Collaborative Environmental Knowledge Management

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ABSTRACT

This article describes the integration of a smartphone, a world viewer and a geodatabase into a collaborative virtual environment (CVE) as a knowledge management platform for use in land management. A spatial interoperability mechanism was designed for integration of these various technologies distributed in different system layers and written in different programming languages. As users may vary in their education backgrounds and understanding of advanced information technologies, the proposed platform employs existing popular spatial technologies to facilitate usage. The platform includes an iPhone™ application, a web portal based on Google Earth™ viewer and a data server, all of which may be deployed in different and distant places, allowing remote collaboration. To evaluate the usability of the platform, a case study was implemented involving a scientist, a farmer and an agricultural consultant working collaboratively, but remotely, within the system to support their farming practices, decision-making and agricultural research. Users found that the efficiency of agricultural knowledge transfer was increased, and the centralized knowledge database would also be helpful for tracking farming history and supporting agricultural research. This represents a new paradigm in agricultural knowledge management, where relationships between the three key parties are bidirectional, in contrast to the traditional knowledge transfer pattern. This paradigm can be readily extended to other environmental management contexts.

Keywords: Agriculture, Collaborative Virtual Environment, Decision Support, Interoperability, Knowledge Management, Land Management, Smartphone

INTRODUCTION

Our rural landscapes are shaped in large part by the choices and actions of landholders who are primarily involved in some form of agriculture, which may also include plantation forestry. The choices that these farmers make are influenced by their knowledge of their environment. Traditionally, this knowledge arises from their own experience, from advisors (whether from government or the private sector) and less directly from scientists. In conditions of rapid change, such as climate change, old knowledge may no longer work to solve emerging problems and successful transmission of knowledge between scientists, advisors and farmers becomes increasingly important if the landscape is to remain healthy, productive and attractive.

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Formerly, the dominant mode of dissemination of new knowledge in agriculture was for research scientists to publish papers. Then, corporations and governments employed people, advisors or extension officers, whose job included staying in touch with agricultural research and passing this on to farmers through extension services. This traditional agricultural knowledge management (AKM) pattern is summarized in Figure 1.

Science and technology, in the form of new plant varieties, new agro-chemical products and computer-based precision agriculture have worked their way into common practice through this process. Agriculture, in the developed world, has consequently become progressively more productive with larger farms and greater mechanization, especially in cropping. The emergence of affordable mapping (Wolfert, Verdouw, Verloop, & Beulens, 2010) and precise positioning (GPS) has supported this development. This paradigm may also work under conditions of climate change, but given the possibility of more rapid changes to climate conditions, arrival of new pest species, new tax or incentive regimes relating to greenhouse gases and soil carbon, and changing international markets, a new approach may allow more effective adaptation.

Already there has been recognition that the ‘cookbook’ approach to agriculture is not ideal for everyone. Attitudes began to change in the 1990s as the value of the participation of farmers and more adaptive approaches based on specific farm conditions and farmer preferences were recognized (Gerber, 1992; Thornley, 1990). The move away from the traditional top-down approach to knowledge dissemination has been widely researched since that time both in terms of actual farmer behavior (Lyon, Bell, Gratton, & Jackson, 2011) and in development of novel information and support systems involving many aspects of farm management including, for example, computer-based games about environmental impacts (Yongyuth, Prada, Nakasone, Kawtrakul, & Prendinger, 2010).
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