for the management of the unit.

The modelling activity, which is central to the MoSAR project, requires attention in two respects. The first concerns the skills that will disappear (retirement) in the coming years and the renewal of them is a key point for the success of the project. The second is in the risk of making modelling an end in itself, that is to say, to build models without formalizing the purpose for which they will be put, for example by industry.

The project presented by the unit encompasses ingestion - digestion - metabolism - partition in dairy goats. It is based on multiple experimental approaches, phenotyping and modelling at the animal and herd levels. This project seems very broad and requires prioritization. Some parts are likely to need to be better explained, especially the interface between questions of partition of energy and animal behavior.

The unit has experienced and continues to experience a significant erosion of its technical laboratory staff. It seems to have managed to cope with it so far. However, it is a real threat to certain activities of the unit.

Finally, if the modeling activities seem to be a good opportunity to succeed at national and European calls for projects, there is certain fragility in financing other activities.

Recommendations

Beyond maintaining the positive dynamic of the unit (scientific production, funding, ...) and its quality of life, some recommendations can be made by the evaluation committee.

It recommends that the unit conducts a precise definition of work objectives it assigns to its modelling activity, in terms of outcomes (for research or breeding or industry). The goal should be to produce models which can be evaluated accordingly.

Thought should be given to whether addressing individual variability can make an economic contribution to precision farming.

In the context of quality assurance, it seems necessary to formalize and to collectively validate the methods of decision making and debate within the unit ; in other words, to explicitly define the operation of governance unit which is currently based largely on good relations between its members.

In terms of personnel management, with the support of AgroParisTech and INRA, MoSAR must be careful to maintain and renew its skills. Two areas may be under threat the coming years: modelling (research) and technical skills (laboratory).

MoSAR could further strengthen its partnerships with other research units, either in complementary areas such as animal genetics (in connection with the phenotyping activity) or on its own themes - modelling of the vital functions of the animal, animal behavior - applied to other species.

Finally, the disaffection of AgroParisTech students in animal specializations seems to be a point requiring vigilance by MoSAR. Indeed, the renewal of teachers' positions in the medium term is probably not independent of changes in the number of students in training. It is probably difficult to oppose this trend which comes from deep movements in society, but some popularisation of issues around livestock farming and its importance in rural development should certainly possible.

3 • Detailed assessments

Assessment of scientific quality and outputs

The evaluation committee notes that MoSAR is on a favorable trajectory in quantity and quality for its scientific production. The number of publications in peer-reviewed journals, increased from 85 (previous period) to 129 (current period) corresponding to an average of about 3 papers per Research Full Time Equivalent per year, is considered to be a good result by the evaluation committee. The part of these publications in journals considered as excellent increased from 33 % to 73 %. Nevertheless, we believe that quality could be improved further by targeting higher-ranking animal science journals.

This output has real originality, particularly in regard to modelling whole-life animal function and rumen modelling (for instance the "GARUNS" model which quantifies animal performance as a function of nutrition ressources but also as a function of animal priorities throughout its whole life), although the applicability of the results is still more potential than actual.

Assessment of the unit's academic reputation and appeal

Many indicators show a good level of academic recognition and reputation of the unit, both nationally and internationally. Researchers in MoSAR are regularly asked to engage in projects funded at national (ANR, IDEX) and European level, mainly in the field of modelling (MoSAR searchers are involved in 5 organisation or co-organisation of national or international collaborative research projects). Several researchers are members of international and national organizations (MoSAR is a focal point of the French Association for Animal Production), scientific committees of international conferences and editorial boards of scientific journals in animal production. The unit was organizing an international symposium.

The attractiveness, especially for foreign researchers (5 researchers or post-docs with an average length of stay of 8 weeks) received during the period, is due to the reputation of the unit. Steps should be taken to maintain this.

Assessment of the unit's interaction with the social, economic and cultural environment

MoSAR has developed numerous interactions with industry and has invested in major projects to transfer knowledge of ruminant feed (*Feedipedia*, *Systali*). The experimental farm is an advantage for the relationship with industry. The unit maintains relationships with industry, including the feed industry, which has a good impact on financing contracts and CIFRE theses, and with professional bodies (Institut de l'Élevage, Unciea (Union Nationale des Coopératives Agricoles d'Élevage et d'Insémination Animale),…). Several members of MoSAR participate in expert committees for professional organizations.

During the period, the articles in magazines or books for professionals (n = 25) is also a good sign of this involvement oriented to the economic world.

The committee also notes the responsibility of MoSAR researchers in expert groups to advise the authorities at national level in the field of animal nutrition (ANSES) and of animal welfare (Ministry of Agriculture).

On the involvement of the unit in the dissemination of scientific culture to the general public, the report produced by the unit only shows very little action. This is a point to watch and maybe is linked with the risks due to the erosion in the number of students who wish to engage in the ways of animal production.

Assessment of the unit's organisation and life

MoSAR is a quite small unit and it is not organised into several teams. As much as possible, decisions are discussed in fortnightly group meetings involving all unit members. Alternatively, a subgroup of three persons (director, deputy director and the director of the teaching unit) deals with the issues that are not suitable to be dicussed with the full group.

During the visit, especially in the meetings with different categories of staff and PhD students, the unit appeared as close-knit and motivated about the project, despite the current and future causes of concern (eg.: decreased current workforce of technical staff, expected moving of AgroParisTech to Saclay). This motivation is certainly connected, in a virtuous circle, to the positive dynamics menitoned in the field of scientific production and reputation. Exchanges between staff and managers are frequent and decisions are transparent.

