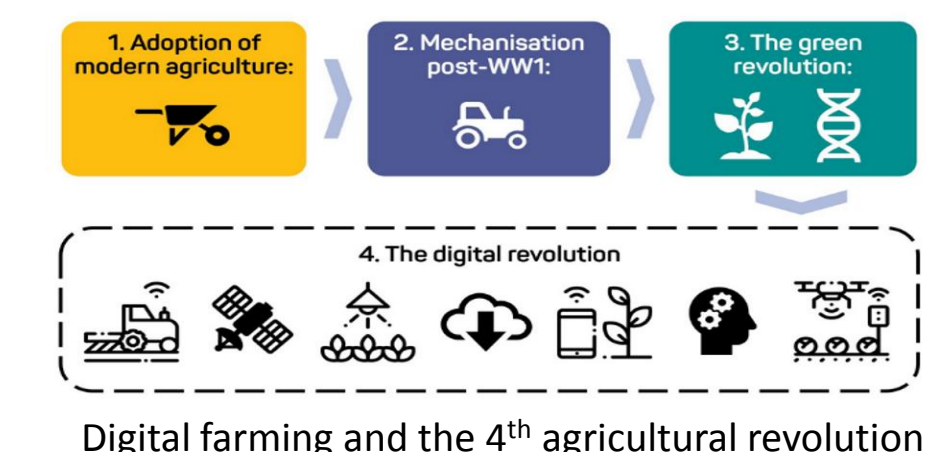


Factors differentiating small scale farmer operators' reliance on risk planning information using signal detection for decisions under uncertainty

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"How do we measure change in Extension learning systems?" - the guiding research question

Introduction:

- Small-scale farm operators need timely, relevant, and reliable information for risk-planning decisions.
- Extension learning systems use feedback loops to develop value-added information for farming audiences (Figure 1) with different technical production; marketing; and finance and credit needs, who rely on a variety of information sources that are used for planning farm-risk decisions (Figure 2).
- However, over-reliance on averages, as well as some imputation procedures for missing data, are problematic for informing low-probability, high-stakes risk planning decisions (Figure 3) among diverse farm operators.¹

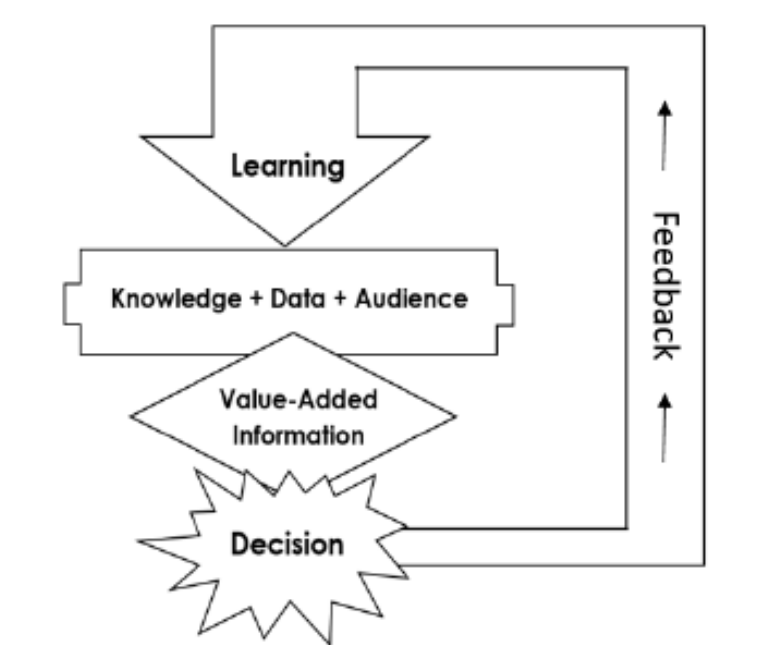


Figure 1. How information gains value (Adapted from: Boehlje & King, 1998).

Research Questions

What types of **resources/information** that is used by beginning and experienced small-scale farm operators signal diverse needs for risk-planning decisions?

