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## Preliminary Investigation and Interview Guide Development for Studying how Malaysian Farmers Form their Mental Models of Farming

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## Preliminary Investigation and Interview Guide Development for Studying how Malaysian Farmers Form their Mental Models of Farming

### Abstract

The development of the interview guide is an integral aspect of the process of conducting qualitative research, yet one that receives little attention in the qualitative research literature. It is often assumed that interview guides are merely a list of questions used to guide a qualitative interview. The background analysis and preparation necessary to prepare an appropriate and effective guide cannot be dismissed, however, as they are integral aspects of the interview process. The current study on mental models of Malaysian smallholder farmers employed in-depth interviews as its primary approach to data generation. This paper details the initial processes undertaken to develop the interview guide based on preliminary data generation. The results included seven main steps to interview guide development.

### Keywords

qualitative research

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# **Preliminary Investigation and Interview Guide Development for Studying how Malaysian Farmers' Form their Mental Models of Farming**

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## **Introduction**

The development of the interview guide is an integral aspect of the process of conducting qualitative research, yet one that receives little attention in the literature. It is often stated that in qualitative research, the researcher him or herself is the research instrument (Pyett, 2003; Fink, 2000), as it is through the researcher that qualitative data is generated or collected, analyzed and interpreted. One important aspect of the data collection process is the research interview; specifically the questions that the researcher uses to probe and generate data with his or her respondents. This process is typically guided by an interview guide or guide, which helps the researcher...

...direct the conversation toward the topics and issues you want to learn about. Interview guides vary from highly scripted to relatively loose, but they all share certain features: They help you know what to ask about, in what sequence, how to pose your questions, and how to pose follow-ups. They provide guidance about what to do or say next, after your interviewee has answered the last question. (Kennedy, 2006, para. 1)

Though there is much information available for students and researchers in qualitative research on the concept of the interview guide (Creswell, 2007; Merriam, 1998; Bogdan & Biklen, 1992; Patton, 1990), few have attempted to outline the process undertaken to arrive at one, particularly in the context of larger, team-based qualitative research studies. This is of concern because the interview guide is an integral tool in the process of collecting data in qualitative research. Though the researcher is the instrument in the research process and may stray from the guide in the midst of interviewing, the guide is a valuable aid that provides the researcher with needed consistency, and a pathway for using questions that can generate data. The interview guide likewise provides the invaluable link between the research problem, research questions, past relevant literature and the sought after data that can fill the gap identified by the researcher.

The current paper aims to outline the interview guide development process, based on the authors' experiences in the context of a team-based qualitative study on the development of Malaysian farmers' mental models and how they influence farm profitability and viability. Through our experiences, we outline the process and discuss in detail our rationale for using the selected approaches along with examples from the research itself. The paper aims to assist qualitative research students as well as other researchers by illustrating in detail one approach for developing a useful and relevant interview guide.

### **Background of the Study: Malaysian Farmers' Mental Models**

The recent revival of agriculture in Malaysia has seen the rebirth of a few mega-businesses that implement and maximize profits by utilizing new technologies and innovations. While this transformation is seen by many as the way ahead for the agriculture sector in Malaysia, it is set against the backdrop of a large number of poorer small-scale farms. As Malaysia's agriculture sector continues to develop in line with the nation as a whole, it is of concern to policy makers and agricultural educators to ensure that small-scale farms and farmers are not left behind in the push for development.

Years of our own personal experiences in the field of extension education indicate that getting a Malaysian farmer to adopt new technology and innovation can be daunting, as the majority of farmers continue to farm using traditional methods. Among the few highly successful small farmers, individual ingenuity appears to be the key to success, or at least an important factor in their level of proficiency, profitability and sustainability (Zanariah, Azimi, Turiman, & Krauss, 2008). Ingenuity enables farmers to see possibilities, take advantage of market niches, and anticipate and solve problems. How they put their vision into action is indicative of their mental model of farming.

