International Food and Agribusiness Management Review

Official Journal of the International Food and Agribusiness Management Association

The Scientific Pluralism of Agribusiness: A Special Issue on Theory and Practice
Volume 14: Issue 5
2011

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International Food and Agribusiness Management Review

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The IFAMR (ISSN #: 1559-2448) is published quarterly and is available at http://www.ifama.org
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EDITOR'S NOTE

We are pleased to present an IFAMR special issue on, *The Scientific Pluralism of Agribusiness.* Co-Editors Wes Harrison and Desmond Ng have worked hard to pull together a rich set of articles helping the community of agribusiness scholars, and industry and peer stakeholders better understand the field of agribusiness. Their concept of scientific pluralism provides a valuable paradigm by which we might frame the work in the field.

Two years ago, Drs. Ng and Harrison, along with other members from the Western Education/Extension and Research Activities Committee on Agribusiness discussed that the time was right to provide greater definition to the field of agribusiness. The Committee felt guidance was needed for curriculum development at the undergraduate and graduate levels. More structure would help clarify how economics and other disciplines interrelate when studying agribusiness phenomena. Young scholars too needed help anticipating the expectations of the promotion and tenure process. Departments and administrators clearly understand the growth and interest in the field by students and stakeholders, but still struggle defining the structure and elements of agribusiness scholarship. The need to fill these voids gave birth to the idea of producing a special issue of the IFAMR. We are pleased to be able to help give Dr. Harrison and Dr. Ng a voice to realize their ambitious task. Congratulations to the authors, well done. We hope you enjoy the various contributions, and trust the issue will serve as an important reference for years to come.

Peter Goldsmith, Executive Editor, IFAMR

International Food and Agribusiness Management Review
Volume 14, Issue 5, 2011

The Scientific Pluralism of Agribusiness

A Special Issue on Theory and Practice

FORWARD

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Abstract

The term "agribusiness" first appeared in Davis and Goldbergs' (1957) seminal book titled "A concept of Agribusiness", which described three distinct yet interdependent sectors in a global food system. These include suppliers of agricultural inputs, producers of agricultural commodities, and institutions that perform the functional aspects associated with marketing food and fiber products. Fundamental to the concept of agribusiness is that many problems related to agriculture are interrelated and dependent upon political, sociological, economic and behavioral factors. In this special issue of the journal, we argue that the "field of agribusiness" is inherently a "scientifically pluralistic" endeavor to which efforts to define it as an academic discipline is not useful. In the introductory paper that follows, we provide a brief commentary about each of the articles featured in this special issue and discuss the opportunities and challenges of scientific pluralism for agribusiness research, teaching and extension.

Keywords: agribusiness, scientific pluralism.

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Review of Scientific Pluralism and its Motivations to Agribusiness

The term "agribusiness" first appeared in Davis and Goldbergs' (1957) seminal book titled "A concept of Agribusiness", which described three distinct yet interdependent sectors in a global food system. The sectors include suppliers of agricultural inputs, producers of agricultural commodities, and institutions that perform the functional aspects associated with marketing food and fiber products. The functional aspects of marketing include product exchange, processing, storage, and transportation, as well as suppliers of market information, risk management, and financial services related to product distribution. Fundamental to the concept of agribusiness is that many problems related to agriculture are interrelated and dependent upon political, sociological, economic and behavioral factors (e.g. King et al. 2010; Ng and Siebert 2009; Sonka and Hudson 1989). The study of agribusiness is arguably complex and involves the study of problems that spans across various levels of analysis – firm, inter-firm, value chains and markets. Due to its increasingly complex nature, agribusiness is an applied field that requires different theoretical as well methodological approaches to the resolution of agribusiness problems (Ng and Siebert 2009).

