

Extension Agriculture and Natural Resources in the U.S. Midwest: A Review and Analysis of Challenges and Future Opportunities

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ABSTRACT This review addresses key changes in U.S. agricultural extension and future opportunities. Agricultural extension has been a part of the land-grant university (LGU) system for more than 100 years. The Morrill Act of 1862 established the LGU system by authorizing states access to federally controlled land and funding for public institutions offering educational opportunities focusing on agriculture and mechanical arts for farmers and the working class. Current surveys in Iowa reveal changing trends in extension: more than 90% of farmers identified private-sector crop advisers as their primary source for recommendations, whereas more than 80% of those advisors identified Iowa State University (ISU) extension as their primary source. These results highlight the shift in extension's client base from end users—farmers and agronomists—to their advisers and consultants. This change reflects, in part, a conscious effort by extension to target agricultural advisers—in addition to farmers—and represents a changing trend in extension's role. Extension has contributed to U.S. farmers' potential for profit and export of goods to international markets. Today, due to continuous reductions in state and federal support, extension faces unprecedented challenges to continue its non-formal educational role. These challenges present opportunities for extension to evaluate programs and serve the common good by charting new directions.

By definition, a company town is a community dependent on one company for all or most of the necessary services or functions of town life such as employment, housing, and stores. In pre-World War II United States, nearly every company town had a company store providing products ranging from food and lace curtains to tools and automobiles (Allen, 1966). These stores were owned and operated by the company and employees were most often required to trade in these employer-owned markets. Unfortunately, company stores at times served as a "...tool for company domination and control of the worker as employees found their very jobs at stake if they were to consider trading elsewhere" (Allen, 1966, p. 128). Prices at company stores were generally higher because there was limited or no competition and shipping costs were higher because of the town's isolated location. Later advances in transportation and communication eliminated most company stores (Allen, 1966).

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Agricultural extension played a significant role in developing management practices based on crop and livestock research, helping increase production to where U.S. farmers often profit and also export goods to an international market. In many respects U.S. extension is a model for the world. Yet, funding reductions have severely impacted this role of land-grant universities (LGUs). Our concern as authors of this article is that if support for the extension system continues to erode, agricultural education and information services may develop into an industrial information model—"company store"—dominated by self-interest and profit-driven motivations where large, private agribusinesses dominate products and services, and control and select information to disseminate. Two questions need answers: First, "Is extension information and the sharing of peer-reviewed, research-based knowledge critical for U.S. agriculture?" And second, "Is it necessary for public-sector extension to continue serving agriculture?" We postulate the answer is "yes" to both questions. However, the structure and delivery of programs used by agriculture extension educators on county, regional, and state levels needs to be revisited, evaluated, and modified to address challenges in the future.

In this current information age, people are more formally educated and have many choices regarding where to find information in stark contrast to the 19th and early 20th centuries when the LGU system and extension were

Abbreviations: AES, Agricultural Extension Service; CES, Cooperative Extension Service; FTE, full-time equivalent; ICM, integrated crop management; IFRLP, Iowa Farm and Rural Life Poll; ISU, Iowa State University; LGU, land-grant university; NIFA, National Institute for Food and Agriculture.

first established. Advances in information dissemination through the Internet and social media present opportunities—and challenges—for extension to adapt in order to be effective and relevant. These factors can alter the value and type of public good that extension typically provides (Hoag, 2005). The objective of this review is to discuss the challenges extension faces in providing research-based information that serves U.S. agriculture, and to address the adaptation of extension to new opportunities for distributing such information.

LAND-GRANT ESTABLISHMENT: ROLE AND PURPOSE

President Abraham Lincoln signed into law on 2 July 1862 legislation that gave states land to provide funding to establish public institutions that would offer higher education opportunities for the sons and daughters of farmers and working-class citizens. These institutions are now represented by one or more land-grant colleges or universities in each state and on tribal lands. Land-grant universities have a common mission of helping solve difficult societal challenges through research, teaching, and extension. Land-grant universities serve a common societal good—in contrast to private or personal good. Extension has played a pivotal role in advancing agriculture in this country and to a certain extent in other countries through active engagement in people's lives and transfer of research-based agricultural knowledge and technology. Extension is one of the three components of the LGU's mission and purpose, and achieves this goal through transferring research-based knowledge and technology to agriculture and food system end users.

A BRIEF HISTORY OF AGRICULTURAL EXTENSION

Production agriculture dominated the U.S. economy of the early 20th century, with 41% of the workforce employed in agriculture then compared to 1.9% in 2000/2002 (Dimitri et al., 2005). Originally called the Agricultural Extension Service (AES), Congress established the Cooperative Extension Service (CES) through the Smith-Lever Act of 1914. Today, "...Extension is the world's largest non-formal educational organization..." addressing agricultural and urban concerns (Seevers et al., 1997). It serves as an "honest broker" of information. In 1887 the U.S. Congress passed the Hatch Act, which provided funds for each LGU to establish an agriculture research station. Shortly thereafter, agriculture faculty initiated field demonstrations and short courses for farmers. For example, in Iowa, county-based extension work started in February 1903 by farmers, and an Iowa State College professor of agronomy in Sioux County (Bliss, 1960) and other states started similar programs.

