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A model utilizing a science-society communication framework was developed to analyze through a case study approach the innovation transmission and adoption mechanisms under the dairy buffalo project being implemented by the Philippine Carabao Centre (PCC) in the province of Nueva Ecija. Called a "Mediated Bilateral Model,"Center it first depicted the unique features of cultural spaces occupied by the farmers, the PCC scientists, and the PCC field technicians. The basic distinguishing feature is the "scripts" of the interacting actors, which constitute the contexts in which their meaning-making and decision-making activities take place. These contextual factors contribute to the shaping of the actors' distinct frames of reference, which influence their viewpoints or how they interpret meanings. Unmediated and unilateral performance of scripts by scientists was evident in the introductory Technical Training sessions given to farmers. This has resulted in boundary demarcation and in low or non-adoption of particular innovations. Boundary blurring was made possible through a mediated performance of scientific scripts whereby the field technicians, as hybrid actors, engaged in negotiations with the farmers during field visits. These were anchored on joint inscriptions of scientific and farmers' cultural scripts to what become "interface instruments", which resulted in integrative agreements regarding the performance or adoption of specific innovations.

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Introduction and Conceptual Framework

The agricultural sector in the Philippines is a significant contributor to its economy and has continued providing employment for millions of its people. Its improvement relies on the application of science and technology through the government's research and development (R&D) programmes. However, the success of agricultural R&D in the country leaves much to be desired. Medrano (2003) argued that Filipino scientists have generated a number of potentially significant agricultural technologies but these have not effectively reached the farmers. Even if they did, the role of farmers is limited to being passive recipients of these innovations. Worst still, many technologies are not adopted at all. Such are indications of a troubled relationship owing to the fact that scientists and farmers belong to two incongruent worlds, surrounded and protected by a socio-cultural boundary that stabilizes their respective attributes. Misunderstandings are thus common occurrences during their intersection.

Although sociological studies have paid great attention to the characteristics of potentially adopting farmers and flows of information to them, their influence peaked as long ago as the 1960s, suffering from an over-emphasis on empirical case studies and exploratory regression analysis, to the detriment of formal models with good explanatory power (Ruttan, 1996). Economic models have become increasingly dominant, but suffer from a supply-side focus which treats farmers as passive participants (Marra, Pannell, & Abadi Ghadim, 2003). The need for new analytical approaches has recently been recognised, for example, by the construction of a comprehensive model that attempts to combine the best of the sociological and economic approaches (Abadi Ghadim & Pannell, 1999).

This paper takes an entirely new approach to the problem, by applying and extending the fruits of the recent upsurge of research into science-society communication, thereby advancing both fields. It proposes a Mediated Bilateral Model in portraying and analyzing how boundary negotiation is carried out in ways that go beyond traditional adoption and extension approaches. It initially described the main elements of the model followed by its application to a case study in the Philippines, i.e., the dairy buffalo project being implemented by the Philippine Carabao Centre (PCC), a government agency attached to the Department of Agriculture.

Actors and their Cultural Spaces

The basic problem of agricultural extension is represented here by a Mediated Bilateral Model involving a scientist and a farmer, with the possibility of "intermediaries" represented by extension agents. By involving two actors, and two-way communication between them, the model represents an alternative to the comprehensive adoption model of Abadi Ghadim and Pannell (1999) in overcoming the limitations of economic models, which focus on scientists and technologies, and sociological models, which focus on farmers and communication but are insufficiently rigorous.

The scientists and farmers are conceived here in a generic manner, which provides a far more sophisticated portrait of farmers, in particular, compared with previous ones that focused only on their human capital (Schultz, 1975) or perceptions of profitability and risk (Just & Zilberman, 1983).

Both scientists and farmers occupy a distinct societal or cultural space. In other words, they are "situated agents" (Scoones & Thompson, 1994). They are "agents" as they are actively engaged in generating, acquiring, and classifying knowledge. Also, their activities are "situated" as these take place in specific contexts, which, in turn,

characterize their respective cultural spaces. In emphasizing the contextuality and distinctiveness of these cultural spaces, the current model nonetheless pursues the idea that cultural boundaries are malleable.