However, the committee emphasizes that functioning in a good ambience, combined with the small size of MoSAR, could have allowed to occur a lack of formalization of the organization unit. This does not seem to be a problem now, but could become one if internal or external conflicts need to be resolved. The choice of avoiding to split the unit in several teams seems justified. However, a functional organizational chart of the unit (identifying the different functions of agents and their responsibilities) is essential. Similarly, procedures for decision-making and arbitration should be written, as well as process management (quality manual is far from being completed).

Assessment of the unit's involvement in training through research

Nine PhD students are currently supervised by MoSAR researchers, including five for whom the unit is the main research group. Members of MoSAR are significantly involved in the supervision of PhD students joined in partnership with other units and contribute to many theses and HDR committees. Sixteen theses were defended during the reference period, including 9 in the unit as main research group. Three theses are co-supervised with researchers from foreign organizations. The involvement of the students in the life of the unit seemed very satisfactory, as well as their management (internal and external presentations, conferences, publications, an average length of 40 months per thesis, PhD are all funded). Career opportunities for MoSAR ex-PhD students are good and in accordance with their training, primarily in higher education and public and private research. The unit is also engaged in the training conducted by the Doctoral School n°435 (ABIES).

These results are rated as satisfactory by the committee, which encourages the unit to continue to engage in doctoral supervision, primarily by recruiting more PhD students and by increasing its leadership capacity (5 HDR currently) by means of support to the staff members in position to defend an habilitation.

Assessment of the strategy and the five-year plan

The unit project is based, generally, around the relationships between, on the one hand, productive and non-productive functions of the animal, and on the other hand, between short term and long term (ingestion/digestion → whole animal life). It is underpinned by the idea that optimal balance between these functions can be found in order to increase the long-term efficiency of the system, while improving the welfare of animals. This project suits very well with current issues in ruminant livestock domain and should fit easily into research funding schemes and should offer opportunities for developping collaborative projects.

In scientific terms, this project is divided into two sub-projects:

- The first is centered on the acquisition of resources (behavior - ingestion - digestion). It aims at modelling the interactions determining the acquisition, at phenotyping animals according to parameters associated with this acquisition phase and at developing tools for early detection of problems occurring during this phase ;

- The second concerns the allocation of resources, and their inter-individual variability throughout life (whole life phenotyping), by studying the regulation of resource (energy) partition to the various functions of the animal, distinguishing between productive and non-productive functions, with the general aim to gradually build a systemic model of energy metabolism of lactating females.

For the committee, this project shows the clear global strategy of the unit. However, it covers a very wide field, combining different approaches (behaviour, physiology, modelling, ...), with nested levels of organization (rumen including microorganisms, animal, herd), considered on very different time scales (from duration of ingestion to the whole life span of the animal). It would be helpful if this vision were articulated in terms of the research outcomes that would make the most significant contributions to livestock production. The project should be broken down in operational works and prioritized research objectives, types of output (research models, decision support tools,…), and steps to be performed.

Finally, the MoSAR project, in the way it was presented, mainly deals with scientific perspectives (in accordance with AERES demand); the Evaluation committee nevertheless invites the unit to incorporate in its reflection synergies between the scientific project and all of the benefits it has shown in its global results, for example its involvement in professional livestock farming sector and in higher education.

4 • Conduct of the visit

Visit date:	Wednesday January 8th 2014
Start:	8.00 am
End:	18.00 pm
Visit site:	AgroParisTech
Institution:	AgroParisTech/INRA
Address:	15 rue Claude Bernard, 75231 Paris

Conduct or programme of visit:

8:00 am	Welcome & Closed-door Meeting of Visiting committee with AERES Scientific Advisor
8:40 am	Introduction of Plenary Session: AERES Role & Procedures: AERES Scientific Advisor
9:00 am	General Presentation of UMR-MoSAR & Discussion; Director of the Unit
9:40 am	Presentations of Research Themes & Discussion: Digestion and feed evaluation Animal behaviour and welfare Partition of energy-providing nutrients
11:30 am	Presentation of the Strategies and Perspectives; Director of the Unit
12:10 pm	Parallel meetings with personnel: Discussion with engineers, technicians, administrative staff Discussion with staff scientists Discussion with students and post-docs
2:00 pm	Closed-door Discussion with Representatives of the Managing Bodies
2:45 pm	Closed-door Discussion with the Director of the Doctoral School
3:00 pm	Closed-door Discussion with the Direction of the Unit (if necessary)
3:30 pm	Closed-door meeting of the Visiting committee (in presence of AERES Scientific Advisor)
6:00 pm	End of the visit Departure of committee members

5 • Supervising bodies' general comments

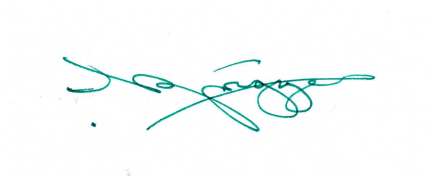
Réf. : rapport d'évaluation AERES S2PUR150007825 - Modélisation systémique appliquée aux ruminants (MoSAR) - 0753465J

UMR 0791 MoSAR response to AERES report

We would like to thank the jury for the evaluation of our Unit, MoSAR, which we find to be both perceptive and helpful.

With respect to the strengths of MoSAR, we are pleased that the jury shares our view of a positive dynamic in the reporting period with a significant increase in scientific production and success in calls for national and European projects. The highlighting of MoSAR's strengths in systemic modelling combined with experimentation on resource acquisition and resource allocation is also appreciated.

We also recognise the recommendations of the jury and have already initiated processes to further focus the short-term objectives within the Unit's scientific strategy, and to reinforce the new Unit structure by further defining the internal organisation of exchange and decision making. We share the jury's concerns about the erosion of the Unit's technical staff and continue to actively seek posts to reverse this trend.



Nicolas FRIGGENS
MoSAR Director
With the agreement with the supervising institutions