Yet, despite the growth and interest in agribusiness, a definitive consensus as to what constitutes the "field of agribusiness" remains a point of contention and confusion among academics, university administrators, and practitioners in the agribusiness system (i.e., agribusiness mangers and policy makers). In this special issue, we argue that the "field of agribusiness" is inherently a "scientifically pluralistic" endeavor to which efforts to define it as an academic discipline are not conducive to the advancement of agribusiness as an applied field (Harling 1995; Ng and Siebert 2009). A scientific discipline consists of a common set of ontological (i.e. assumptions about the nature of reality) and epistemological assumptions (i.e. assumptions about the way of knowing the nature of reality) (Lewis and Keleman 2002; see also Peterson this issue). This consists of a common census and accepted world view on basic assumptions, concepts, theories and methods (Markoczy and Deeds 2009). Yet, discipline-based definitions of agribusiness are necessarily elusive because they reflect but one aspect of the complex realities confronting agribusiness. Namely, as the problems dealt by agribusiness managers are complex and multi-faceted, agribusiness researchers are often required to extend their training beyond the discipline of economics to include other social sciences (Sonka and Hudson 1989; Harling 1995; Ng and Siebert 2009; King et al. 2010). Multiple view points and/or methods of analysis have been increasingly called for when studying agribusiness phenomena (see e.g. Boehlje et al. *this issue*). This was recognized earlier by Westgren and Cook (1986) and many others (Harling 1995; Ng and Siebert 2009; King et al. 2010) who had noted, "if inroads are to be made in agribusiness management research, cross-disciplinary efforts are necessary" (p. 488).

Such pluralism has long been widely recognized in organization and management. Pluralism rests on the premise that "truth" is revealed not through the lens of a particular paradigm or discipline, but through many (Jackson 1999). The goals of scientific pluralism are distinct from a singular disciplinary focus. A singular focus promotes a consensus of views that promotes a common basis to assess, compare and refine theories, methods and results (Markoczy and Deeds 2009). This promotes an examination and explanation of certain facts of organizations that is consistent with the paradigm without a need to clarify conflicting viewpoints (Markoczy and Deeds 2009). Under such a disciplinary orientation, novel facts and empirical irregularities tend

to challenge the accepted paradigm and thus are often discounted as nuisances to the development of the paradigm (Lewis and Keleman 2002; Kuhn 1970). While, in contrast, the goals of scientific pluralism do not seek to explain organizational phenomena in ways that conform to the accepted paradigm, but rather "encourages inquiry across paradigms and to foster greater understandings of organizational plurality and paradox." (Whitley 1984). This follows Kuhn's (1970) arguments that the singular pursuit of a paradigm can yield political processes that perpetuate a paradigm well beyond its useful value. Kuhn argues revolutions in science or true knowledge can only develop when alternative viewpoints are pursued to challenge the legitimizing forces of paradigm development.

In spite of the merits of scientific pluralism, it has been criticized on various fronts. Critics contend that pluralism can lead to a lack of scientific consensus and hinders the advancement of a shared paradigm (Markoczy and Deeds 2009). While the development of a shared paradigm is important to advancing the status and prestige of a discipline, philosophers of management contend the field of management has grown in prominence not because of a lack of a disciplinary consensus but has grown because of it (e.g. Mahoney and McGahan, 2007; Zahra and Newey 2009). For instance, as Scherer (1998) notes "the conventional wisdom in management research has been a continued call to welcome the search for new paradigms and to which many contend theoretical pluralism is generally advocated as a fruitful expansion (Smirch and Stubbart 1985; Daft and Buenger 1990; Bowman 1990, 1995; Thomas and Pruett, 1993). When 'uniqueness' is seen as scientifically valuable, researchers have an incentive to create even more perspectives" (151). Such varied perspectives however do raise a problem of incommensurability. A lack of scientific consensus can promote the combining of paradigms that have incompatible assumptions, theories and or methodologies (Scherer 1998). Remedying such concerns remains a key challenge in advancing a scientific pluralistic agenda. Various solutions exist. For instance, some contend that the use of positivism and empirical hypothesis testing can be used to help sort false hypotheses or viewpoints (see also, Scherer 1998; Zahra and Newey 2009). In the long run, the falsification of different paradigms can "lead to a coherent set of law-like explanations that are considered a true picture of the world" (Scherer 1998, 152).

