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Marion Robert, Alban Thomas, Jacques-Eric Bergez. CMFDM: A methodology to guide the design of conceptual model of farmers' decision-making processes. 8. International Congress on Environmental Modelling and Software (iEMSs 2016), Jul 2016, Toulouse, France. hal-02739506

**HAL Id: hal-02739506**

**<https://hal.inrae.fr/hal-02739506>**

Submitted on 2 Jun 2020

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Jul 12th, 3:30 PM - 3:50 PM

# CMFS: A Methodology to Guide the Design of Conceptual Model of Farmers' Decision-Making Processes

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Robert, Marion; Thomas, Alban; and Bergez, Jacques-Eric, "CMFS: A Methodology to Guide the Design of Conceptual Model of Farmers' Decision-Making Processes" (2016). *International Congress on Environmental Modelling and Software*. 99.  
<https://scholarsarchive.byu.edu/iemssconference/2016/Stream-D/99>

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# CMFS: A Methodology to Guide the Design of Conceptual Model of Farmers' Decision-Making Processes

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## Abstract:

The agricultural research community uses languages and approaches to model farmers' decision-making processes but does not clearly detail the steps necessary to build a decision model. We propose an original and easily applicable methodology for modelers to guide data acquisition and analysis, incorporate expert knowledge, and conceptualize decision-making processes in farming systems. It combines decision-making analysis with a modeling approach inspired by cognitive sciences and software-development methods. It is organized into four steps:

### 1) Problem Definition

- Specify the context and the initial research question.
- Chose the type of data to collect.

### 2) Case Study Selection

- Select case studies based on theoretical sampling approach to search for diversity instead of representativeness.

### 3) Data Collection and Analysis of Individual Case Studies

- Collect preliminary knowledge on the context domain.
- Select appropriate knowledge representations for the task.
- Use critical decision method to collect farmer's knowledge and identify critical incidents disrupting farming management.
- Present an initial transcription of the knowledge collected to the farmer for verification, refinement, revision.
- Represent farmers' knowledge with UML diagrams.

### 4) The Generic Conceptual Model

- List similarities and differences between individual analysis and UML graphs.
- Use literature, experts and modelers to strengthen development of the generic model by formulating and adding complex concepts.
- Format the generic conceptual model with UML graphs.

We applied the methodology to two research questions on water management, one in a developed country (France) and one in an emerging country (India). This methodology can be used in different contexts and will be a useful tool to guide modelers in building decision model in farming system.

**Keywords:** Decision-making; case-based analysis; cognitive task analysis; UML