- RQ1: Technical Production
- RQ2: Marketing
- RQ3: Financial
- RQ4: Supply chain
- RQ5: Sources of credit
- RQ6: Information source

$$H_0 = p_1 - p_2 = 0$$

$$H_0 = p_1 - p_2 \neq 0$$

where, $p_1 = \text{Experience farmers}$,
 $p_2 = \text{Beginning farmers}$

$$d' = \frac{p_1 - p_2}{\sqrt{\sigma^2}}$$

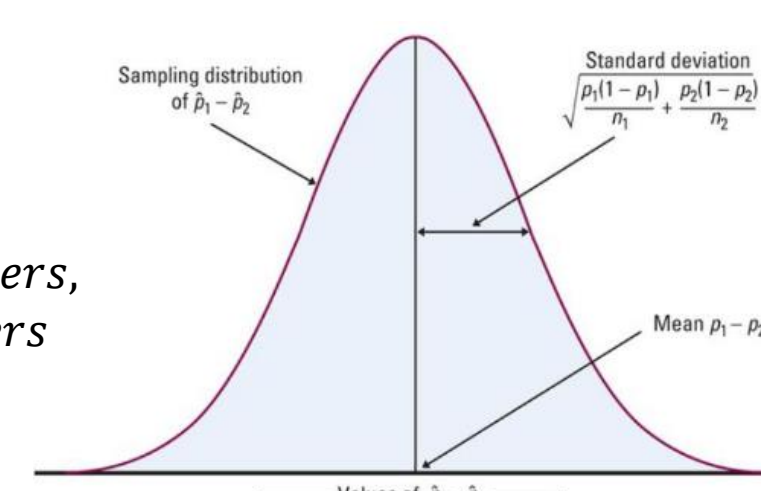


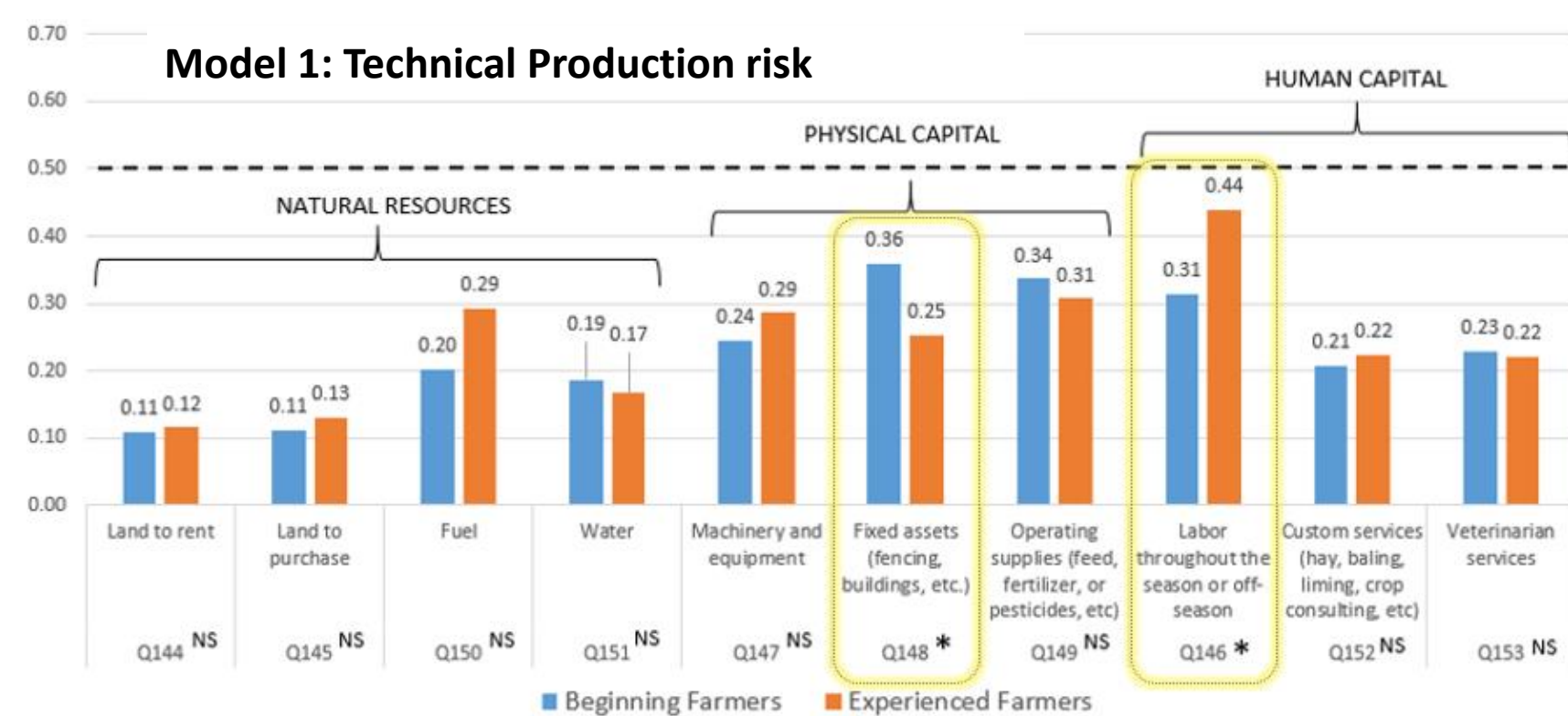
Figure 6. Parameters of feedback data modeled as difference of proportions signals