Historically, the U.S. government publically supported research and extension on the grounds that research produces knowledge and extension disseminates it publically for the common good (Lindner, 1993). "When the Cooperative Extension Service functions properly, agents of the public—who possess agricultural expertise—challenge and work with the industry [agribusiness] to bring about change responsive to public interests, yet sensitive to the needs of agriculture" (Bloome, 1993). There is no doubt that a major contribution to democratic life in the United States was the establishment of LGUs across all 50 U.S. states through the Morrill Act of 1862, the Hatch Act, and the Smith-Lever Act. This social contract—between

extension and the public—is implemented by engaging the agriculture community through the transfer of knowledge and technology, and by organizing and conducting research and educational activities. However, with reduced public support, LGUs and the CES face a number of challenges, including inadequate funding for programs essential to accomplish its mission (Jackson and Thomas, 2003). The decline in public support for extension signals a weakening of the social contract first codified through the Morrill Act and further strengthened through the Smith-Lever Act.

EXTENSION'S ROLE AND CHANGING AUDIENCE

Agriculture extension was established to serve the common good and all people regardless of farm size, resources, or economic status. It transfers research-based information, technology, and advances in agriculture by bridging the agriculture community with academic institutions through educational forums. Extension, as a trustworthy provider of research-based information, made large impacts in improving yield potential for many crops and agriculture products. Extension's contribution to best management practices for agriculture and natural resources through education and technology transfer was one key to improving management skills of farmers, ranchers, and agronomists. This was accomplished through the transfer of new technologies, research-based information, and production methods to end users. Extension plays a critical role in helping farmers maintain productivity and reduce the unintended impacts of the power of private industry in agriculture. With recommendations for reducing soil erosion and enhancing soil health, addressing the development of management-resistant pests, reducing runoff of nutrients and manure, or teaching best management practices in livestock production, grazing techniques, ranch management, or natural habitats and wildlife, extension serves the public good by addressing long-term concerns that short-term, profit-driven approaches do not. Studies for returns on investment in extension indicate "...that Extension activities are an important conduit for research to the agricultural production in a state" (Foltz and Barham, 2009).

However, extension's role has changed in the last few decades as reflected in reductions in direct service to farmers. The Iowa Farm and Rural Life Poll (IFRLP), an annual survey of farmers (Arbuckle et al., 2012), provides evidence that farmers' direct reliance on extension as an information source has changed. The poll periodically asks farmers where they would go first for information on crop production. In 1985, 42% of respondents indicated that they would go to Iowa State University (ISU) extension first (unpublished data, IFRLP, 1985). By 1995, the percentage had dropped to 17%, and by 2005 only 12% of farmers indicated that they would go to extension first (Korsching et al. 2005) (Fig. 1). The biggest drop in this number occurred between 1985 and 1996, coinciding with the farm financial crisis and shift to larger-scale operations for both farmers and agribusinesses (J. Arbuckle, personal communication, 2013). For example, a demonstration project conducted by ISU extension in a nine-county area in northwest Iowa documented consolidation of agribusiness retail dealers (chemical and seed). The project focused on delivery of crop management services between 1992 and 1997. At the start of the project, 61 retail dealers populated the nine counties. In the fall of 1997 consolidation narrowed the list

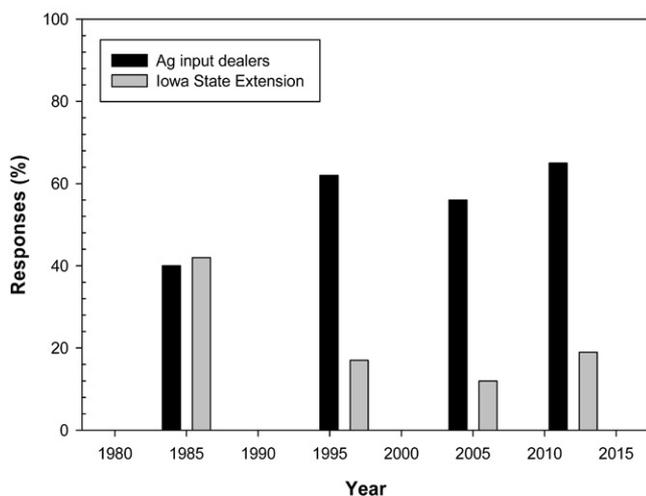


Fig. 1. Average of responses by corn and soybean farmers for first source of information. ($n = 1796$ in 1985, 1879 in 1996, 1246 in 2005, and 1190 in 2012) (Arbuckle et al., 2012).

to 28 separate agribusiness dealerships, although most of the 61 facilities remained operational (G.A. Miller, personal communication, 2014). Agribusiness dealers became the first information stop for 65% of farmers in 2012, in contrast to 42% in 1985. About one-third of farmers go first to ISU extension for information on conservation practices, whereas 45% go to USDA service centers for this information (Arbuckle et al., 2012).