Mental models have been defined by Seel (2001) as "inventions of the mind that represent, organize and restructure domain-specific knowledge" (p. 408). According to Holyoak (1984), a mental model is a psychological representation of the environment and its expected behavior. Previous researchers (e.g., Eckert, 2003; Raedeke & Rikoon, 1997) have identified the important role that mental models of farming play in farmers' learning, decision-making, and adapting to change. For many farmers, success requires overcoming assumptions embedded in mental models of farming that keep them tied to their current practices and prevent them from seeing possibilities for success (Berton,

2001; Eckert, 2003). For the current study, we defined mental model as a model explaining the thought processes that incorporate one's beliefs, values, experiences, knowledge and subject-in-question-based perceptions that lead to decision-making.

Agriculture educators often direct programs and resources to support farmers in adjusting their practices to improve the viability or profitability of their operations. Because learning experiences appear to shape farmers' mental models of farming and mental models serve as guides for decisions and actions (Eckert & Bell, 2005), understanding how farmers develop mental models can help educators design learning programs and services that are better positioned to enable farmers to succeed.

### **The Interview Guide Development Process**

In qualitative research, developing the interview guide is often referred to as a fairly straightforward process. Merriam (1998) refers to it as a list of questions that the researcher intends to ask in an interview. According to McCracken (1988), first, it

...ensures that the investigator covers all the terrain in the same order for each respondent. The second function is the care and scheduling of the prompts necessary to manufacture distance. The third function is that it establishes channels for the direction and scope of discourse. (p. 24)

According to Reysoo and Heldens (2007), the steps for guide development include: selecting the topic; defining all the aspects of the topic; formulating initial (open-ended) questions; determining the kind of questions; determining the logical order of the topics/questions; preparing the introduction and the end; and preparing the interview-technical indications. Strauss and Corbin (1990) emphasize that the interview guide can be revised on an ongoing basis to elicit more focused responses from participants and to accommodate themes that emerge in the early stages of data analysis (Eckert & Bell, 2006).

In the current study, the research team felt that it was important to develop a universal, semi-structured interview guide that all researchers in the team could use. As the research team comprised seven researchers in all, there was a felt need to ensure some level of consistency in the approach taken to generate data. In such a large-scale study that makes use of multiple researchers and sites, the interview guide becomes more important for consistency in data analysis (Bogden & Biklen, 1992).

Without a well-structured interview guide to direct the interviews with farmers, difficulties would undoubtedly arrive at the time of data analysis. Often, as is mentioned by Creswell (2007), the semi-structured interview guide need not be more than five or six general questions. However, in the case of team-based, multi-site research, there may be a need for more detail in the guide that includes cues for probing, to ensure some level of consistency among the different interviewers. Typically, in an in-depth interview it is nearly impossible to determine exactly how the respondent is going to answer, which makes probing a unique adventure with each interview. However, through the process of preliminary interviewing, indicators for probing can be identified. This tension between allowing for each interview to be unique and maintaining "open-endedness," while at the same time keeping the interview "on track" in terms of the research questions is one of

the challenges of doing team-based qualitative research where multiple researchers are involved in data collection.

### **The Challenges Posed by Mental Model Research**

What makes developing an interview guide for interviews on mental model development so challenging is the nature of mental model research itself. Mental models, as stated, are attempts to understand the decision-making processes of subjects. The current study, however, focuses not only on identifying the mental models per se, but to delineate the factors and processes that contribute to their development. Along these lines, Eckert and Bell (2005) write:

A mental model for a particular domain includes related values and beliefs. It includes conceptions of knowledge and skills, and how to use them. Mental models create perspectives and points of view; they serve as both a filter and a guide for information, learning experiences, and problem solving. Often, mental models overlap. (para. 4)

The challenge of qualitative research on mental models thus lies in understanding and ascertaining the relevant values and beliefs, and the processes that such factors play on an individual's decision-making. In relation to farming, in Eckert and Bell's (2005) similar study conducted with farmers in the U.S., the authors found that the farmers' mental model of farming and their mental model of family had many components in common, and it was difficult to delineate between the two. Mental model research thus has unique challenges that stem from understanding how basic values and beliefs contribute to decision-making and behavior, and developing conceptual frameworks capable of describing, explaining and predicting future actions (Klimoski & Mohammed, 1994). Furthermore, the nature of the mental model concept also makes decisions about how to identify important mental processes of which the respondents themselves may not be conscious difficult. Thus, choices about questions and probes that the researcher should employ become imperative.

