

Research Brief

Information and Communication Technology in Sustainable Agriculture

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Funded by University of California, Agriculture and Natural Resources

Issue

Sustainable agriculture stakeholders are increasingly experimenting with social media and other new information and communication technologies (ICTs) to engage in education and outreach for agriculture and natural resources (Aker 2011, and multiple references from *Journal of Extension*). This experimentation has created an active debate about the effectiveness and best practices for using ICTs. Proponents view ICTs as having the potential to reach new, more diverse, and more distant audiences with knowledge that was previously communicated mainly locally via face-to-face interaction. These benefits are more likely with increasing use of computers and other digital technology in agriculture (USDA 2015), and the globalization of agricultural science, communication, and production. Critics of social media and ICTs worry about the lack of training and technical capacity, lack of professional recognition, and the possibility of false and incorrect information being spread without expert oversight. To inform this debate, this policy brief reports the initial findings from a survey of sustainable agriculture stakeholders regarding their usage of different ICTs, as well as their perceptions of relative advantages and barriers to adopting this innovation in outreach and education (extension activities, for short).

Key Findings

Sustainable agriculture stakeholders are relatively frequent users of ICTs although social media is not as popular for extension activities as for personal use (Pew Research Center 2016). As might be expected, over 75% of respondents use email and websites for extension activities. Facebook, LinkedIn, and Twitter are the most popular social media platforms, but LinkedIn and Twitter are relatively more popular for sustainable agriculture than for personal use. Among those who use social media, the majority use Twitter or Facebook at least a few days per week and sometimes daily, while other platforms are accessed less frequently. The usage frequency for sustainable agriculture is substantially lower than the frequency for personal use (Pew Research Center 2016). Diffusion of innovation theory (Rogers 2010) identifies four categories of variables that may be linked to the perceived motivation to and barriers against adopting new technology: relative advantage, compatibility, complexity, and observability. Respondents perceived the most significant advantages as social media's capacity to quickly reach larger, more diverse and geographically distant audiences. The most important barriers are the potential for spread of incorrect information, lack of professional incentives, and capacity to measure effectiveness and audience targeting. Social media is not seen as a major advantage for coordinating professional activities or decision support, which indicates a potential gap between communicating knowledge and action.

Policy and Management Implications

ICT and social media are on the pathway to becoming established tools for extension and outreach, and can be an important complement to more traditional face-to-face communication, especially in an era of decreasing resources in university extension systems. Sustainable agriculture stakeholders are using Facebook, Twitter, and LinkedIn with enough frequency to merit developing integrated social media strategies, with updates at least a few times per week to maintain visibility. Training is needed on the best practices for social media use, including measuring effectiveness and reaching the appropriate audience. Extension outreach professional also need clear professional incentives to use social media, for example having a social media presence recognized as a legitimate form of professional output. Recognition and learning from colleagues is also an important accelerator, which may be facilitated by the formation of some type of strategic workgroup to help develop and spread best practices. A concern about the spread of misinformation on social media suggests a need for some type of watchdog group for agricultural and natural resource information, who can receive appeals to check the accuracy of suspect messages. More research is needed on how to close the gap between communicating knowledge and action, which may be facilitated by explicitly linking face-to-face and online communication and knowledge sharing.

Methodology

This analysis based on a survey of sustainable agriculture stakeholders conducted from May to July 2016. The survey was designed by Mark Lubell with a multidisciplinary team and reviewed by selected sustainable agriculture stakeholders. The sample frame was assembled via a Google search using the terms “sustainable agriculture” and “county name” from every county in California, and then extracting contact information from the resulting organization and project websites. The Google search was complimented by adding names from several existing lists, including a series of social media focus groups conducted by the research team, the entire list of cooperative extension professionals from the UC Division of Agriculture and Natural Resources, producer groups, a mailing list from the Agricultural Sustainability Institute, and also County Agricultural Commissioners. We also included the capacity for each respondent to email or use social media to recruit additional respondents via “snowball sampling”. Follow-up reminders were sent to non-respondents on a weekly basis until returns dropped to a very low rate.