Due to the complex nature of agribusinesses problems, we believe, the pursuit and discovery of alternative paradigms are not only conducive to developing better understanding of the field of agribusinesses, but also serves to develop normative prescriptions that are relevant to agribusiness managers. Our motivation for this special issue was driven by this basic premise. Our goal is to encourage agribusiness researchers to discover and/or integrate different perspectives to addressing the challenges faced by agribusinesses. In particular, we envision this publication as one small step to a longer journey in developing a coherent and integrated body of assumptions, theories and methods that define the complex and applied nature of the agribusiness field. While, we were pleased to have received many submissions to this special issue, the articles we selected were chosen because they advanced, each in their own unique way, the pursuit of this longer term objective. Although we regret not being able to provide the opportunity for other authors to expressing their unique perspectives on agribusiness, we nevertheless want to thank the authors for their efforts in defining and shaping the field that is agribusiness. We also would like give special thanks to the reviewers of IFAMR. As evidenced by their detailed and thoughtful comments, the reviewers of IFAMR have placed much effort in not only the selection of articles in this special issue, but were instrumental in shaping their

development in ways consistent to the goals of this issue. As guest editors, we thank you for your dedication and commitment to the scholarship of agribusiness.

In what follows, we provide a brief commentary about each of the featured articles[1]. These commentaries represent our interpretations of the featured articles and their relationships to the goals of our special issue. Our perspectives may differ from those intended by the authors and any errors in our interpretation are solely our responsibility and not that of the authors. In conducting our synopsis, we outline the central agribusiness concerns of each article, how the author(s) have tackled the study of agribusiness from a pluralistic perspective and identify their implications to agribusiness as a field. From a broader perspective, we conclude with a discussion about the opportunities and challenges of scientific pluralism for agribusiness.

Editors' Synopses of Featured Articles

Peterson: As agribusiness researchers often operate in agricultural economic departments, Peterson's study attempts to resolve a basic tension faced by agribusiness faculty (see also Detre et al., *this issue*). Agribusiness faculty face pressures to conform to the positivism of their agricultural economic peers, but also to develop scholarship that is practical and relevant to agribusiness managers. This philosophical tension was raised earlier in Harling's (1995) study in which agribusiness researchers "…want to be true to their own predilections towards management yet have to satisfy the majority [agricultural economics] that thinks in terms of economics." (Harling 1995, 509). In particular, as agribusiness is an "applied" or "practical oriented science", Peterson argues a "practical" science places different epistemological (ways of knowing what one knows) demands on agribusiness researchers relative to their agricultural economic counterparts. The practical nature of agribusiness underscores that decision making and the context to which such decisions are made are fundamentally inseparable. This stands in contrast to the positive method of agricultural economics because it rests on an implicit assumption that the decision maker can be separated from their natural context (Peterson *this issue*). For instance, behavioral experiments are designed in laboratory settings that are divorced from the natural settings of the decision maker. Incidentally, behavioral experiments have been heavily criticized because decisions made in such laboratory settings may not be generalizable to real world decision settings. To understand the context in which decisions are made, Peterson proposes that the epistemology of agribusiness should not be based on a positive method but should be founded in a "ground theory" approach. This is because a grounded theory approach involves using case study to jointly analyze decision making and the context in which decisions are made. Such a grounded theory approach yields "practical" knowledge, while at the same time is scientific because it involves a "Kantean cycle of induction, deduction and verification" (pg. 8). The implication raised by Peterson is that while agricultural economics is also an applied science, its positivistic epistemology is ironically incompatible to its applied nature. In distinguishing itself from the discipline of economics, applied agricultural economists underscore that policy makers operate in a decision context that is uniquely agricultural. Policy makers operate in a natural setting involving matters such as seasonality, drought, geographical distribution, uncertainty in biology production process, lagged production cycles, storage,