Questions during the interview process, therefore, must be chosen and posed in a judicious manner. One cannot merely rely on a question such as "what are your beliefs about farming?". The researcher must, through his or her deep understanding of the topic, be able to pose questions that will allow both the researcher and the respondent to explore the topic together. This process is unique to qualitative research and is often referred to as data generation or in some cases even "making data" (Morse & Richards, 2002). The data is thus generated through the synthesis of the researcher's questioning and the respondent's answering, which result in a type of verbal reflection where the respondent discovers new aspects to him or herself. It is a shared process in which both the researcher and the respondent must be active participants.

This process is particularly tricky for the researcher, who must guide the process and know what to look for in relation to the research question, for the data may not be explicit. The respondent will most certainly not talk directly about mental models or even values and beliefs per se, yet the researcher must know how and when he or she is obtaining data relevant to these topics. A team-based approach makes the process more

complex as well, although having multiple perspectives about data interpretation can add depth and richness to the findings of the study.

### **Background of the Research Team**

Our involvement in this mental model study is due partly out of our collective interest in qualitative research and extension education, and partly out of our sense of responsibility to the country where we work. We are all lecturers in human resource development, extension education, adult education and/or continuing education as all of these fields of study fall under our academic department. Our involvement in the topic at hand also stems from our shared interest in the renewed importance of agriculture in Malaysia, that grew as a response to global inflation and the ensuing food shortage that has been expressly felt in the developing and under-developed worlds. As one such resource-rich developing nation, Malaysia relies heavily on agriculture for its food security but has, in recent years, neglected the sector's development due to the popularity and wealth of ICT and technology-based emerging markets. With the Malaysian government's recent push to re-invest in agriculture, agricultural extension has been called upon to reinvigorate the small-holder farming sector and help farmers progress and become larger contributors to the nation's agricultural wealth. With this backdrop, researchers and educators in extension education are being mobilized to help identify the needs of the farming sector and develop programs to aid their development.

The older members of the project team started out in extension education at a time when extension education in Malaysia was deemed integral to the development of the nation's agricultural sector. However, with the growth in the country's stake in technology-based manufacturing, extension education became downgraded and drew less support from the government, thus reducing the attention paid to it in the form of research and teaching in the public universities. For the older team members, their expertise in extension gradually shifted over to human resource development and continuing education, even though they never lost their passion and interest for extension.

The younger members of the team are less well-versed in extension and are more specialized towards human resource development and its related fields. Nevertheless, the Malaysian Government's attempt to resuscitate extension education has breathed new life into extension-related research, which has given the younger researchers on the team an impetus for delving into extension. The current project echoes the new buzz found within the entire agricultural sector best captured by the Ministry of Agriculture's new tagline: "Agriculture as Business". This new push for agriculture and extension as an engine for the nation's development is encouraging much research in a field that was just 10 years ago labeled a 'sunset industry' by the government.

As a Malaysian government-sponsored research initiative under the Ministry of Science and Technology, the current study was designed to acquire a fundamental understanding of how Malaysian farmers make decisions about their farming practices. As qualitative researchers, we saw the opportunity to conduct a large-scale project on mental models as a great but exciting challenge that would expand our knowledge not only of Malaysia's smallholder farmers and their valuable work, but also of qualitative research methods. We feel it is important to note, however, that there was at the outset a certain level of apprehension about the project due to our limited background in mental

modeling from the perspective of cognitive psychology, which is where the concept has its roots. Our lack of exposure, conceptually, to mental modeling has challenged us to fully grasp its meaning and multiple applications. At the same time, however, our apprehension has been matched by the excitement of attempting to expand the horizons of qualitative research in this area, at least within the Malaysian context.