This does not mean that extension is no longer a viable source of crop production information. Interestingly, “Larger-scale, more influential farmers tend to look to ISU extension more frequently than other farmers” (Arbuckle, 2013). Although a 2003 survey found that more than 90% of farmers identified private-sector crop advisers as a primary source for recommendations, more than 80% of those crop advisers identified ISU extension as their main source for information (Tylka et al., 2005). For two decades, ISU extension focused on “train the trainer” as a model for education transfer; the effectiveness of the university-private sector partnership and extension’s “train the trainer” approach was obvious. Extension’s client base shifted from farmers to their advisers and their need for new methodology for information and technology transfer to end users—farmers and agronomists. This change reflects, in part, a conscious effort by ISU extension to target agricultural advisers in addition to farmers. For example, in 1987 ISU extension established a field education laboratory to teach diagnostic and management practices in a wide range of disciplines including soil, crops, fertility, pest, weed, and disease management. The primary audience for this laboratory was industry service providers and agronomists. More recently, ISU extension established state-wide training programs in agriculture and natural resources including the Crop Advantage Series and the Integrated Crop Management (ICM) Conference to provide educational training in crop and soil management for certified crop advisers, extension specialists, agronomists, and farmers. Iowa State University extension responded to the demand to serve agribusiness and larger farmers by offering the ICM conference, which reaches nearly 1,000 people annually (Brent Pringnitz, Agriculture and Natural Resources, Program Services, events coordinator, personal communication, 2013). Similar efforts have been implemented in several

Table 1. Differences in the role and mission of agribusiness and extension.

Agribusiness	Extension
Private good and profit as a goal	Common good as a goal
Sells product—supported by customer sales	“Provides” research-based information—supported by the public
“Sells” information and service to aid sales	Provides information and service for the common good to educate and change behavior and conditions
Customers	Clients
Shareholders	Stakeholders
Ability to pay is important	Ability to adopt changes in approaches is important
In-house information from scientists filtered through sales people before release	Research-based information usually peer-reviewed before release
Results: increased company sales volume and profits with the hope of customers making better decisions.	Results: outcomes and impact by changing behaviors through education, training, and demonstrations
Building business relationship and future customers	Building a client base for community wide well-being

midwestern states where extension has recognized that it could disseminate research-based information more widely with a focus on advisers. In addition, advisers were looking to extension for assistance.

CONTRASTING ROLES: AGRICULTURE AGRIBUSINESS AND EXTENSION

The roles of extension and agribusiness intersect in terms of delivery of information and services to farmers. Yet, extension and agribusiness differ in their objectives and approaches. At times this produces a tension in serving the end user (Table 1). Agribusiness sometimes positions itself as a one-stop-shop for farmers to receive product and technical expertise—a quasi-company store model. In addition, agribusiness duplicates extension’s role by utilizing, in part, extension-developed information and repackaging it as its own product. In this way, agribusiness providers serve as multipliers for extension information as they transfer technology and information to their clients (Tylka et al., 2005). Although, this duplication multiplies extension’s efforts, it is sometimes at a cost—farmers do not always recognize the information source because agribusiness often does not acknowledge extension’s role of providing accurate and practical information that serves multiple purposes of sustaining productivity and protecting natural resources. Both agribusiness and extension professionals carry their own preconceived ideas with specific perceptions through which they screen their ideas and actions. Both groups are “selling” something. To counter this, at least from the extension viewpoint, research-based information with critical peer review is an important part of extension programs.

Whether it teaches the need for reducing soil erosion and enhancing soil health, addresses the development of pests and weed resistance, focuses on surface runoff and nutrient loss, or promotes best management practices, extension serves the public good by addressing potential long-term

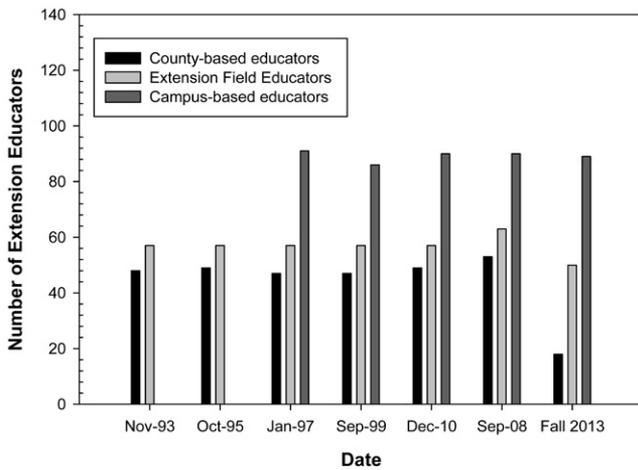


Fig. 2. Changes in Iowa State University extension full-time equivalents from 1993 to 2013.

effects that short-term, profit-driven approaches do not. For example, extension educators provide research information and conduct field demonstrations to show farmers the benefits of cover crops, weed and insect refuges for row crops, sod-based rotations, and other soil and water conservation practices.

CHALLENGES FOR EXTENSION

Today, extension faces unprecedented challenges regarding the relevancy and role of its non-formal educational approach (Seevers, 2000). Extension's current challenges present new opportunities to assert its educational role as an honest and credible information provider by continuing to share knowledge with the public. This role is imbedded in its core mission of providing research-based information for the public good. Changes in public funding and support, agriculture demographics, and acceleration of technological advancement in agriculture industry and improved communications present significant challenges and opportunities to agriculture extension. To remain relevant, it is imperative to examine current approaches in delivering information and partnering with a wide range of clients, in addition to the traditional role of serving extension clients who are farmers.