The Boundary between Science and Society

While Gieryn (1999) argued that maintaining the boundary between scientific space and societal space is essential for maintaining the integrity of the former, in this new model, this requirement is extended to other social groups, too, so that science no longer has a privileged position. In short, farmers, like scientists, can also perform "boundary work". The new model thus transcends the dichotomy of demarcated and blurred boundary models of Felt (2003) and Nowotny (1993), respectively. These are insufficiently nuanced to describe reality, too limited even when judged on their own terms, and generally take too much for granted. In this model, the character of the interface is, like all other aspects of relationship among the actors involved, open for negotiation and change.

Communication and Negotiations across the Boundary

Communication between scientists and farmers is viewed in this model as a two-way, negotiated process. For too long, science-society communication and adoption of agricultural technology have been viewed as a one-way process that relies on educating a scientifically illiterate public (Russell, Ison, Gamble, & Williams, 1989; Nowotny, 1993). This orientation still persists in some economic models, and models of communication from scientists to society, but fortunately has disappeared in others (e.g., Cash, Clark, Alcock, Dickson, Eckley, Guston, Jager, & Mitchell, 2003; Halffman, 2003).

Negotiation is premised on the assumption that farmers and scientists have divergent interests and perceptions as influenced by their differing scripts. "Scripts" are the distinctive behavioural patterns and cultural models that became internalized and as such commonly observed or shared by or among actors in a cultural space (Silvasti, 2003). In other words, "scripts" represent the "standard operating procedures" (Dougherty, 2002) akin to "rules of the games" or mental maps that direct the individuals on how to "feel, think, and behave in particular situations" (Wiederman, 2005, p. 496). Scripts, as reinforced by values, beliefs, capital, previous experiences, and anticipation of future events constitute the "frame of reference" of each actor.

As an illustration, the scientist's frame about agriculture is "out of time" as they conduct their activities under experimental controls in which temporal and spatial realities are "frozen" (Richards, 1993). For scientists, what matters is "replication and comparison" for validating their theories and for fulfilling the expectations of their peers (e.g., publication of a scholarly research). In contrast, the frames and practices of farmers are deeply "embedded in particular agro-ecological and socio-cultural contexts" (Scoones & Thompson, 1994, p. 20). For them, what matters is how to fit optimally the available resources and innovations to actual and ever changing circumstances in the farm.

The different interpretations of meanings of an agricultural innovation as may be influenced by varying frames of reference resonate with one of the important elements of social constructivism, namely, "interpretative flexibility" (Pinch & Bijker, 1987). But prior to the meaning of an innovation being stabilized, the divergence in meaning interpretations by farmers and scientists could spawn misunderstandings or conflicts when they interact. Likewise, both actors could engage in strategic actions reflected in terms of adopting certain "modes" or "styles" in relation to conflict situations. These could be in the forms of avoidance, competition, compromise,

accommodation, or collaboration (Tubbs & Moss, 2003).

While farmers and scientists may adopt one or combination of such "styles", the current model builds more on the concept of "negotiation" as a strategy in dealing with conflict situations. "Negotiation" is a joint decision-making process, combining "the conflicting points of view into a single decision" (Zartman, 1978, p. 70). Viewed this way, "collaboration" could be an aim or an outcome of negotiation. To achieve its purpose, negotiation necessitates a "reframing" process whereby disputing actors develop a "new way of interpreting or understanding" the conflict situation and a "new way of appraising" the other party in such a situation (Gray, 2003, p. 32). In essence, reframing assumes that the frames of actors, while important in providing the context for their interpretations of meanings, are not fixed and hence can be challenged by other viewpoints (Weber & Word, 2001). It aims ultimately to evolve a common frame of reference that will be shared by the negotiating actors.

Besides settlement of possible disputes, negotiation involves making deals which provide opportunities for joint benefits or gains. In other words, it is a "zero-plus" game where the scientist and the farmer jointly create strategies to "enlarge the pie" towards achieving "win-win" situations (Raiffa, Richardson, & Metcalfe, 2002). The surplus value that was jointly created in integrative negotiations is more advantageous than the outcomes achieved in distributive negotiations or those pursued by either actor in isolation (Kickert & Koppenjan, 1997).

The nature of the scripts will be a main subject of negotiation between the two actors as they are expressions of their cultural spaces. This joint inscription model challenges the basis of "standardized packages" (Fujimura, 1992) and cognitive deficit model that have held sway in science communication studies for too long (Ziman, 1992). It also represents an advance over the lay-expertise model (Gregory & Miller, 1998), which can be criticized as privileging local knowledge over science (Lewenstein, 2003) and for being too applied in focus.