In Malaysia, the collective “mentality” of certain groups is often cited as an impediment to further development, especially among occupations like farming. It is commonly believed in Malaysian society that the only thing that holds Malaysia back from achieving greater success as a nation is the mentality of certain sectors of the population, who are perceived as not valuing the opportunities for development that they have been afforded and do not strive to progress. In some ways, therefore, the current study also aims to address commonly held beliefs such as this through formal research. The research team felt that qualitative research using a mental model framework would be the most appropriate place to begin to understand this phenomenon from a more scientific perspective.

### **Results: Steps for Interview Guide Development**

To begin understanding Malaysian farmers’ mental models, preliminary data collection was conducted in Terengganu State, located in the northeast part of peninsular Malaysia. Terengganu is one of the poorer states in the country that relies on agriculture and fishing as two of its main industries. The state is comprised mainly of ethnic Malays, alongside small minority populations of ethnic Chinese and Indians. The state currently receives the highest amount of federal funds in support of agricultural activities.

Preliminary data collection included seven in-depth interviews with farmers in addition to a focus group with district Agricultural Officers and Assistant Officers who work closely with the farmers. Overall, the researchers identified six general steps in their process of developing the interview guide for the study.

### **Review of Literature on Farmers’ Mental Models**

Based on the study purpose as outlined above, we began by delving into the research literature on mental models, focusing particularly on studies dealing with farmers and mental modeling related to farming practices. Though there is a growing body of literature on mental models, those related to farming in particular are scant. Of those located qualitative studies on farmers’ mental models, none provided specific insight into the development of the interview guide. This posed a problem for the research team, for mental models relate to beliefs, values, goals and the underlying processes that influence decision-making. The few studies located that did relate to farmer’s mental models were based in the U.S., yet did contribute to the theoretical background for developing the interview guide for the current study.

### **Analysis of the Setting Through Focus Groups**

Prior to the start of the project, the research team sought permission to engage agricultural officers, extension agents and farmers in data generation from the Terengganu

State Department of Agriculture Director. Following the Director's approval, a focus group with Agricultural Officers and Assistant Officers was convened for the purpose of furthering our understanding of the farmers, their farming practices as well as key variables related to mental model such as farmers' worldview and core values. First, for the sake of the questions, we convened 25 officers and assistants officers and asked them to identify one successful, one moderately successful and one "laggard" farmer with whom they work. Questions were then posed to them including descriptives – location, age, commodity or crop that they grow, level of family involvement in farming, and others. These were followed by focus group questions pertaining to: farmers' worldview (i.e. perceptions on the role of education, the agricultural industry, agro-entrepreneurship, future plans); perceptions of farming; attitude toward farming; critical incidents in their work with the farmers identified in relation to successful/unsuccessful transformation of the farmer's farming practices and outcomes; and SWOT (strengths/weaknesses/opportunities/threats) analysis, asking the officers' how the farmers use their strengths to grasp opportunities to improve and unleash their potential strengths while overcoming their perceived threats. From the results with the Officers, tables were generated to obtain a profile (descriptives) of the identified farmers according to the three levels, along with additional tables listing responses to questions related to their values and worldviews. Another table was generated including Officer responses to questions related to the SWOT analysis.