[1] Readers should note that all papers including "invited" papers have been subject to a double and at times triple blind review process. All articles have been subjected to at least two revisions.

perishable nature of food, government policy intervention, etc. Yet, as the positive method is the preferred method, positivism is incompatible to an "applied way of knowing" in agricultural economics. This is because an adherence to a positive method by its very nature separates the context that has distinguished itself from its economics counterpart. As a result, Peterson's grounded theory approach is appealing not only to the advancement of agribusiness, but under the conditions ascribed by Peterson yields a "practical knowledge" not found in the positivism of agricultural economists. Specially, in distinguishing from the positivism of economics, Peterson argues that a "grounded theory" approach when combined with a "trans-disciplinary" approach can be useful in gaining a "practical knowledge" to managing problems in agribusiness.

Sporleder and Boland: What characteristics make agrifood supply chains unique and different from other supply chains in the global economy? This is a fundamental question that defines agribusiness as a specialty area. Sporleder and Boland discuss seven unique aspects of agrifood supply chains and provide insights into how idiosyncratic economic problems of agrifood systems shape the research agenda for agribusiness scholars, and discuss implications of the agribusiness research agenda for managers. The seven characteristics discussed are: 1) risk emanating from the biological nature of agrifood supply chains, 2) the role of buffer stocks within the supply chain, 3) the scientific foundation of innovation in production agriculture having shifted from chemistry to biology, 4) cyberspace and information technology influences on agrifood supply chains, 5) the prevalent market structure at the farm gate remains oligopsony, 6) relative market power shifts in agrifood supply chains away from food manufacturers downstream to food retailers, and 7) globalization of agriculture and agrifood supply chains. The paper discusses each of these characteristics in some detail, and asserts that complexities and interdependencies of agrifood supply chains necessitates research case studies and other qualitative methods (such as Peterson's grounded theory) of analysis to understand these complexities. The authors also discuss the usefulness of institutional economics and traditional economic methodologies. An important implication being that the richness of detail provided by qualitative analysis improves the specification of economic models and quantitative methodologies.

Boehlje et al.: Boehlje et al.'s study also focuses on the uniqueness of agrifood supply chains, and introduces a varied set of decision tools and concepts to managing the uncertainty, innovation and structural changes in agribusiness. Economic treatments of uncertainty are primarily based on the concept of probabilistic risk (Lawson 1988; Davidson 1991; Langlois and Cosgel 1993). Distinct from Knightian uncertainty (Knight 1921), the concept of probabilistic risk rests on the ontological assumption that the likelihood of a future outcome can be predicted from a similar and observable past (Davidson 1991). This directly follows from the positive method of economics in which the study of "uncertain" phenomena is restricted to only those future outcomes that can be objectively observed over repeatable instances (Knight 1921; Lawson 1988; Davidson 1991; Langlois and Cosgel 1993). Yet, Boehlje et al.'s study distinctly recognizes that agribusiness managers do not have access to such objective and quantifiable data and thus often deal with an "uncertainty" that cannot be directly quantified. Fundamentally speaking, Boehlje et al.'s study tackles the problem of how one should manage future uncertainties that cannot be directly measured? Hence, the goals of their study were to introduce to agribusiness managers a diversity of tools and concepts that deal with Knightian forms of uncertainty. In describing such uncertainty, Knightian uncertainty is not just an inability to

assign probabilities to a future outcome state, but it refers to a basic ignorance of the state itself. Boehlje et al. study introduces various decision tools and concepts to reducing the ignorance of such states. For instance, they introduce score carding and heat mapping tools as a means to imagining future outcomes states. Furthermore to understand structural change, they draw on concepts from transaction costs economics and resource based reasoning to develop a causal understanding of the drivers of future outcome states. The implication of this study is these varied tools and concepts not only introduce a different approach to understanding uncertainty but also a means to managing it. That is, the management of uncertainties in agribusinesses is not only confined to uncertainties that can be directly measured or observed, but also includes those that cannot. This is because as noted by Einstein, "not everything that can be counted counts, and not everything that counts can be counted".