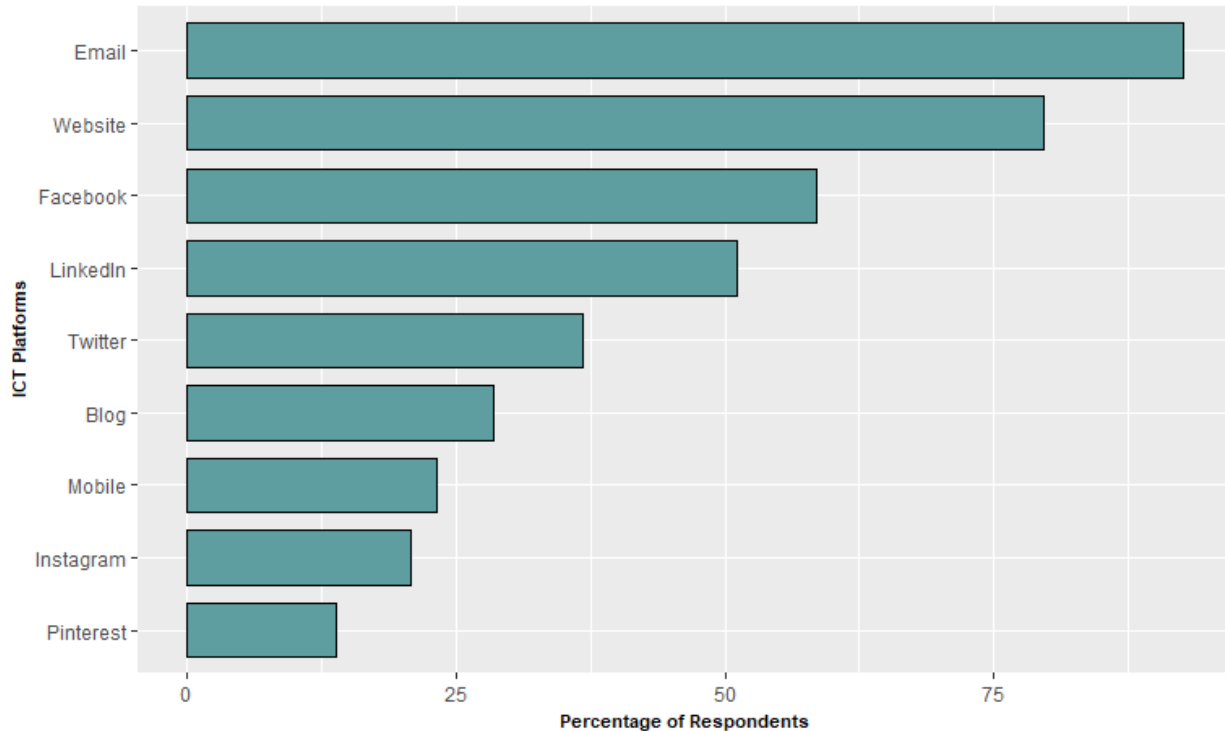
While some growers were included in the sample frame, our goal was to identify the “stakeholders” or “extension professionals” who develop knowledge and manage extension projects and serve as key nodes in the overall knowledge network and innovation system regarding sustainable agriculture. Because there is no statewide list of sustainable agriculture stakeholders, we purposely cast a very wide net and provided an opportunity for respondents to exit the survey if they did not self-identify as being involved in sustainable agriculture. Hence, we expected a relatively low response rate and further research should seek to improve the sampling frame. Overall, we delivered 2671 invitations and received 661 useable responses including a small number of snowball respondents. Including an estimate of ineligible respondents, this is an overall response rate of 28% (American Association of Public Opinion Researchers, Response Rate 4).