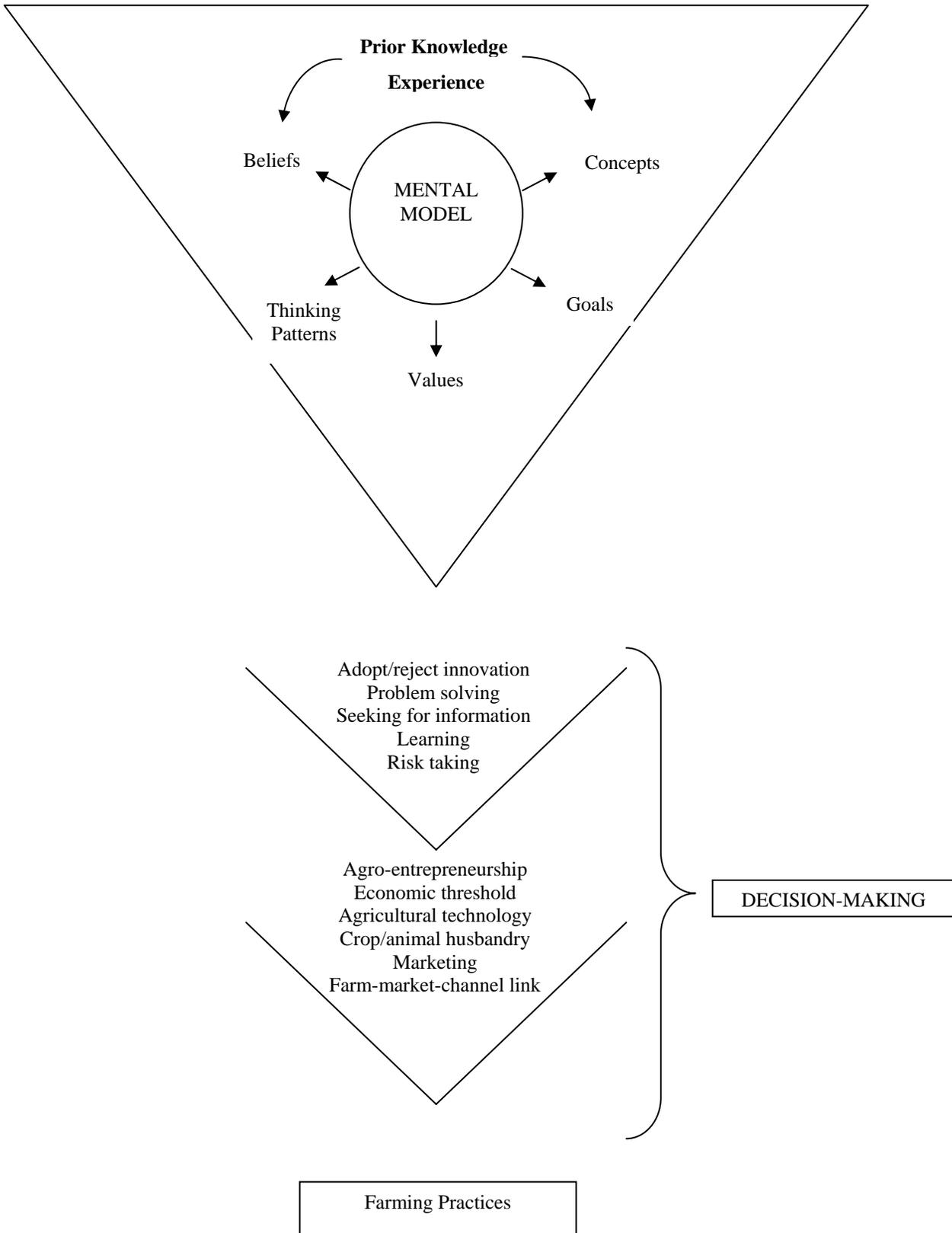
This exercise provided the research team with important background information of the Agricultural Officers' perceptions of the farmers with whom they work. It was an important step in helping the team understand their would-be respondents, and also helped to develop rapport with the Officers, who are responsible for working with the farmers in their development and continuing education. Any formal recommendations that result from the research will be passed on to them for implementation, and as such, they were highly vested in the research from the outset.

### **Develop Preliminary Conceptual Framework**

From the literature (Eckert & Bell, 2005, 2006; Klimoski & Mohammed, 1994) and data obtained from the Officers, the research team then convened to develop a preliminary conceptual framework for the study (see Figure 1). The role of the conceptual framework in qualitative research differs from that of quantitative research, in that it is expected that the conceptual framework will evolve as the study goes along. New data and findings will contribute to the ongoing conceptualization of the study, thus creating new insights in relation to the study topic. Conceptual frameworks, like other aspects of the study, evolve during the course of the study. However, they are an important tool for synthesizing preliminary data and the existing literature, which help to guide the research process.