Change in Funding and its Effect on Extension's Mission

Funding challenges began as early as the 1980s when U.S. and foreign governments questioned program budgets (Benson and Jafry, 2013). This was, in part, due to significant changes in global economic circumstances, which included the rise of foreign debts and the U.S. farm financial crisis. Wang (2014) argued that "federal appropriations have continued to grow while real total federal extension funding (in inflation dollars using ERS's research price indexes the deflator) as well as real formula funding has declined since 1980." He indicated that programs supported by the statutory distribution of funds required by the Smith-Lever Act as amended, the so-called formula funds, accounted for more than 80% of total federal extension appropriation and dropped to 70% by 2010.

Funding reductions also resulted in a rapid decline in extension staffing. Wang (2014) documents the decline in extension full-time equivalents (FTE) between 1980 and 2010 across all 10 U.S. production regions. Although his

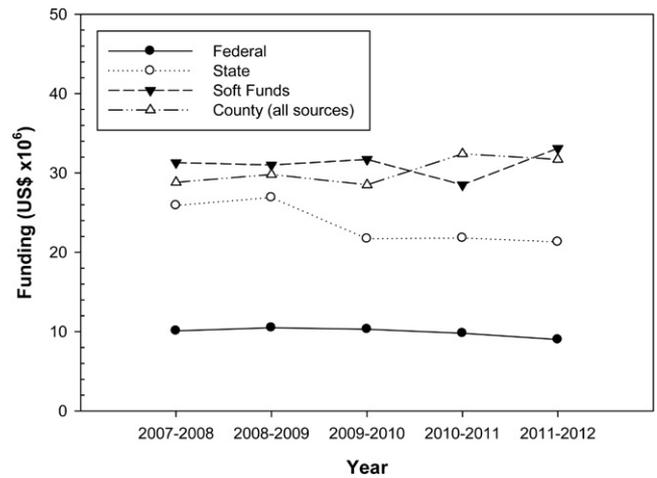


Fig. 3. Iowa State University Extension Revenue Source. From Iowa State University (2012).

analysis accounts for all four extension program areas (Agriculture and Natural Resources, Communities, Families, and 4-H and Youth Development), he concludes that the agriculture and natural resources area accounts for about 45% of the total FTEs. Wang (2014) shows that the number of FTEs at the county level decreased from 11,441 to 7,974 during this 30-year period, while extension specialists increased from 3,714 to 3,972. In the Corn Belt region, the University of Illinois had 92 full-time equivalent, tenured extension faculty members in 1986. In 2013, there were only 16, an 82.6% reduction (Ruen, 2013). Wang (2014) indicated that although the Corn Belt, Appalachian, and Northwest production regions maintain more extension FTEs than other regions and ranked as the top three regions in the United States in both 1980 and 2010, a considerable decline in FTEs has occurred as in other regions. The number of ISU extension educators—both field and campus-based—was relatively constant (Fig. 2) until 2008–2009 when state budget reductions eliminated all county extension education directors (Fig. 3). This reduction included nearly 50 county director positions with agriculture backgrounds. Following an earlier reorganization of extension areas in 1992, ISU extension had 60 agricultural field specialist positions. Currently there are 42 extension field specialists (e.g., field agronomists, agricultural engineering, farm management, horticulture, and livestock specialists) that serve multiple counties. Prior to 1992, all of Iowa's 99 counties had an extension educator trained in agriculture. Now there are 20 regional directors and only 12 of those have degrees in agriculture.

With decreases in federal and state funding, land-grant institutions compete for contracts and grants with other public and private institutions. This has led to a shift from the land-grant mission as a "people's university" toward a focus on more costly research, and graduate and undergraduate training (Alperovitz and Howard, 2005). Ludwig (2002) states, "...most U.S. Extension systems are stuck... drifting between a diminishing rural society and the urban transformation." Despite its accomplishments, some people believe extension is becoming extinct (Ahmed and Morse, 2010; McDowell, 2004; Bull et al., 2004; King and Boehlje, 2000; Franke-Dvorak et al., 2010). In a real sense, extension's survival is threatened (Ruen, 2013).

This growing sense of loss among the public regarding the LGU concept and mission of higher education and

extension led to the formation of the Kellogg Commission in 1996 (Kellogg Commission, 1996).

“Unprecedented problems confront our campuses. We face seismic shifts in public attitudes. We are challenged by new demographics and exploding technologies. We are beset by demands to act ‘accountably’ toward students, parents, communities, and taxpayers. An increasingly skeptical press questions our priorities... We must take charge of change. That is what the Kellogg Commission on the Future of State and Land-Grant Universities is all about.” (Byrne, 2006).

Almost two decades ago, the Kellogg Commission called for a renewed agreement between LGUs and society to restore the focus of the historic mission of the land-grant concept by moving beyond extension and toward engagement. Yet, the same challenges still exist and extension must adapt if it is to continue its role as a conduit between LGU’s and the public in transferring knowledge and technology.

Integrating Research and Extension

Emerging agricultural technology compelled extension to embrace and adapt new approaches in producing and disseminating information as a public educational provider. If extension is to remain relevant in the United States, methods of achieving its mission must constantly adapt to the ever-changing social and political environment to provide research-based information utilizing evolving technology to communicate with its clients. Therefore, there needs to be an innovative way to engage agriculture extension specialists and faculty in developing a research and extension platform coupled with clear methods of identifying end users and innovative methods of delivery. Mechanisms to engage extension into research programs are especially pertinent considering the current requirements for extension components of USDA National Institute for Food and Agriculture (NIFA) grants. This model has potential to benefit both extension and academic units by encouraging the development of team projects while minimizing competition among faculty for the same funding sources.