Methods:

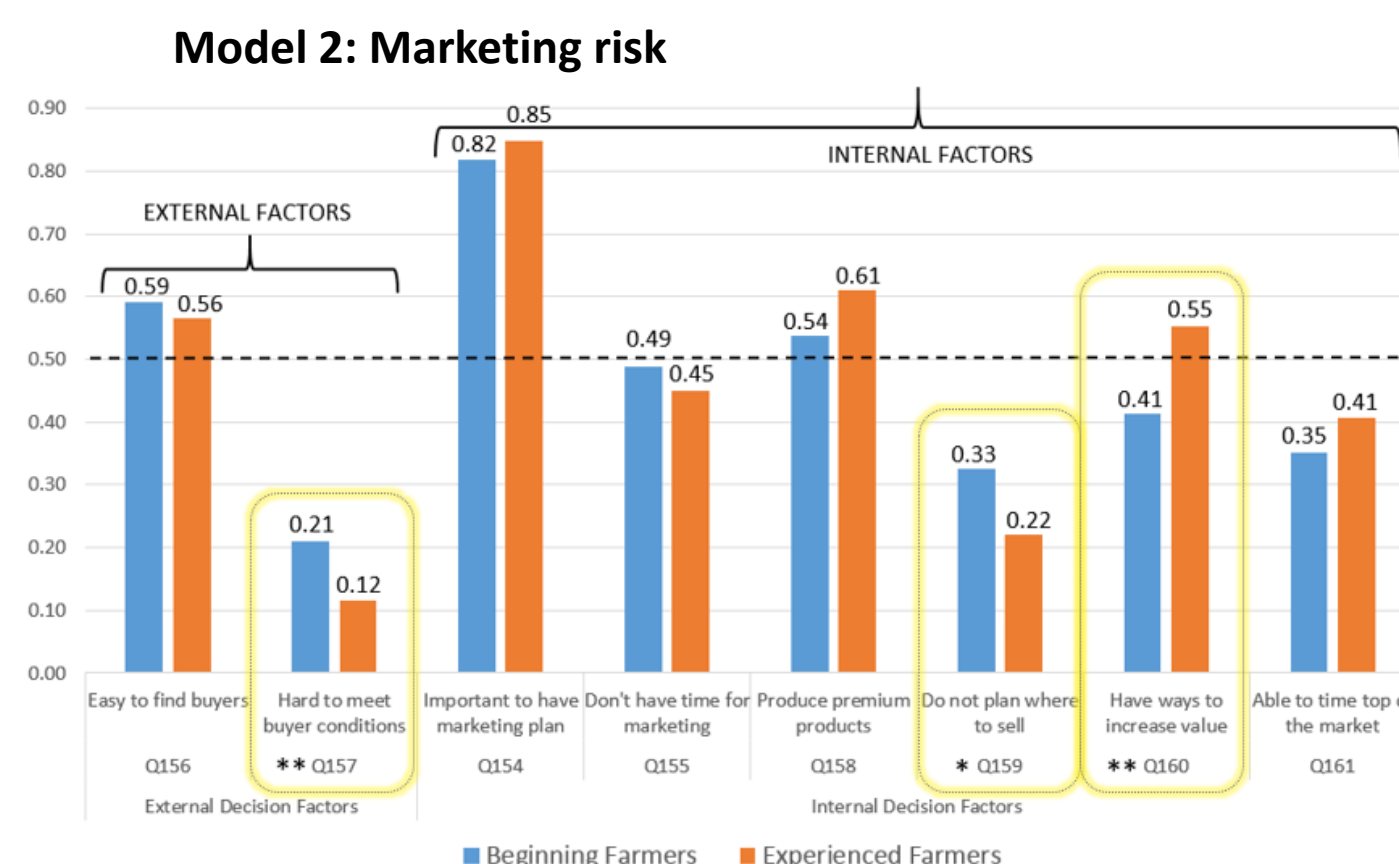
- A 2008 Land-Grant Extension Small Farm Survey identifies characteristics of farmers and re-sampling is used as a signal detection among groups classified as beginning and experienced farmers ($n = 304$).⁴
- Boolean logic [0,1] re-maps Likert decision tree into binary classification frame.
- Difference of two proportions z-tests are used as a discriminability index (d') to detect feedback differences in farm operator risk-planning information needs.