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Detailed Results

Figure 1 reports the percentage of respondents who use each of the indicated ICT platforms, regardless of how frequently they use them. As expected, email and websites have become nearly universal technologies for learning and communication. Facebook, LinkedIn, and Twitter are the most popular social media sites, and not reported in the graph were qualitative comments that YouTube was also seen as a valuable tool. The popularity of ICT for sustainable agriculture diverges from the popularity for personal use. For example, the PEW Research center reports that among US adults, 79% use Facebook, 32% Instagram, 31% Pinterest, 29% LinkedIn, and 24% Twitter. Twitter and LinkedIn are ranked relatively higher for sustainable agriculture, most likely due to their functionality for communicating new information and professional updates, respectively. Note that the survey question cannot distinguish between producing versus consuming social media; for example we do not know if the respondent writes a blog, reads a blog, or comments. It is also interesting to note that mobile technology is used infrequently, which is relevant to the emergent development of Smart Phone applications for decision support in sustainable agriculture.

Figure 1: Which of the following information and communication technologies, if any, do you use in your professional responsibilities?



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Figure 2 reports the average temporal frequency indicated by each respondent for using just social media. These questions were not asked for more traditional ICTs like email and websites. Compared with PEW results, the frequency of social media use to communicate specifically about sustainable agriculture is lower than for personal use. For example, PEW reports that 55% Facebook users, and 23% of Twitter user, access their accounts several times per day. In contrast, sustainable agriculture stakeholders are more likely to access Twitter and Facebook once a day or a few days per week. This suggests that maintaining a visible or “live” social media presence on these platforms requires weekly not daily management. LinkedIn, most likely due to its professional profile type of communication, is accessed less frequently most likely reflecting the slower rate of occurrence for professional changes in accomplishments, relative to the more news-related communication that occurs on Twitter and Facebook.