The meaning of "interface instrument", the term used here in lieu of standardized package and in emphasizing joint inscription, is determined directly by scientists and farmers through negotiation. For an effective negotiation to take place, scientists and farmers are assumed to have adequate "cultural literacy" (Schirato & Yell, 2000) about each other's scripts. Familiarities in both scripts imply that "blurring" of socio-cultural boundaries can occur both ways, i.e., when scientists communicate to farmers and when farmers communicate to scientists. Both scripts inscribed in the interface instruments are considered parts of interpretative backdrops of effective scientist-farmer communication. Conversely, lack of mutual cultural literacy results in ineffective negotiations and adoption.

The Role of Intermediaries

While negotiation between scientists and farmers can possibly proceed in a direct manner, the new model recognizes that these two actors are heterophilous individuals (Rogers, 2002). As a result, scientists may have inadequate cultural literacy in relation to the scripts of farmers, and vice versa. Negotiations premised on lack of mutual cultural literacy demarcates rather than blurs boundaries. More significantly, reframing can be a difficult process if left to the two actors alone. As such, the role of intermediaries is crucial in mediating the negotiation process. Intermediaries are individuals who sit between two divergent worlds and are familiar with the scripts of both worlds. They can be classified as "hybrid actors" in that they have acquired or developed adequate cultural literacy in both science and farming and can facilitate

meaningful negotiation between the two distinct cultures.

By incorporating intermediary actors, the model fills in the gap associated with the neglect of conceptualization of agricultural extension agents (Fulton, Fulton, Tabart, Ball, Champion, Weatherly, & Heinjus, 2003). While the latter have been traditionally regarded as the main intermediaries in agricultural extension, their role has been previously limited by the one-way paradigm, i.e., as carriers of pre-packaged information or innovations from the scientists to the farmers. In contrast, the new model considers the intermediaries as boundary-spanning individuals who can negotiate meanings and nurture mutual understanding between the scientists and the farmers. They convey contextual information in both directions, fulfilling the roles of communication, translation, and mediation identified as necessary for a two-way "boundary management" by Cash et al. (2003).

The interface instrument is the product of this meaningful negotiation and at the same time the means utilized by the intermediaries to facilitate communication between the two actors. In fulfilling their roles, the intermediaries are also portrayed in a more active way. Instead of just being neutral actors facilitating the communication process, they help in framing and reframing the issues for the two interacting actors towards win-win situations or resolution of possible conflicts (Gray, 2003). Likewise, they possess certain attributes and resources that allow them to also engage in strategic actions required in forging sustainable agreements (Leeuwis, 2000). Ultimately, what is negotiated among the various actors in agricultural extension, and other instances of science-society communication, is "meaning" (Felt, 2003). This implies that offering a "single statement of fact" to actors which hold varying frames will be inadequate as it will likely elicit questions and qualifications (Weber & Word, 2001, p. 493).

Statement of the Problem

The main premise of this paper is that direct communication between scientists and farmers is often ineffective, leading to limited or non-adoption of agricultural innovations. How then can this concern be addressed?

Purpose

This paper aims to offer explanations as to how intermediaries facilitate communicative processes towards improved transmission and adoption of agricultural innovations.

Objectives

1. Gain new insights into the adoption of agricultural innovations by interpreting it within the framework of science-society communication;
2. Devise a conceptual model of the adoption of agricultural innovation using a science-society communication methodology; and
3. Test the model in the Philippines by using it to interpret the effectiveness of innovation adoption as may be influenced by two-way communication and by the degree to which it represents a negotiation of contextual meaning

Methods

The empirical evidences or application of the Mediated Bilateral Model were derived from a fieldwork conducted by the author in the province of Nueva Ecija, Philippines from July 2007 to February 2008. A case study approach was applied, utilizing mostly qualitative data from direct observations and face-to-face individual interviews with sample informants of farmers (N=38), PCC scientists (N=5), and PCC field technicians (N=4) who are

involved in a dairy buffalo project introduced by the PCC in the province.