Results:

- Production risk in Model 1 signals respondents' agreement related to factors (relative frequency) and discriminates between beginning and experienced farmers' perceptions (signal detection) in the past two years. Data displays relative frequency (Figure 1) and discriminates beginning & experienced farmers' perceptions (signal detection) at the *90%, **95%, ***99% level of significance.
- Marketing risk in Model 2 and Financial risk in Model 3, also signal respondents' agreement related to factors reporting relative frequency and significance level.



Model 1 Technical Production
Gaps between beginning & experienced farmers include: **problem accessing fixed assets & available labor**



Model 2 Marketing
Gaps between beginning & experienced farmers include: **difficulty meeting buyer conditions, planning where to sell, and ways to increase product value**



Model 3 Financial
Gaps between beginning & experienced farmers include: **problem accessing good financial advice, enough credit, time to keep good records, and collateral to get a farm loan**

Model 4 Supply chain
Ways to sell gaps between beginning & experienced farmers (w/i 2 years) include: **marketing alliance, middleman, and marketing contracts**

Additional findings:

- Model 5 Sources of credit (w/i 2 years) presented no significant differences between experienced and beginning farmer' reliance on sources of credit (w/i 2 years), including (percent frequency): Farm Credit (15%); Cooperative (3%); FSA (10%); Commercial or Local Bank (27%, 19%); Credit Union (17%); Family member or friend (25%)

Conclusion

- Extracting signals from big data feedback systems can signal change needed in learning systems among audiences' information value.

Resources

- Grateful for the encouragement and feedback of Dr. Wendell Porter, Dr. Ray Bucklin (Agricultural and Biological Engineering); Dr. Edward 'Gilly' Evans, Dr. Richard Weldon (Food and Resource Economics); and Dr. Sebastian Galindo (Agricultural Education and Communication).

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Research Objectives:

- The goal of this study is to explore significant differences in (d') feedback related to risk-planning factors among beginning and experienced farm operator groups.
- Significant differences in (d') in resource and information signals may indicate emergent conditions in decision factors among diverse audiences in learning systems (like Extension) signaling knowledge, data, or audience context needs.