Drivers for Change in Agriculture Extension Support

With the turn of the 21st century, a number of institutional challenges, including but not limited to funding, have compromised the historic land-grant and extension mission and weakened the social contract between citizens and extension. Alperovitz and Howard (2005) present the following reasons for the changes: (1) farmers are currently in the minority (2%) of the U.S. labor force compared with 43% in the early 1900s; (2) agriculture is more corporate and industrialized than ever before; (3) populations are more urbanized and suburbanized than ever before; and (4) extension does not directly impact the lives of a large percentage of the urban population.

As public support for agriculture extension diminishes and budget cuts surge, agriculture extension struggles to sustain its role. Budget cuts could be just the symptom of a larger problem. Hoag (2005) indicated that at the core of agriculture extension’s problem is the supply and demand of extension information. Hoag (2005) identified six principles as necessary to prevent agriculture extension from extinction:

1. *Public goods*: Extension’s public goods are accurate information based on research and equitable education.
2. *Competitive advantage*: Extension must emphasize its high-quality research-based information.
3. *Privatization*: Extension needs to privatize part or all of its activities.
4. *Long-run sustainability*: Extension should avoid the assumption that solutions to existing agricultural problems will conform to current thinking.
5. *Business practices*: Extension should utilize the economic concepts of demand and supply, diminishing returns, opportunity costs, economies of scale, complements and substitutes for extension information, and competing “products.”
6. *Political economy*: Extension should ensure that people know extension’s value, especially in agriculture and rural interests.

We agree with five of these principles, but disagree with the concept of privatization. Therefore, we will discuss privatization in the next section.

A POTENTIAL CHALLENGE AND/OR OPPORTUNITY: PRIVATIZATION

Transition is not new. However, during the past few decades extension experienced severe cuts in state and federal funds (Fig. 3), leading many to suggest privatization of extension (Hoag, 2005). Of the six principles Hoag listed, extension’s privatization would no doubt result in the most dramatic philosophical, structural, and institutional change for extension.

The call for privatization is not unique to U.S. extension. Privatization occurred in some countries while there was increasing discussion among policy makers on privatizing extension as well as research (Rivera, 1996). However, Pray (1996) stated, “There is little evidence...that privatization either creates major savings for taxpayers or that the private sector will provide the services which the government is trying to privatize.” The following are examples and experiences from other countries’ extension privatization.

Australia

Both public and private extension systems in Western Australia increased farmer acceptance of lupines crop, in part by “bringing forward the start time of the diffusion curve” (Marsh et al. 2004). However, a fee-based system in Tasmania—one of the first in the world—did not generate significant cost recovery in its first 10 years (Bloome, 1993). “When Extension is both publicly and privately funded, its ability to serve the public interest on issues such as sustainability is questioned...With a weakened public sector pursuing its interests through voluntary approaches, the Tasmanian electorate resorted to greater regulation of its agricultural industries” (Bloome, 1993). After 15 years of “minimal Tasmanian government Extension support,” Hunt and Coutts (2009) noted both private and public-sector extension services had failed to meet the collective needs of the wool industry. Hunt et al. (2012) suggested, “...that RD&E in Australia is currently in the unravelling phase which may have serious future adverse implications and countries reliant on Australian food exports.”

New Zealand

Experiences in New Zealand, where advisory services were commercialized in 1987, suggest that the public benefits of extension can't be commercialized and that commercial organizations cannot serve the public interest well (Bloome, 1993; Rivera, 1993). In that country, small- and medium-scale farmers can't afford extension agricultural information, which was once considered a public good; the privatized system was biased toward large and wealthier farm enterprises (Rivera, 1993). Based on experiences in New Zealand, Hall et al. (1999) stated that education plays an important role in farmers adopting environmentally sustainable practices. As extension activities were eliminated, New Zealand relied more heavily on regulations and fines to encourage adoption of good management practices. Hall et al. (1999) summarized by saying, "education has been shown repeatedly to be superior, in most cases, to regulations and fines at encouraging adoption of technology and management practices..."

Britain

Privatization of some research groups occurred in Britain during the late 1980s. British grain and oilseed growers now essentially tax themselves to pay for research through a commodity group. Sugarbeet, potato, and dairy farmers increased levies to support research (Pray, 1996). With privatization, applied crop research declined significantly, but some increases were observed specifically in crop breeding research, which was likely underfunded originally. The overall result of privatization, though, was less research and users paying a higher share of the cost of research that was conducted. The savings from privatization were less than expected (Pray, 1996).

The Netherlands

Extension privatization began in 1990 in the Netherlands. Cooperation among private and public sectors disappeared and farmers were less willing to share information (Rivera, 1993). Additional side effects of privatization in the Netherlands have been the reduction of investing at local experiment farms and a dismantling of agricultural sector coordination on a national level (Labarthe, 2009). Labarthe (2009) adds that this could lead to a reduction in knowledge generated and exchanged as well as less innovation by researchers in the areas similar to what is often called sustainable agriculture.