Results and Discussions

Actors and Scripts

The farmer-informants are situated in a cultural space characterized by constant struggle and uncertainties towards earning a livelihood, which is constrained by limited resources and other external conditions in the farm. Their scripts are manifested through the "traditional" and mostly "unwritten" rules and conventions governing smallholder crop and livestock production including access to and optimization of all possible resources and support services. These scripts are reinforced by values and beliefs that they associate with farming, which they consider not only a source of livelihood but "a way of life". While some of them have earned higher education, their human capital is largely informed by practical experience, gained from many years of tending the soil and as handed down, through an oral culture, by their parents who are farmers themselves.

Unlike the farmers, the PCC scientists are in a cultural space that allows for a regular source of income (salary) and additional benefits, as guaranteed by their civil service eligibilities and security of tenure. They are housed in modern buildings and provided with material resources to facilitate the performance of their jobs. However, they also thrive on the rudiments of a bureaucratic organization. Thus, they are bound to observe "formal" or "written" scripts in performing both scientific and administrative tasks. As scientists, they perform their jobs objectively as prescribed by the "scientific method", their technical backgrounds, and their terms of reference. Their human capital is largely theoretical in nature, i.e., rooted in higher levels of formal education in their respective disciplines. The application of their theoretical knowledge, however, is generally confined to controlled conditions in experimental farms or laboratories as they seldom go out and interact with the farmers.

While sharing the same "physical" space with the scientists, the field technicians (FTs) of PCC are "hybrid" actors as they are "culturally" situated at the "interface" of science and farming. Thus, while they may be governed by the same scripts and share the same material resources with the scientists, they have also developed adequate levels of literacy about the scripts of the farmers brought about by their frequent interactions with them. Their human capital is therefore a mixture of theoretical and practical knowledge on the scripts of both cultural spaces.

Non-Mediated Performance of Scientific Scripts

Content of Technical Trainings by Scientists. As one of the requirements of the dairy buffalo project, farmers participate in formal Technical Trainings on improved practices in animal feeding, health, and reproduction prior to the awarding of the buffalo as a "soft loan". These training sessions, which are free of charge, serve as the main interface between farmers and PCC scientists. A typical session runs for two days and is held at one of the lecture rooms of the PCC headquarters. It has a classic "teacher-student" set-up, i.e., the PCC scientists stand in front of the farmer-trainees and deliver one to two-hour lectures utilizing Power Point presentations. Practical sessions or technology demos, when applicable, sometimes accompany the formal lectures.

Dominant-Passive Communication in Technical Trainings. Since most farmers only know about raising native carabaos for farm work, the training session is a venue where the scientists impart new information about a different type of buffalo that requires a different type of husbandry practices. Yet, it also allows the scientists to assert their expertise on a particular topic,

i.e., their scientific script, by showing and justifying to the farmers that a certain innovation or technology works, theoretically speaking, with support from their on-station experience or research findings. Thus, the training session is a venue for a direct manifestation of usually uncontested "boundary work" (Gieryn, 1999) by the PCC scientists. In such a situation, there is no "negotiation of meaning" because of the unidirectional flow of information from the scientists to the farmers. As a result, the cultural boundary of the scientists, as "knowledge experts", is demarcated further.

Nonetheless, the farmers did not mention any conflict with the scientists during the sessions. This is rooted in their high levels of trust and regard to the PCC scientists. Many of them also stated, "The scientists will not teach something that is wrong or detrimental to their welfare." Such passive behavior of farmers also demonstrates a natural inclination of a "guest" to behave in accordance with the culture or standards of a "host" in the process of acculturation. It is also uncommon for the farmers to contest what the scientists are saying during the lectures as they themselves acknowledged that scientists occupy a "higher knowledge plane". Such a scenario could also be indicative of "accommodation" (Tubbs & Moss, 2003), a mode adopted by the farmers in managing their relationship with the scientists. By "giving in" to what the scientists say in the lectures, the farmers contribute to a "smooth flow" of lecture presentations. Yet, it does not strengthen the relationship and instead contributes to the creation of a boundary between the two actors.

More importantly, while the farmers may attend the training sessions with a genuine intention of learning something new, they are also there to fulfill an obligation and at the same time pursue a major purpose, i.e., to obtain a dairy buffalo from the PCC. Thus, such encounters could also be manifestations of personal interests from both actors, dictated or influenced by their respective scripts. While scientists may utilize the sessions as a platform to assert their scientific script by selling the idea of improved practices in dairy buffalo, the farmers are satisfying their own cultural script, i.e., maximizing all available resources for farm survival and for increasing income by acquiring the buffalo.

