**PhD PROPOSAL FOR THE DOCTORAL SCHOOL**  
« Ecologie, Géosciences, Agronomie, ALimentation »

**GENERAL INFORMATION**

<table>
<thead>
<tr>
<th>Thesis title: Towards a decision-support tool for the use of wheat flour in industrial bakeries</th>
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<tbody>
<tr>
<td>Acronym: ODAMFAR</td>
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<tr>
<td>Disciplinary field 1: Food sciences</td>
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<tr>
<td>Disciplinary field 2: Agronomy</td>
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<tr>
<td>Three keywords: kneading, structure, modelling</td>
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<td>Research unit : INRAE, UR1268 Biopolymères, Interactions &amp; Assemblages</td>
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<tr>
<td>Name of the thesis director: DELLA VALLE Guy</td>
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<td>Email address of the thesis director: <a href="mailto:Guy.della-valle@inrae.fr">Guy.della-valle@inrae.fr</a></td>
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<tr>
<td>Name of the thesis co-supervisor 1 (if applicable): SAULNIER Luc</td>
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<tr>
<td>Email address of the thesis co-supervisor 1 (if applicable): <a href="mailto:Luc.saulnier@inrae.fr">Luc.saulnier@inrae.fr</a></td>
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<tr>
<td>Name of the thesis co-supervisor 2 (if applicable): KANSOU Kamal</td>
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<tr>
<td>Email address of the thesis co-supervisor 2 (if applicable): <a href="mailto:Kamal.kansou@inrae.fr">Kamal.kansou@inrae.fr</a></td>
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<tr>
<td>Thesis grant (funding origin and amount): CIFRE-ANRT + private company contribution (&gt; 72000€ brut)</td>
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<tr>
<td>Contact(s) (mailing address and E-mail): INRAE Pays de Loire,BP 71627, 44316 NANTES cedex 3</td>
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**Recruitment process:** Recruitment process depends on thesis funding. To select the corresponding recruitment process, please visit the EGAAL website [here](#). This information is needed for proposal publication.

- [ ] Doctoral school contest  
- X Interview  
- [ ] Other (indicate) :

**SCIENTIFIC DESCRIPTION OF THE PhD PROJECT**

**Socio-economic and scientific context : (10 lines)**

La Boulangère & Co is a French manufacturer of pre-packed breads and pastries. Founded in the Vendée region of France and rich in family heritage, today it combines baking know-how, a culture of innovation and a commitment
to the French agricultural sector.

At the end of 2019, it will have 2086 employees spread over 1 head office in Essarts-en-Bocage (85) and 7 production sites in France. It distributes products accessible to all in 25 countries around the world, in supermarkets, through its La Boulangerie brand, organic stores, out-of-home catering and e-commerce.

It has long been involved in R&D aimed at understanding and controlling the impact of flour variability on the behaviour of dough on line. This approach makes sense in the current changing and complex context of the cereal sector, with a growing diversity of wheat farming practices, changes in consumer behaviour and expectations, and a growing focus on more sustainable, ethical and local production.

**Assumptions and questions (8 lines)**

The starting hypothesis is that flour hydration and dough kneading behaviour are the main factors that condition the behaviour of the dough in line.

Large amounts of data, and information from statistical analyses, have been produced in this way, but it is now necessary to put these results into perspective in order to better control flour variability. The research program proposes multidisciplinary research that combines experimentation and expertise on the role of flour constituents, dough rheological properties, bread-making technology and data modelling and knowledge. The scientific questions are as follows: in the usual field of flour variation, what are the contributions of the constituents to the rheological properties of the dough? how to use the power curve of the mixer to modulate these rheological properties? how to integrate technological and scientific knowledge, qualitative and quantitative data in the same model?

**The main steps of the thesis and scientific procedure (10-12 lines)**

1- Bibliography on the relationship between the biochemical characteristics of flour and the rheological behaviour of the dough and Collection of knowledge from Company personnel and analysis of data available on the sites. This task will make it possible to determine characteristic properties of the dough's behaviour.

2- Characterization of flours from the Enterprise's sample library using biochemical and spectroscopic methods. This task will aim at finding the causes of the presence of defects during manufacture.

3- On a few batches of flours of different compositions
   - Study of kneading: dough hydration properties, different operating variables (% water, time, temperature, speed), rheological properties.
   - Study of the fermentation performance of these doughs by video monitoring.

4- Construction and evaluation of a predictive model of hydration, based on the data.

5- Transfer of methods and tools, building of a computer model of the model, on-site validation including possible training sessions for user training on the production site.