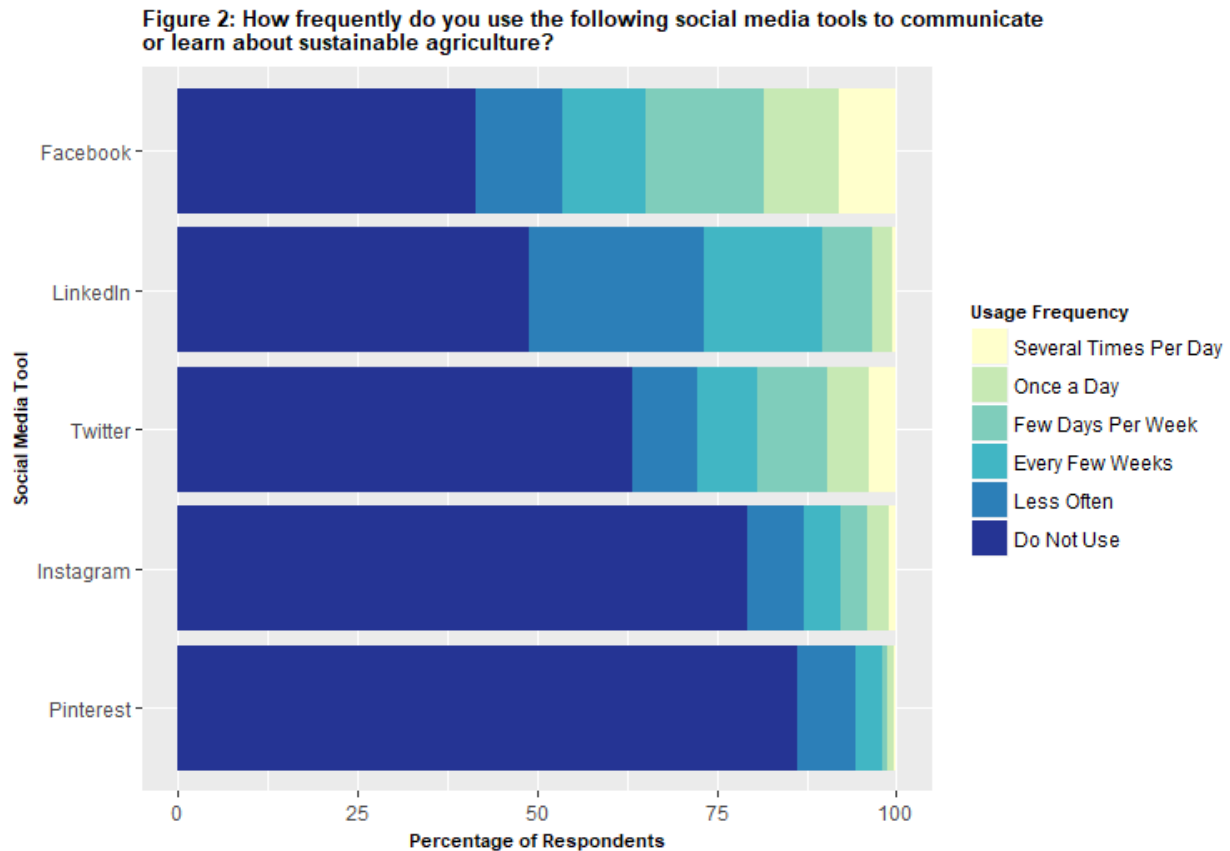


Figure 3 reports the average perceived relative advantages of different ICT platforms, based on diffusion of innovation theory and discussions with sustainable agriculture stakeholders. The averages compute the mean response on the 1-5 scale across all respondents; an average above three indicates three more respondents agree, below three means more respondents disagree, and three is neutral. The primary advantages are related to quickly reaching a larger, more diverse audience across longer distances. It is notable that stakeholders do not see a major benefit for coordinating professional activities or supporting on-the-ground decisions. This suggests a possible gap between communication of knowledge and behavior.

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Figure 3: Perceived Relative Advantage