Mediated Performance of Scientific Scripts

Two-Way Communications between FTs and Farmers.

Communications between FTs and farmers are entirely different in character from those with scientists. They are bidirectional instead of unidirectional, the farmers are active instead of passive, and the two actors negotiate with one another. This results in a mediated performance of scientific scripts, which enables farmers to add their cultural scripts to the final interface instrument.

The FTs visit the farmers to provide extension services and "field coaching". These visits, done almost daily from 1999 to 2006, allowed the FTs to be acquainted with the scripts of the farmers. As an outcome of these frequent visits and interaction, the farmers became very comfortable with the FTs, treating them not as visitors but as close colleagues. There is a visible camaraderie between the two types of actor, e.g., they would often exchange "light talks" even when discussing problems about the buffalos. Thus, the FTs depart from the traditional portrayal of an agricultural extensionist who conducts field visits just to "deliver pre-packaged technologies" to the farmers.

It is not surprising that the FTs are the first people that farmers look for and consult with when they visit the PCC. At times, they also ask the FTs to accompany them when they like to consult with a particular scientist, as they are apprehensive

to do so directly, and expect the FTs to mediate on their behalf. This the FTs can do because they can speak the "language" of both actors.

The FTs have now become lecturers in the Technical Trainings, too. Initially, they only acted as support staff but they soon began to give talks themselves. These elicit active participation from farmers because the FTs know almost every farmer, and are familiar with their "language" and farm situations. They often inject humor into their presentations by using anecdotes, which they know the farmers can relate to. In contrast, when scientists "take the stage", their lectures are more formal and the audience more subdued. Some scientists routinely ask FTs to act as facilitators to put a particular point across because they "connect" more easily with farmers.

Delivered Innovations. During their field visits, the FTs are expected to follow through with farmers the implementation of innovations to which they were introduced in the training sessions. Some of these innovations are "delivered", e.g., animal health services such as vaccination and vitamin administration, as these do not require much activity on the part of the farmers, other than helping in restraining the animals. As a result, practically all the farmer-informants are "adopting" these innovations.

Negotiations. What FTs actually do in the case of other innovations, however, is to engage in negotiations to adapt the said innovations to field conditions. As an example, in feeding management, the script of the scientists requires keeping the dairy buffalo under complete confinement and feeding it with "cut-and-carried" grasses, a practice called "zero grazing" or "stall feeding". Knowing that farmers have limited landholding, this does away with establishing a large parcel of pasture area (e.g., one hectare) to support a grazing, mature animal. Instead, the farmers were asked to plant just 0.1 ha with improved grasses like Napier and forage corn, which contain more dry matter than native grasses. Because of the minimal movement while on confinement, the animal is expected to conserve its energy and use it for milk production. Feeding with legumes, concentrates, and mineral supplements are also recommended.

Instead of doing this feeding practice, the FTs discovered that farmers were bringing buffalos to a communal pasture at certain times of the day, and tethering them so they would graze in a particular area, just as they used to do with native buffalos in the past. The animal is then confined and handfed with Napier, mixed forages (native grasses, weeds, shrubs), or rice straw. Thus, the farmers are practicing their script on semi-intensive feeding using locally available feed resources instead of the more intensive feeding that was recommended.

The response of the FTs was to let the farmers continue this practice, in return for their agreement that the buffalo be dewormed regularly, as it can be infested with helminths while grazing in the field. Farmers have to sacrifice a little for this. They need to pay for the anthelminthics. There is also a withdrawal period, i.e., the farmers must discard the milk from the dewormed buffalo for three consecutive days for safety reasons. Because this deprives them of income from milk for three days, a few farmers refused to let their buffalos be dewormed, but the majority recognized the long-term benefits of deworming and agreed. It is therefore now part of the regular routine of the FTs to deworm buffalos every three months.

Another example is in the area of reproduction management. Proper and early detection of heat, i.e., a period when animals are sexually receptive, facilitates the matter. Simple heat detection practices include looking for physical and behavioral signs exhibited by the buffalo, e.g., clear, mucous discharge from its reproductive organ, loss

of appetite, and uneasiness. In-heat buffalos are bred via artificial insemination (A.I.) by a skilled technician. It offers many advantages, e.g., allows the use of semen from superior bulls, permits the insemination of more buffalos, prevents the spread of reproductive diseases as the semen is pre-evaluated in the laboratory, among others.