**Methodological and technical approaches considered (4-6 lines)**

- Knowledge elicitation (interviews and observation of production on site),
- Biochemical and spectroscopic methods (e.g. multi-spectral, FT-IR, low field NMR)
- Rheological methods: Penetrometry and adhesion tests (used in companies) and measurements under dynamic conditions (Dynamic Mechanical Analysis) to evaluate the structuring of the paste, and under elongated deformation (Lubricated Squeezing Flow) to determine the viscosity.
- Data analysis methods such as experimental design, multifactorial analysis, ANOVA, etc.

**Scientific and technical skills required by the candidate**

BAC+5 years, with a background in food processing, process engineering.

Skills in statistics and modeling.

Knowledge of cereal/wheat products

Proficiency in English, at least in writing.
**THESIS SUPERVISION**

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<th>Unit name:</th>
<th>Team name:</th>
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<tr>
<td>BIA</td>
<td>MC2</td>
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<th>Unit director name:</th>
<th>Team director name:</th>
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<tr>
<td>Marc Anton</td>
<td>Denis Lourdin</td>
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<tr>
<th>Mailing address of the unit director:</th>
<th>Mailing address of the team director:</th>
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<tbody>
<tr>
<td>02 40 6750 00 <a href="mailto:marc.anton@inrae.fr">marc.anton@inrae.fr</a></td>
<td>0240675147 <a href="mailto:denis.lourdin@inrae.fr">denis.lourdin@inrae.fr</a></td>
</tr>
</tbody>
</table>

**Thesis director**
Surname, first name: DELLA VALLE Guy  
Position: IRHC  
Obtained date of the HDR (Habilitation thesis to supervise research): 1993  
Employer: INRAE  
Doctoral school affiliation: EGAAL  
Rate of thesis supervision in the present project (%): 40  
Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 40  
Number of current thesis supervisions/co-supervisions: 1

**Thesis co-supervisor 1 (if applicable)**
Surname, first name: SAULNIER Luc  
Position: DR, DU-adj. BIA  
Habilitation thesis to supervise research ☒ yes ☐ no  
If yes, date diploma received: Feb. 1997  
Employer: INRAE  
Doctoral school affiliation: EGAAL  
Rate of thesis supervision in the present project (%): 30  
Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 40  
Number of current thesis supervisions/co-supervisions: 1

**Thesis co-supervisor 2 (if applicable)**
Surname, first name: KANSOU Kamal  
Position: CR  
Habilitation thesis to supervise research ☐ yes ☒ no  
If yes, date diploma received:  
Employer: INRAE

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1 In EGAAL Doctoral School, if only one scientist in thesis supervision = 100% of supervision rate; if 2 people involved in thesis supervision = from 50% to 70% of supervision rate for the director; if 3 people involved in thesis supervision = 40% / 30% / 30% of supervision rate distribution among supervisors.
Doctoral school affiliation: EGAAL
Rate of thesis supervision in the present project (%): 30
Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 60
Number of current thesis supervisions/co-supervisions: 2

Private partner (if CIFRE funding, private funding,....)
Surname, first name: HUGON Florence
Position: Directrice R&D
Employer: La Boulangerie & Co
Rate of thesis supervision in the present project (%): 50 %
Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 0
Number of current thesis supervisions/co-supervisions: 0

International partner (if Cotutelle thesis)
Surname, first name:
Position:
Employer:
Rate of thesis supervision in the present project (%):
Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%):
Number of current thesis supervisions/co-supervisions:

Professional status of previous PhD students supervised by both director and co-supervisors (from 5 years)
Please provide the following information for each PhD students supervised
Surname, first name: ASSAD-BUSTILLOS Mélissa
Date of PhD beginning and PhD defence: Mai 2016-Juin 2019
Thesis supervision: Guy DELLA VALLE
Professional status and location: Post-doctorat ETH Zurich (CH)
Contract profile (post-doc, fixed-term, permanent):
List of publications from the thesis work: post-doc
Assad-Bustillos M., Guessasma S., Réguerre A.L., Della Valle G. Impact of protein reinforcement on the


Five main recent publications of the supervisors on thesis subject:


**THESIS FUNDING**

**Origin(s) of the thesis funding: ANRT + private funding (CIFRE)**

**Gross monthly salary: > 2000 € incl. charges**

**Thesis funding state : Partly acquired (co-funding)**

**Funding beginning date/Funding ending date: 1/10/2020**

**Date: 15/05/2020**

**Name, signature of unit director:** ANTON Marc

**Name, signature of team director:** LOURDIN Denis

**Name, signature of thesis project director:** DELLA VALLE Guy