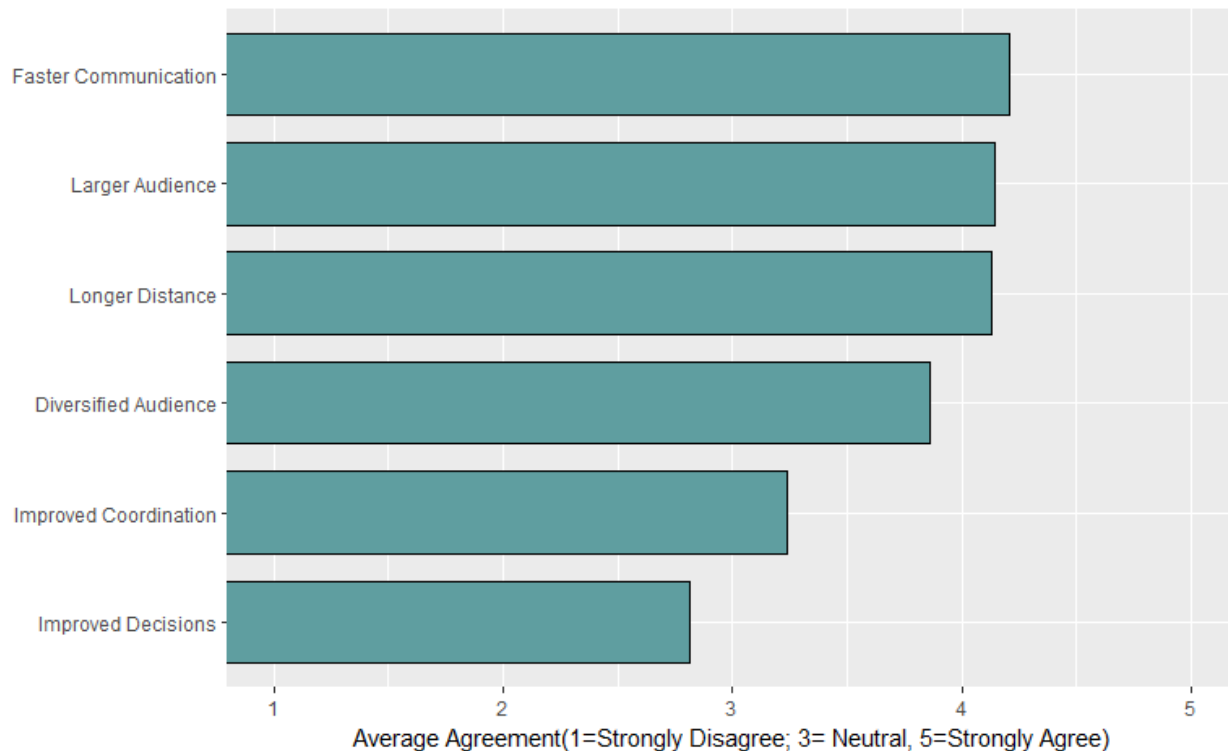


Figure 4 reports the perceived compatibility of social media using the same approach described for Figure 3. Compatibility reflects the extent to which using social media conforms to the professional norms of extension and outreach, in particular the communication of scientifically accurate information, professional support for new forms of communication, and expectations of reasoned dialog. The respondents report that the largest compatibility barrier is the spread of incorrect information, which may become even more of a concern as global media attention is focused on the idea of “fake news”. Stakeholders are also concerned about the availability of professional incentives and collegial support for the use of social media, which is seen by some as a less legitimate form of extension activity than traditional publication and personal communication.

Figure 5 reports perceptions of complexity and observability, again using the same quantitative approach as Figure 3. Complexity refers to the difficulty of using social media, which relates to the technical capacity of users and resource requirements. Observability and the related idea of trialability, refers to the possibility of accurately assessing the effects of social media. If a user cannot observe the effects of social media, it is difficult to evaluate the overall utility of the innovation. The respondents report the time and number of platforms as the biggest obstacles relating to complexity, but they also are challenged by a lack of knowledge about best practices and how to identify the appropriate audience and effectiveness. The technical challenge of actually using the technology is minimal.