Potential Outcomes of Extension's Privatization

The challenges extension faces calls for a serious examination of its role of serving and advancing agriculture. The above examples demonstrate the inability to shift from extension's core mission as a social contract between LGUs and the public in providing for the common good to a privatized/commercialized model based on financial interest and cost of delivering services. Benson and Jafry (2013) state that decisions to privatize are based upon "narrow experience" and that the long-term consequences have "rarely been addressed." They further maintain that as extension professionals we must consider the needs of small and "marginal" farmers. It is clear that where environmental, food quality, food safety, and food security are concerns, or where small farmers have difficulties keeping up with new technologies, publically funded extension has a role.

The market cannot "...respond adequately to these types of externalities" (Benson and Jafry, 2013).

When knowledge is privatized, it transforms from a public good to what Lindner (1993) and others refer to as "...a price excludable public good." This means that pricing knowledge or products of knowledge may exclude some clients from using that knowledge because it is too expensive. Knowledge is "a classical public good which will be under produced because of lack of price excludability" (Lindner, 1993). No doubt, private producers of knowledge would and should expect some return on their investment. Development of new maize hybrids and tillage implements are just two examples of profitable private goods—both of these innovations resulted from LGU research and extension efforts. Labarthe (2009) states that privatization of extension services cannot meet the needs of an agriculture that produces quality safe food that contributes to economic and social welfare, while conserving biodiversity and the environment. Serving these functions requires constant renewing of farmer technical knowledge. "Increasing the role of the private sector (whether for-profit or not-for-profit) in agricultural Extension is neither the panacea nor the Pandora's box that many would claim" (Kidd et al., 2000).

The risk in shifting to a privatized extension model or business-oriented model rather than "Education for the public good model" may lead to the following outcomes:

- Increased cost of production to growers due to lack of information and technology transfer based on research.
- Potential increase in regulation and extension's inability to serve the public interest, especially on issues like natural resources and environmental concerns.
- Extension's decreased role as an agent for public behavior change.
- Fewer extension-oriented research projects and clients paying a greater proportion of the cost.
- Reduction in knowledge generated and transferred to the public and less innovation.
- The general public will be excluded from knowledge generated, except those who are able to pay.
- Society may be less able to meet the goals of sustainable agriculture and a cleaner environment.

OPPORTUNITIES AND FUTURE DIRECTIONS FOR EXTENSION

Agricultural extension is more relevant now than ever before, even with the advances in agriculture technologies and the increased role of private agribusiness in providing information and services. The uniqueness of extension's mission in serving the public good provides a strong argument to continue this historical work. For example, although many farmers rely on USDA service centers for information on nutrient management strategies as mentioned above, the same Iowa poll shows that 30% of farmers think the pollution effects of nitrogen fertilizers are unimportant relative to their benefits (Arbuckle et al., 2012). This is a reduction from 42% in the 1996 poll. Just over 30% of the farmers use ISU guidelines to determine N fertilizer rates; 24% rely on crop consultant recommendations. The latter may or may not use research-based university recommendations. Although Iowa chemical fertilizer rates have not changed much since 1989, only 45% of corn farmers thought that "modern farming relies too heavily upon chemical fertilizer"; that is a reduction from 76% in 1989 (Arbuckle and Rosman, 2014).

These examples highlight the relevance and critical need for extension in developing and providing education information for farmers' needs. Fertilizer, pesticide, and transgenic crops have become more central and the primary means of managing pests and fertility as opposed to longer crop rotations with legumes and the use of manure. Fertilizer, pesticide, and transgenic crops are simply viewed as less of a problem in the minds of farmers (Arbuckle and Rosman, 2014; Morton et al., 2013). We can also further speculate that a decline in extension presence has had something to do with these changes.

Extension does not need to follow the route leading to an outcome of privatization as described here. It is possible to change course and rethink its direction—and it must as increasing numbers of agencies and agribusiness firms offer “extension” services (Benson and Jafry, 2013). New times require a new framework and new approaches (Nancy Franz, personal communication, 2013). How can extension educators and faculty respond to these challenges?

- Build more collaborative partnerships with agribusiness and agencies (local, state, and federal), commodity organizations, environmental groups and non-government organizations.
- Develop innovative ways to engage extension as an essential partner on research projects—from the planning stages to completion. Mechanisms to engage extension into research programs are especially pertinent considering the current requirements for extension components of USDA-NIFA grants. This model will serve both extension and the academic unit by producing a team project while minimizing competition among faculty for the same funding sources.
- Collaborate more with agribusiness staff in planning and designing applied field studies and on-farm demonstrations held locally within the agribusiness service area.
- Work with farmers and their service providers to analyze and synthesize production data using state-of-the-art models to develop decision tools for implementing best management practices.
- Take the lead to promote agriculture practices that enhance soil health, water quality, and ecosystem services by partnering with agriculture industry, government agencies, and non-government organizations.
- Each subject matter or plan of work team establish small (four- or five-member) informal external advisory groups; meet face-to-face with the advisory group one or more times annually. This format may have been practiced in the past, but it is time to revive it to increase public connections. Members of the advisory group should include both champions and critics.
- Embrace social media to develop educational programs and deliver knowledge and technology transfer. In general, extension underutilizes current technologies in information delivery.
- Engage in student training by participating in graduate student teaching and advising, serving on departmental committees, and developing internship programs.
- Participate in educational events that focus on their area of expertise whether they are giving presentations or not. The extension “host” organizing the event should recognize colleagues and expertise in the audience to increase their public visibility.
- Rethink the idea of charging for knowledge. When fees are charged they should cover out-of-pocket and

current expenses and certainly not offset salary and benefits. Charges for interacting with extension are not compatible with its public educator role or organization mission.