Dentoni and Peterson. In Dentoni and Peterson's study, they illustrate environmental sustainability as one example of a "wicked problem". Wicked problems involve complex problems consisting of divergent stakeholder interests to which cannot be solved but merely managed (Peterson *this issue*). Environmental sustainability constitutes a wicked problem because it involves managing divergent stakeholder interests toward a sustainability goal that cannot be fully defined or specified. As an application of Peterson's grounded theory approach, Dentoni and Peterson draw on a trans-disciplinary approach in which stakeholder theory, the theory of reasoned action, and status theory were used to illustrate and manage the "wicked problem" of environmental sustainability. Specifically, in drawing on an inductive method involving a case study analysis of the 50 largest multi-national corporations (MNC), one of the objectives of this study is to introduce the phenomena of multi-stakeholder sustainability alliances (MSSA) to agribusiness research. Most notably, they argue that the status and environmental focus of alliance members are positively associated with acting favorably to the sustainability interests of the MNC. Such arguments yield normative prescriptions that are relevant to the practicing agribusiness manager. It suggests that a MNC's ability to signal its commitment to environmental sustainability initiatives requires more than the production of products and services with "environmental friendly" attributes but also requires identifying and managing those stakeholders that support the production of these attributes.

Nganje and Skilton: This paper develops a conceptual framework for analyzing what is perhaps the most significant distinction of agrifood supply chains from other supply chains in the global economy – food safety risks. The authors outline ways management may design B2B systems to detect, prevent, and respond to food safety/defense risks in food supply networks by learning from error based disruptions. Minimization of Type I (false positives) and Type II (false negatives) errors in detecting and sourcing food safety risks are central to a safe food system. The paper develops three propositions relating threat, vulnerability and consequence of food safety risks to investment in control based food safety systems. These propositions provide a foundation for research models to aid managerial decisions regarding investment in control based food safety systems.

Ward et al. As agribusiness is an applied science, extension has played an important role in applying the principles and prescriptive insights of agribusiness research to the practical needs and challenges to various stakeholders in the agribusiness system. The objective of Ward et al.'s study was to provide a historical examination of extension as it relates to agribusinesses, and

articulate synergies between research, teaching and extension. In terms of its contributions, historically, the commodity focus of farm production has directed extension efforts to improvements in farm production efficiencies. Yet, with the increasing globalization of food markets and advancements in new information technologies, there are increasing demands on extension faculty to provide services that extend beyond this commodity focus. This requires developing management skills that involve a greater attention to the consumer, agribusiness entrepreneurship, integration and coordination of production and distribution. In their paper, they also assert that extension contributes important input into teaching and research programs in agribusiness. Such synergy not only provides students and researchers greater practical understanding of the challenges faced by agribusiness stakeholders, but also provides a means to apply principles and concepts to solving the challenges faced by these stakeholders. While it is difficult to anticipate the future directions of extension programming given increasing fiscal pressures, the opportunities to capitalize on synergies between research, extension and teaching will be one important area of growth. Specifically, the client base of extension is largely confined to small farm businesses and hence, given limited extension resources, one of the challenges faced by Ag. Extension is not only to leverage the research and teaching of agribusinesses but to apply such experiences to the growth of small businesses into world food markets.