Figure 4: Perceived Comptability

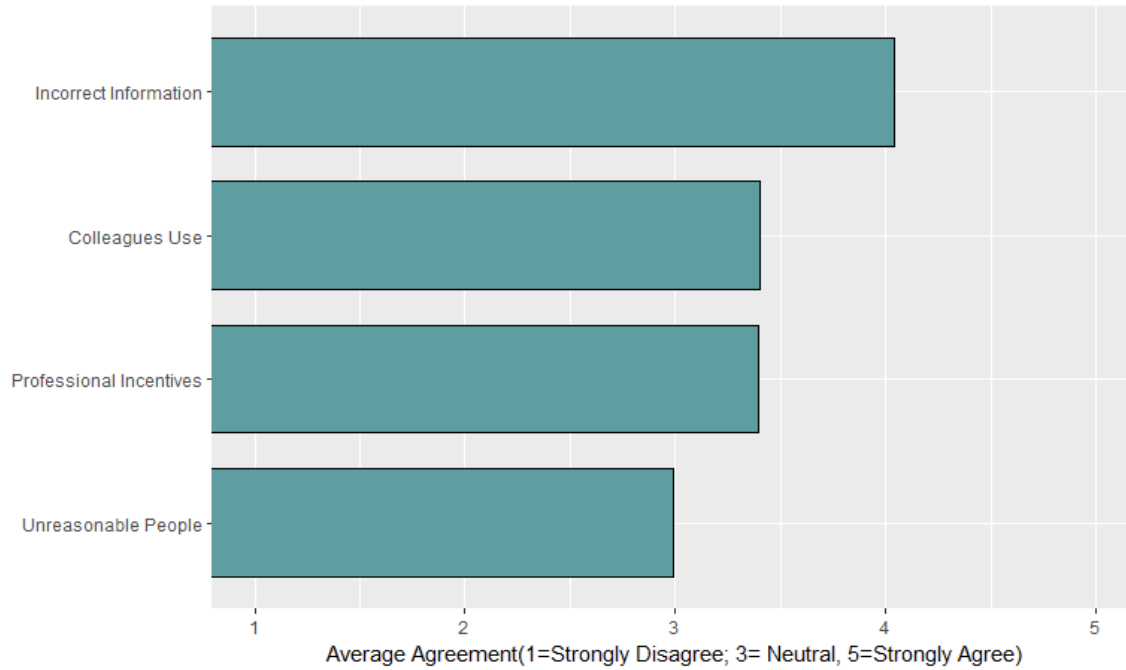
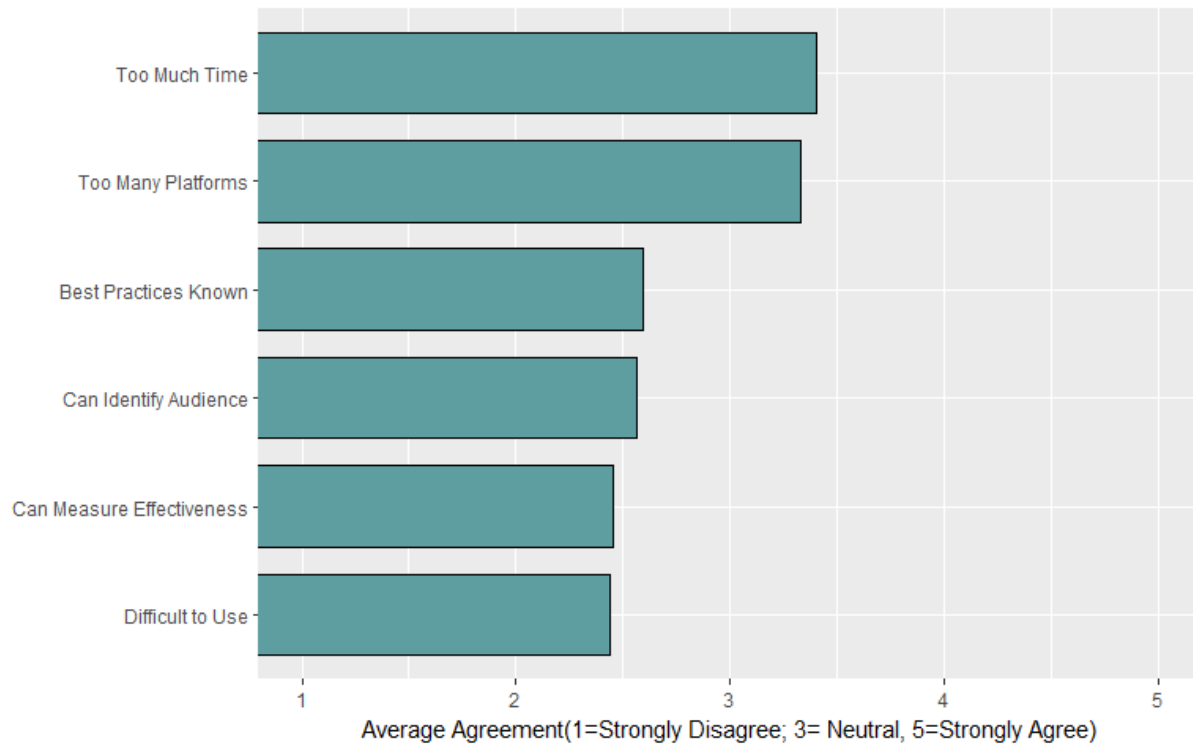


Figure 5: Perceived Complexity/Observability



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New Research Directions

The next stage of this research will investigate the factors measured in the survey that are associated with the adoption and use of ICT and social media. The analysis will include demographics of each individual as well as their perceptions of the various attributes of ICT technology. Given the inherent limits of this survey, more research is needed with larger samples of sustainable agriculture stakeholders to further validate these initial results. Research is also needed on social media and ICT use by farmers and other audiences of extension in agriculture and natural resources. This includes other groups of users organized around other issues, since our study of sustainable agriculture did not include more “conventional” agriculture, natural resource issues, or other audiences of cooperative extension. A high priority should be placed on understanding the conditions under which the knowledge communicated in social media is effectively retained and translated into decision-making and policy. The research on social behavior and attitudes will be usefully complemented by “big data” approaches that analyze patterns of interaction in social media platforms like Twitter and Facebook; one example is provided by our study with [a policy brief on Twitter networks](#).

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