- Look beyond traditional funding sources. Extension educators and administrators need to proactively facilitate connections and actions with private entities to form funding partnerships.
- Encourage the public to acknowledge extension's value and communicate their support to legislators and policy makers.

SUMMARY AND CONCLUSIONS

“I think it will be a real shame to lose what has been an incredible and unique American agriculture strength and source of unbiased information” (Mike Gray, Assistant Dean for Agriculture and Natural Resources Extension Program, University of Illinois, Ruen, 2013). “Once this infrastructure is gone, I am convinced it will be nearly impossible to rebuild. I think we need to pause and reflect on how we can sustain what has been an incredible success so far” (Mike Gray as quoted by Ruen, 2013). The combination of public and private partnership efforts to produce and disseminate knowledge serves U.S. agriculture well. An elimination or reduction of agriculture extension's public role in transferring knowledge and technology will diminish agricultural returns and do a disservice to agriculture, not only nationally, but globally as well. Wang (2014) indicates that an increase in extension FTEs per number of farms or square miles can increase the benefits of public research and improve productivity by reducing costs. Alston et al. (2011) reported that extension accounted for 7.3% of annual productivity growth for the period 1949 to 2002. In order to feed our growing population, agriculture needs a constant influx of new research, development of ideas, and a viable extension system for delivery and transfer of that knowledge and technology to clients. As a society, we have a choice to pay with public funds to strengthen extension's role resulting in the public good for all, paying with private funds resulting in the private good for a few, or a combination of the two and balancing private and public interests.

Wang (2014) closed by stating “...there are challenges awaiting Extension in its second century, including the changing roles between state specialists and county agents, budget constraints, and emerging issues—such as climate changes' impact on production, and greenhouse gas emissions, as well as its focus on agriculture versus a broader role addressing rural development, youth, and human health and nutrition.” The challenges agricultural extension faces, and especially the level of support at both state and federal levels, requires new approaches that combine public and private partnerships. Such approaches are more effective in keeping both public and private good in balance as an alternative to the “company-store” model. The “company-store” model will not suffice for 21st century agriculture and future challenges.