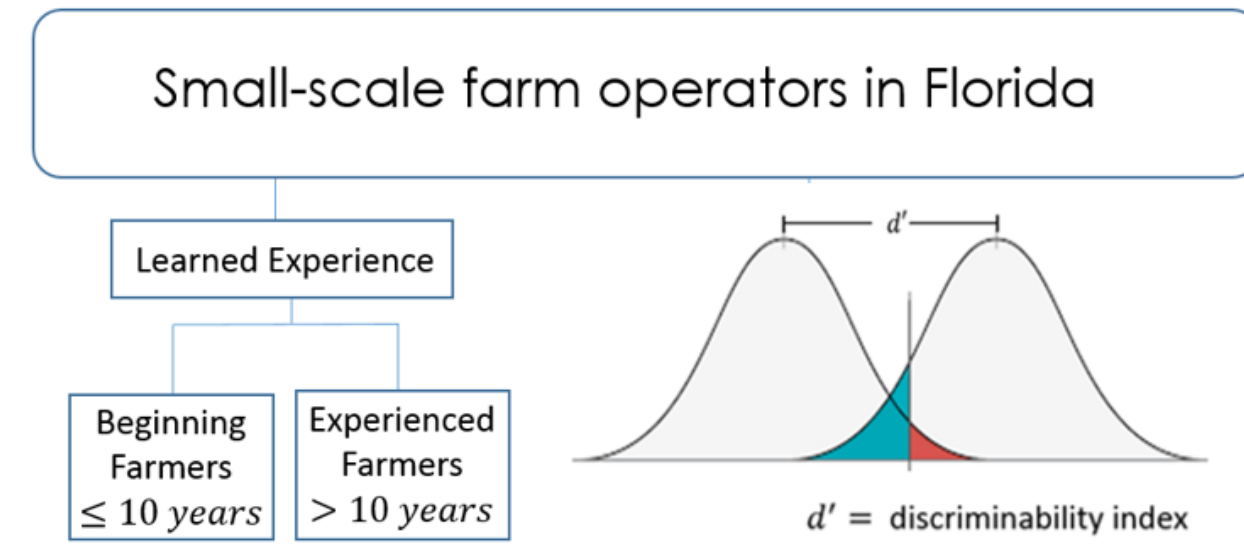


Figure 5. Feedback model schematic and signal (Source: Adapted from Hunt, E. (2006) The Mathematics of Behavior)

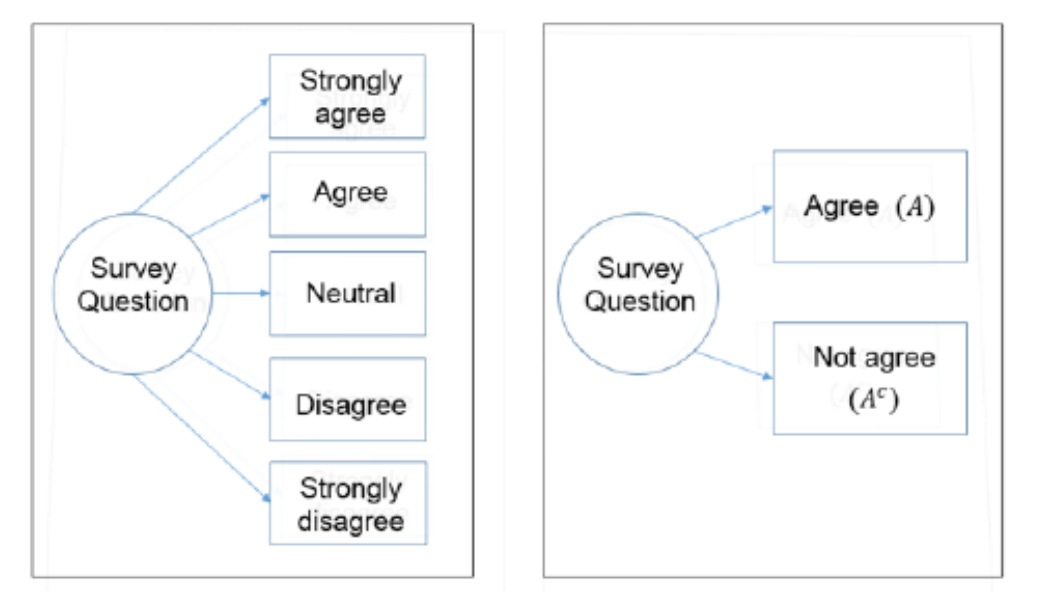


Figure 4. Quantized decision tree. A) Likert data, B) Binary- (binomial) data.