In the current study, using literature relating to mental models along with the preliminary data with Agricultural Officers, an initial conceptual framework was developed on farmers' mental models. The main theoretical categories to explore in understanding how farmers develop their mental models were identified as follows:

Figure 1: Preliminary conceptual framework of the study.



In the initial conceptual framework, the research team identified prior knowledge and experiences as influences on farmers' beliefs, values, goals, expectations, concepts and thinking patterns. These and other concepts related to farming form the basis for mental model development. These fundamental concepts guide farmers in their decision-making, problem solving, adoption of innovation and the like (Eckert & Bell, 2005). Such processes then lead to good agricultural and business practices, which result in farm productivity and viability.

Eckert and Bell (2005) mention the importance of farmers' reliance on their assumptions about farming, based on beliefs and knowledge, as important factors influencing mental model development. Accordingly, mental model development as well as its transformation can occur in many ways and often results from an event that "typically exposes a discrepancy between what a person has always assumed to be true and what has just been experienced, heard, or read" (Cranton, 2002, p. 66). With this in mind, it was the aim of the research team to look at multiple factors to uncover how mental models are developed among Malaysian farmers. The next step was to develop the preliminary interview guide based on the framework.

### **Develop Preliminary Interview Guide Based on Conceptual Framework, Literature and Preliminary Data**

From the initial conceptual framework, literature and focus group data with Agricultural Officers, a preliminary interview guide was developed. In generating the interview guide, the level of structure had to be determined, based upon the ultimate goals of the research. Topics and interview questions then had to be selected accordingly (Nassar-McMillan & Borders, 2002). To put together the initial guide, the team members were each given a category from the conceptual framework (and related concepts) and were requested to come up with five questions each. From the foundational concepts of beliefs, values, goals, knowledge, past experiences, concepts and thinking patterns, the team developed an initial list of approximately 30 questions. Following the initial brainstorm, the questions were reviewed one-by-one and scrutinized by the other team members for language, relevance and probing potential. The questions were also regrouped to ensure that each of the main topics was adequately covered. This process of scrutinizing by the team members was conducted to help establish trustworthiness of the interview guide (Johnson, 1997) by acting as a form of triangulation through corroboration by multiple investigators (Pulkinnen, 2003). This process resulted in a preliminary interview guide of 19 questions, which was then to be tested with the first group of farmers.

### **Test Preliminary Guide with Farmers**

Following the development of the preliminary interview guide, interviews were conducted with seven farmers. Interviews were arranged through the Agricultural Officers (AO's) in two local districts in Terengganu State. Interviews were conducted at the District Agricultural Offices as well as, in a few cases, on site at the farms. Farmers were selected by the AO's and comprised of a mix of "successful," "moderately successful" and "laggard" farmers as determined by the AO's. In most cases, the

interviews were conducted one-on-one, or in two of the cases, two researchers interviewed one farmer. In one case two farmers were interviewed simultaneously by one researcher.

The interviews were all recorded using digital IC recorders. Data was transcribed into Microsoft Word and then transferred into NVIVO 8 qualitative data management software. NVIVO 8 was used to analyze the data from the seven interviews. The seven preliminary interviews ranged in time between approximately 40 minutes to one and a half hours. The research team was advised to include all questions from the interview guide and make notes during the interview on issues related to question relevance and effectiveness. Researchers were also advised to identify important areas and prompts for further probing.

### **Reflect on Preliminary Data Collection and Revisit Literature**

The first step following the preliminary interviews was to reflect on the experience as it related to the interview guide questions. Even prior to coding the data, the research team felt it would be best to discuss their experiences to help strategize for revision of the interview guide. Reflection is a major element to qualitative research due to the fact that the researchers themselves are the instrument of data collection and analysis. This trust demands that the researcher continuously goes back and forth between the experience in the research setting, the data and oneself, in an attempt to understand what is really happening, and to determine what role the researcher is playing to facilitate the data generation process. Additionally, qualitative research method requires that researchers continuously consult the relevant research literature to compare one's current study findings with what has been done by others, and to help make sense of findings. The literature can help the researcher frame his or her findings within the existing body of knowledge and also identify new findings that extend contemporary theory.

