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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