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REFERENCES

- Ahmed, A., and G.W. Morse. 2010. Opportunities and threats created by extension field staff specialization. *J. Ext.* 48 (1). <http://www.joe.org/joe/2010february/rb3.php> (accessed 28 Jan. 2015).
- Allen, J.B. 1966. *The company town in the American west*. Univ. of Oklahoma Press. Norman.
- Alperovitz, G., and T. Howard. 2005. The next wave: Building a university civic engagement service for the twenty-first century. *J. Higher Educ. Outreach Engage.* 10(2):141–157.
- Alston, J.M., M.A. Anderson, J.S. James, and P.G. Pardey. 2011. The economic returns to U.S. public agricultural research. *Am. J. Agric. Econ.* 93:1257–1277. doi:10.1093/ajae/aar044
- Arbuckle, J.G., Jr., and H. Rosman. 2014. Iowa farmers' nitrogen management practices and perspectives. Ext. Rep. PM3066. Iowa State University Extension and Outreach, Ames.
- Arbuckle, J.G., Jr. 2013. "Iowa Farmers' Use of Information Sources and Preferred Ways of Receiving Information." 2013 ISU Agriculture and Natural Resources Extension Professional Development Meeting. Ames, IA, 27 Mar. 2013. <http://www.soc.iastate.edu/staff/arbuckle.html> (accessed 2 Feb. 2015).
- Arbuckle, J.G., Jr., P. Lasley, and J. Ferrell. 2012. Iowa Farm and Rural Life Poll: 2012 Summary Report. Ext. Rep. PM3036. Iowa State University Extension, Ames.
- Benson, A., and T. Jafray. 2013. The state of agricultural extension: An overview and new caveats for the future. *J. Agric. Educ. Ext.* 19:381–393. doi:10.1080/1389224x.2013.808502
- Bliss, R.K. 1960. History of cooperative agriculture and home economics extension in Iowa: The first fifty years. Iowa State University of Science and Technology, Ames, IA.
- Bloome, P. 1993. Privatization lessons for U.S. extension from New Zealand and Tasmania. *J. Ext. Int.* 31(1):24–25.
- Bull, N.H., L.S. Cote, P.D. Warner, and M.R. McKinnie. 2004. Is extension relevant for the 21st century? *J. Ext.* 42(6):Article 6COM2. <http://www.joe.org/2004december/comm2.php>.
- Byrne, J.V. 2006. Public higher education reform five years after The Kellogg Commission on the future of state and land-grant universities. National Association of State and Land-Grant Colleges and the Kellogg Foundation.
- Dimitri, C., A. Effland, and N. Conklin. 2005. The 20th century transformation of U.S. agriculture and farm policy. *Inf. Bull.* 3:1–13. USDA-ERS, Washington, DC.
- Foltz, J.D., and B.L. Barham. 2009. The productivity effects of extension appointments in land-grant colleges. *Rev. Agric. Econ.* 31:712–733. doi:10.1111/j.1467-9353.2009.01463.x
- Franke-Dvorak, T. C., K.D. Kelsey, and T.A. Royer. 2010. Is extension still reaching stakeholders? An assessment of minor crop producers' educational needs and use of Cooperative Extension Service. *J. Agric. Educ.* 51:55–63.
- Hall, M.H., S.D. Morriss, and D. Kuiper. 1999. Privatization of agricultural extension in New Zealand: Implications for the environment and sustainable agriculture. *J. Sustain. Agric.* 14:59–71. doi:10.1300/J064v14n01_06
- Hoag, D.L. 2005. Economic principles for saving the Cooperative Extension Service. *J. Agric. Res. Econ.* 30:397–410.
- Hunt, W., and J. Coutts. 2009. Extension in tough times: Addressing failures in public and private extension, lessons from the Tasmanian wool industry, Australia. *J. Agric. Educ. Ext.* 15:39–55. doi:10.1080/13892240802617452
- Hunt, W., C. Birch, J. Coutts, and F. Vanclay. 2012. The many turnings of agricultural extension in Australia. *J. Agric. Educ. Ext.* 18: 9–26 doi:10.1080/1389224X.2012.638780
- Iowa State University. 2012. Iowa State University Extension and Outreach Annual Report: Becoming the university that best serves its state. <http://www.extension.iastate.edu/our-story/content/2012-iowa-state-university-extension-and-outreach-annual-report> (accessed 28 Jan. 2015).
- Jackson, D., and J. Thomas. 2003. What is the role of extension educators in the first decade of the twenty-first century? *J. Higher Educ. Outreach Engage* 10:37–44.
- Kellogg Commission. 1996. Kellogg Commission on the future of state and land-grant universities. National Association of State and Land-Grant Colleges and the Kellogg Foundation.
- Kidd, A.D., J.P.A. Lamers, P.P. Ficarelli, and V. Hoffmann. 2000. Privatizing agricultural extension: Caveat emptor. *J. Rural Stud.* 16:95–102. doi:10.1016/S0743-0167(99)00040-6
- King, D.A., and M.D. Boehlje. 2000. Extension: On the brink of extinction or distinction? *J. Ext.* <http://www.joe.org/2000october/comm1.php> (accessed 1 May 2013).
- Korsching, P., P. Lasley, and T. Gruber. 2005. Iowa Farm and Rural Life Poll: 2005 Summary Report. Ext. Rep. PM2012. Iowa State University Extension, Ames.
- Labarthe, P. 2009. Extension services and multifunctional agriculture. Lessons learnt from the French and Dutch contexts and approaches. *J. Environ. Manage.* 90:S193–S202. doi:10.1016/j.jenvman.2008.11.021
- Lindner, R.K. 1993. Privatising the production of knowledge: Promise and pitfalls for agricultural research and extension. *Austr. J. Agric. Econ.* 37:205–225. doi:10.1111/j.1467-8489.1993.tb00535.x
- Ludwig, B.G. 2002. We are not your grandfather's extension service. In: Proceedings of the 18th Annual Conference of the Association for International Agricultural and Extension Education, Durban, South Africa.
- Marsh, S.P., R.K. Lindner, and D.J. Pannell. 2004. Does agricultural extension pay? A case study for a new crop, lupins, in Western Australia. *Agric. Econ.* 30:17–30.
- McDowell, G. 2004. Is extension an idea whose time has come—and gone? *J. Ext.* 42(6) Article 6COM1. <http://www.joe.org/joe/2004december/comm1.php> (accessed 28 Jan. 2015).
- Morton, W., J.H. Lois, and J.G. Arbuckle, Jr. 2013. Shifts in farmer uncertainty over time about sustainable farming practices and modern farming's reliance on commercial fertilizers, insecticides and herbicides. *J. Soil Water Conserv.* 68:1–12. doi:10.2489/jswc.68.1.1
- Pray, C.E. 1996. The impact of privatizing agricultural research in Great Britain: An interim report on PBI and ADAS. *Food Policy* 21:305–318. doi:10.1016/0306-9192(95)00077-1
- Rivera, W.M. 1993. Impacts of extension privatization. *J. Ext.* 31(3).
- Rivera, W.M. 1996. Agricultural extension in transition worldwide: Structural, financial, and managerial strategies for improving agricultural extension. *Public Adm. Dev.* 16:151–161. doi:10.1002/(SICI)1099-162X(199605)16:23.0.CO;2-S
- Ruen, J. 2013. Shut off the lights when you leave. *AgProfessional*. 12 Aug. 2013. <http://www.agprofessional.com/agprofessional-magazine/Shut-Off-the-Lights-When-you-Leave-219297321.html> (accessed 28 Jan. 2015).
- Seevers, B.S. 2000. Identifying and clarifying organizational values. *J. Agric. Educ.* 41:70–79.
- Seevers, B., D. Graham, J. Gamon, and N. Conklin. 1997. *Education through cooperative extension*. Delmar Publishers, Albany, NY.
- Tylka, G., W. Wintersteen, and B. Meyer. 2005. Survey to assess Iowa State University corn and soybean research and extension programs. ISU News Release, January 2005.
- Wang, S.L. 2014. Cooperative extension system: Trends and economic impacts on U.S. agriculture. *Choices* 29(1):1–8.