From the team's discussion and reflection following preliminary data collection, it was determined that the two biggest challenges were probing, followed by identifying what aspect of the farmers' experiences to focus on to actually ascertain their mental model, (i.e., to arrive at consensus on the scope of the study). As mentioned previously, mental model research is conceptually challenging and can be broad in scope unless specific parameters are in place. As the current study was the researchers' first experience with mental model research, there were many uncertainties early on in the process. Team members, therefore, expressed the need for more clarity on how to get at the heart of the farmers' mental model. It was thus agreed on by the team that the questions on the preliminary guide were effective to a degree, but that probing and scope were major concerns that needed to be addressed. The team, therefore, agreed to proceed with the analysis of the preliminary interview data and use it to pinpoint areas for probing.

### **Analyze Preliminary Data and Revise Initial Interview Guide, Including Identifying Areas and Strategies for Further Probing**

Data analysis for the purpose of solidifying the study scope and interview guide took place over several weeks as the first seven interviews had to be transcribed, resulting

in many pages of data. The first round of data analysis employed an open coding approach, where all the relevant data is coded so as to find as many textual units as possible that are thought to be relevant to the study research questions (Giske & Artinian, 2007). Open coding resulted in an initial list of 23 codes. This list and the initially coded data were then discussed upon which the team members decided to undertake a more thorough analysis of the data and expand the breadth of coding. The original 23 codes were thus placed under each of the three research questions for the study, and the data was re-examined by the team members for additional codes. The result was an expanded list of nearly 50 codes.

From here, the team was able to identify areas for further probing and guide revision. It was decided that based on the initial round of data collection, a critical incident approach was needed for follow-up interviews in order to “go deep” with the farmers on how and why they make the decisions they do in terms of their agricultural practices. A key consideration in this was the need to elicit the unconscious beliefs of the farmers that influence their decision-making in farming, therefore tapping into their tacit knowledge. This was realized from the initial set of interviews when the researchers recognized that several of the farmers, when asked directly about their beliefs and values in relation to farming had difficulty articulating their responses; that perhaps they were – on a conscious level – unaware of these guiding beliefs and values. It was then decided that to access this type of data a different approach was needed that would be based on their actual experiences, rather than abstract concepts.

To arrive at the unconscious beliefs that the team believed was integral to understanding the mental model of the farmers, a critical incident approach (Flanagan, 1954) was chosen as the basis for the interview framework. Critical incident approach is “an epistemological process in which qualitative, descriptive data are provided about real-life accounts” (Stitt-Gohdes, Lambrecht, & Redmann, 2000, para. 8). The approach was employed by Eckert and Bell (2006) in their own study of farmers’ mental models in the U.S. In their study, Eckert and Bell refer to the critical incident technique in the form of key “activating events” that the farmers in their study experienced. These activating events were “...occurrences that caused the mental model to become explicit and open to reflection, refinement, and sometimes transformation” (Eckert & Bell, 2006, para. 15). It was through their probing of these activating events that the mental model and how it actually impacted their farming decisions and practices were identified. Activating events help researchers to understand many important elements of mental models beginning with assumptions, beliefs and values and how such concepts evolve as a result of real-life experiences.

Using a critical incident approach in the current study, we decided to probe the farmers’ practice-based decisions by asking them to recall two incidents: their most “successful” farming season (self-described); and their most unsuccessful farming season (self-described), and to recall the major steps/decisions taken along the way in relation to farming practices. During their recollection, we would probe each major decision made, scanning for important reactions, ideas, emotions and anything else that might explain why they decided and did what they did. As an activating event, we believed something like a successful/unsuccessful harvest would be much easier for the farmers to talk about rather than asking them questions related to their beliefs, values, assumptions, goals and the like that might be too abstract for them to elaborate. From this approach, we hoped

that more natural opportunities for probing on different aspects of the conceptual framework would result.