Adoption of A.I. is only about 65%. Other farmers prefer natural mating as it has a relatively higher success rate. Recognizing the advantages and disadvantages of both approaches, the FTs negotiated with the farmers a revised arrangement whereby they utilize A.I. first but if the buffalos do not get pregnant after three successive inseminations, they will use a bull for natural mating. This "clean-up bull" is made available via the PCC's Bull Loan Program. To increase efficiency, the FTs and farmers agreed to establish a "night corral", wherein a breeding bull and female buffalos are put together overnight. This has resulted in a high conception rate.

The FTs provided feedbacks to the scientists about the foregoing field circumstances and agreements. In response, the scientist supported the joint decisions made and adjusted the contents of their subsequent lectures accordingly.

The "negotiated" practices on feeding management and reproduction management serve as interface instruments toward the coordination of activities of the two divergent actors. "Coordination" in this case represents the other type of "boundary work" that departs from "demarcation" (Halffman, 2003).

Conclusions

The Mediated Bilateral Model offers a novel way of portraying and interpreting the dynamics of transmission and adoption of agricultural innovations. It differs from the existing boundary-organization model (Guston, 2001) in allowing scientists to communicate with farmers both directly and indirectly, via intermediary actors, in this case, the FTs. In both routes, farmers have potential to offer feedback, as in the boundary-organization model. Yet only the mediated route offers the possibility of negotiations, with intermediaries. This research shows that farmers are merely passive recipients of scientific scripts on the direct route from scientists during the formal lectures. However, they also performed their own version of "boundary work" when they resorted to their traditional scripts in raising buffalos. Nonetheless, on the indirect route, they can actively negotiate with intermediaries a mixture of scientific scripts and their own scripts which is more meaningful to them and which they are happy to incorporate into their livelihoods. The feedback from intermediaries to scientists can also cause the latter to change their own scripts.

A further advance in the Mediated Bilateral Model is that, in contrast to the boundary-organization model in which the scripts transferred and translated from scientists to end-users are purely textual, in the new model they can include "performed scripts", too. Scientists have their own performed scripts, in the lectures, which they deliver to farmers. Meanwhile, the farmers are expected to translate these into daily actions, which in this case, refer to how they raise their dairy buffalos.

Successful negotiations and actual performance of joint agreements among the farmers, the FTs, and the scientists are manifestations of blurring of cultural boundary that initially separated them. The processes involved are iterative because of the tendency of some actors to deviate from the joint agreement.

References

Abadi Ghadim, A. K. & Pannell, D. J. (1999). A Conceptual framework of adoption of an agricultural innovation. *Agricultural Economics*, *21*, 145-154.

Cash, D., Clark, W., Alcock, F., Dickson, N., Eckley, N., Guston, D., Jager, J., & Mitchell, R. (2003). Knowledge systems for sustainable development. Retrieved from http://www.pnas.org/content/100/14/8086.full

Dougherty, M. (2002). Gendered scripts and declining soil fertility in southern Ethiopia. *African Studies Quarterly: The Online Journal for African Studies*, *6*(1). Retrieved from www.africa.ufl.edu/asq

Felt, U. (2003). Spaces where publics encounter "their" sciences. In U. Felt, (Ed.), *Optimizing public understanding of science and technology.* Retrieved from http://sciencestudies.univie.ac.at/en/publications/

Fujimura, J. (1992). Crafting science: standardized packages, Boundary objects, and translation. In A. Pickering, (Ed.), *Science as practice and culture*. Chicago, IL: The University of Chicago Press.

Fulton, A., Fulton, D., Tabart, T., Ball, P., Champion, S., Weatherly, J., & Heinjus, D. (2003). *Agricultural extension, learning and change*. RIRDC Publication No. 03/032. Barton, AU: Rural Industries Research and Development Corporation.

Gieryn, T. (1999). *Cultural boundaries of science*: *Credibility on the line*. London: The University of Chicago Press.

Gray, B. (2003). Framing of environmental disputes. In R. J. Lewicki, B. Gray, & M. Elliott, (Eds), *Making sense of intractable environmental conflicts: Concepts and cases*. Washington, DC: Island Press.