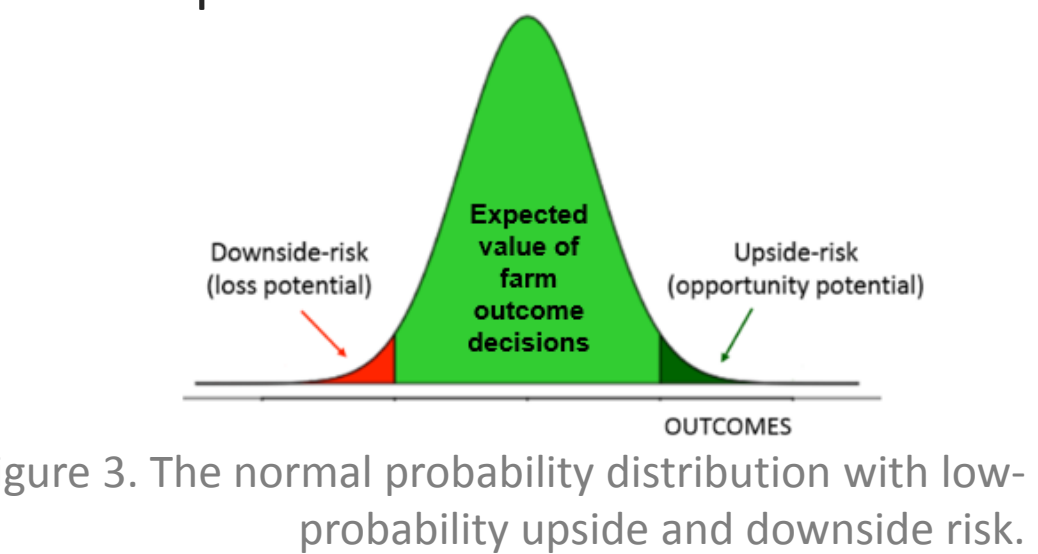


Figure 3. The normal probability distribution with low-probability upside and downside risk.

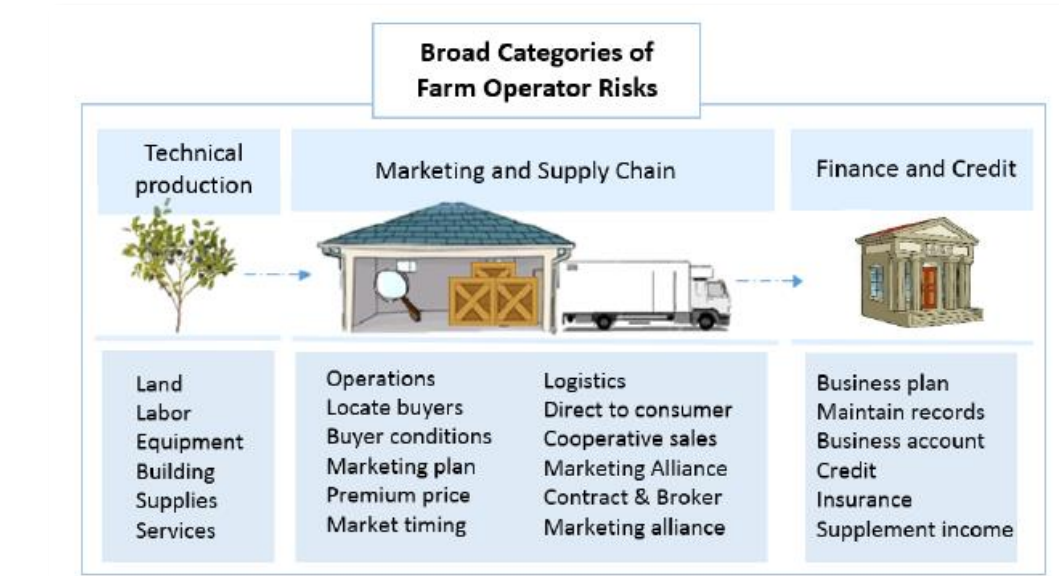


Figure 2. Broad categories of farm risk