According to Norman, Redfern, Tomalin, and Oliver (1992), there are three assumptions commonly associated with CIT that make the technique applicable: critical incident refers to a clearly demarcated scene; if a detailed account of what actually happened cannot be obtained, that incident is not valid; and the critical incident itself is the basic unit of analysis. One fear we had in employing the approach was not knowing whether the assumptions could be met, particularly as to whether the farmers could recall their decisions and behaviors in such detail. Furthermore, there was the possibility that the farmers' experiences with successful and unsuccessful seasons could be difficult for them to elaborate on, thus reducing the level of detail provided and likewise the opportunities to probe. Nevertheless, we hoped that subsequent interviews with the farmers would be more focused toward understanding the key factors and processes involved in the decision-making of farmers, and thus, begin to unveil their mental models of farming.

### **Conclusion**

The seven-step process of guide development can be summarized as follows: review of literature, setting analysis through focus groups, conceptual framework development, preliminary interview guide development, preliminary data collection, reflection on preliminary data collection and revisit of the literature, and analyze preliminary data and revise initial interview guide, followed by identifying areas and strategies for further probing. All or at least some of the steps will be revisited again following subsequent rounds of interviews with the farmers, in line with the dynamic and cyclical nature of qualitative data collection and analysis.

Understanding how to ascertain farmers' mental models has important implications for stakeholders, including extension education agents, policy makers, researchers and others. Knowing how farmers think and make decisions and what influences their farming practices can help educators, specifically, optimize the transfer of technology with farmers, and tailor other educational interventions in an appropriate manner. Progression to higher success levels in farming often requires the ability to overcome incorrect assumptions, limited thinking, fear of the unknown and other barriers. Understanding mental models helps to identify where such factors play a role in farmers' decision making, and how educational interventions can be maximized to open up the doors of proficiency, productivity and other areas of successful agricultural practice (Eckert & Bell, 2006).

Finally, it is important to note that the qualitative research process is non-linear and entails constant reflection and reframing of the study, including the revision of interview guides and even research questions. In relation to the current study, therefore, further additions, edits and new insights in relation to guide development will certainly arise as the study progresses. This paper is but an encapsulation of the initial stages of the process.

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## Appendix

### Interview Guide for In-Depth Interviews with Smallholder Farmers

Ice-breaking questions: (be prepared to probe)

1. What do you understand by “agriculture as business”?
2. Since when have you been involved in agriculture?
3. What type of crop do you grow?
4. Of all the potential crops to grow, why do you focus on rice?
5. Who assists you in your farming practices?

## Critical incident questions:

6. In rice farming, what are the major steps that you take from start to finish? (Researcher needs to do homework prior to interview to know the steps – to be able to probe)
7. (Start with critical incident) Can you think of a past season/year when you had a successful outcome or crop that you were truly satisfied with? Probe – why were you successful that season, how much more successful were you that season as compared to others? What was the difference?
8. In reference to your satisfaction with that particular season, I would like to get more detailed information in relation to each of the steps that you took (as in question 6).
  - a. Referring to question 6, E.g. choice of seed, etc. (Probe on each step taken).
9. (Start with critical incident) Can you think of a past season/year when you had an outcome or crop that you were not satisfied with? Probe – why were you not successful that season, how much less successful were you that season as compared to others? What was the difference?
10. In reference to your being unsatisfied with that season's outcome, I would like to get more detailed information in relation to each of the steps you took.
  - a. Referring to question 6, E.g. choice of seed, etc. (Probe on each step taken).
11. (Future): So I can see that there are clear differences in the thinking and approaches you used in obtaining high and low results; as such, from what you have just told me and from what you have learned from the experiences, what will be the basis for your decision-making in the future so that you can advance further in your padi activities?
12. Final question, what do you think are the similarities in farming approach and practice between Malay and non-Malay farmers, or the similarities/differences among farmers from the three main ethnic groups in Malaysia (i.e. Malay, Indian and Chinese)?

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