Gregory, J. & Miller, S. (1998). *Science in public communication, culture and credibility*. New York, NY: Plenum Press.

Guston, D. (2001). Boundary organizations in environmental policy and science: An introduction. *Science, Technology, & Human Values*. *26*(4), 399-408.

Halffman, W. (2003). Boundaries of regulatory science: Eco/toxicology and the regulation of aquatic hazards of chemicals in the US, England, and the Netherlands, 1970-1995, *EASST Review, 22*(2/3), 14-17.

Just, R. E. & Zilberman, D. (1983). Stochastic structure, farm sizes and technology adoption in developing agriculture. *Oxford Economic Papers*, *35*, 307-328.

Kickert, W. J. M. & Koppenjan, J. F. M. (1997). Public management and network management: An overview. In W. J. M. Kickert, E. Klijn, & J. F. M. Koppenjan, (Eds). *Managing complex networks: Strategies for the public sector*. London: Sage Publications.

Leeuwis, C. (2000). Reconceptualizating participation for sustainable rural development: Towards a negotiation approach. *Development and change, 31*, 931-959.

Lewenstein, B. (2003). *Models of public communication of science and technology.* Retrieved from http://www.dgdc.unam.mx/Assets/pdfs/sem_feb04.pdf

Marra, M., Pannell, D. J., & Abadi Ghadim, A. (2003). The economics of risk, uncertainty and learning in the adoption of new agricultural technologies: Where are we on the learning curve? *Agricultural Systems, 75,* 215-234.

Medrano, W. (2003). Research and development priorities of the Department of Agriculture. *Seminar on Technology Promotion: Lessons Learned from DA-JICA Assisted Projects, 10-11 March 2003, Manila*.

Nowotny, H. (1993). Socially distributed knowledge: Five spaces for science to meet the public. *Public Understanding of Science, 2*, 307-319.

Pinch, T. & Bijker, W. (1987). Social constructivist approach. In W. E. Bijker, T. P. Hughes & T. J. Pinch, (Eds.), *The social construction of technological systems: A new direction in the sociology and history of technology*. Cambridge, MA: MIT Press.

Raiffa, H., Richardson, J., & Metcalfe, D. (2002). *Negotiation analysis: The science and art of collaborative decision making*. Cambridge, MA: The Belknap Press of Harvard University Press.

Richards, P. (1993). Cultivation: Knowledge or performance? In M. Hobart, (Ed.), *An anthropological critique of development: The growth of ignorance*. London: Routledge.

Rogers, E. (2002). The nature of technology transfer. *Science communication, 23*(3), 323-341.

Russell, D. B., Ison, R. L., Gamble, D. R., & Williams, R. K. (1989). *A critical review of rural extension theory and practice*. Richmond, NSW: University of Western Sydney.

Ruttan, V. W. (1996). What happened to technology adoption-diffusion research? *Sociologia Ruralis, 36*, 51-73.

Schirato, T. & Yell, S. (2000). *Communication and culture: An introduction*. London: Sage.

Schultz, T. W. (1975). The value of the ability to deal with disequilibria. *Journal of Economic Literature*, *13*, 827-846.

Scoones, I. & Thompson, J. (1994). Knowledge, power and agriculture: Towards a theoretical understanding. In I. Scoones & J. Thompson, (Eds.), *Beyond farmer first: Rural people's knowledge, agricultural research and extension practice.* London: Intermediate Technology.

Silvasti, T. (2003). The cultural model of the "Good Farmer" and the environmental question in Finland. *Agriculture and Human Values*, *20*, 143-150.

Tubbs, S. & Moss, S. (2003). *Human communication: Principles and contexts* (9th edition). New York: McGraw-Hill.

Weber, J. & Word, C. S. (2001). The communication process as evaluative context: What do nonscientists hear when scientists speak? *BioSciences*, *51*(6), 487-495.

Wiederman, M. W. (2005). The gendered nature of sexual scripts. *The family journal: Counselling and therapy for couples and families*, *13*(4), 496-502.

Zartman, I. W. (1978). Negotiation as a joint decision-making process. In I. W. Zartman, (Ed.), *The negotiation process: Theories and applications*. London: Sage.

Ziman, J. (1992). Not knowing, needing to know, and wanting to know. In B. Lewenstein, (Ed.), *When science meets the public*, American AAS: CoPUS.