Detre et al. This paper summarizes the results of a survey of "agribusiness" and "non-agribusiness" faculty among departments of agricultural economics in the United States and globally. "Agribusiness" faculty are broadly defined as scholars that study issues related to agribusiness management, agricultural chemicals, agricultural finance, biotechnology and bioenergy, food marketing, food safety, labor and human capital, nutrition, and supply chain management. The current status of attitudes and perceptions by agribusiness and non-agribusiness faculty regarding the role and expectations of agribusiness programs within departments of agricultural economics are discussed. The survey elicits information regarding the time agribusiness faculty allocate to teaching, research, extension, grantsmanship and service, and discusses the expectations of faculty regarding promotion and tenure. The paper also provides a current description of the most prominent journals in which agribusiness faculty publish and aspire to publish their work. The principal conclusion of the study is that research FTE's in the areas of agribusiness and agribusiness management are underfunded relative to the teaching FTE's. A corollary being that agribusiness faculty teach more courses relative to non-agribusiness faculty, which is not surprising given the relative growth of undergraduate student numbers in agribusiness relative to traditional agricultural economics. The study also concludes that agribusiness faculty have similar promotion and tenure expectations to non-agribusiness faculty, but less time is devoted to extension and outreach by agribusiness faculty because of heavier teaching loads.

Future Directions and Challenges of a Scientific Pluralistic Agenda for Agribusiness

Although agribusiness bears considerable parallels to the scientific pluralism of management, agribusiness faculty face opportunities and challenges that are distinct from those in management (Ng and Siebert 2009). Unlike management, agribusiness researchers are often housed in agricultural economic departments (see, Harling 1995; Ng and Siebert 2009). Agribusiness

researchers thereby face a unique opportunity from that of their management counterparts. They cannot only engage in cross disciplinary exchanges with their agricultural economic counterparts, but as a consequence identify points of complementary interest (see also, King et al, 2010). On the other hand, the pursuit of new theories, and the use of methods from other social sciences, are not readily accepted by our peers in agricultural economic unless they complement economic explanations of agribusiness phenomena (see also, King et al. 2010) - this is an issue that remains a challenge for agribusiness faculty. This concern seems to emerge from a fear that pluralism can promote an "anything goes perspective" (Scherer, 1998), which may detract from a positivist scientific rigor. The discipline of economics is often the dominant and accepted paradigm for scientific research in most agricultural economic departments in the United States. Agribusiness research is thereby evaluated through the lens of economics. Hence, while agribusiness researchers face unique opportunities to combine the various social science disciplines within the dominant economic paradigm of their department, pluralistic research endeavors are likely to be governed by an economic world-view. Interdisciplinary pursuits that venture too far from the accepted premises of an economic world-view may either be treated at best as a marginal advancement, or worse, a nuisance to the study of agribusiness issues. Hence, the pursuit of pluralistic or inter-disciplinary agribusiness research involving the various fields from management is likely to be a high risk strategy, especially for those involved in the tenure process (see also, Detre *this issue*; Markoczy and Deeds 2009). This is suggests that although various departments of agricultural economics have offered agribusiness programs reflect an "agribusiness focus", departments that do not reflect a "true" change in the way non-agribusiness faculty view agribusiness research will likely face challenges blending agribusiness and traditional agricultural economics programs.

Agribusiness undergraduate and graduate teaching programs have experienced increasing growth in enrollment (see, Detre et al. *this issue*). Given the applied nature of agribusiness, we believe the interdisciplinary focus of management complements and enhances a students' agricultural economic training. We argue that undergraduate and graduate agribusiness teaching programs that emphasize the application of different perspectives rather than a singular disciplinary focus can capitalize on enrolment opportunities in agribusiness education. Departments who recognize this basic premise will not only serve the interests of its agribusiness students, but will also provide greater flexibility in conducting applied research that is relevant to a broader set of stakeholder needs.

Agribusiness faculty are well positioned to capitalize on teaching opportunities, but there are challenges. Agribusiness is a less established field and thus has fewer faculty than that of its agricultural economic counterparts. As a result, despite an increasing growth in undergraduate and graduate enrolment in agribusiness, there are fewer faculty resources available to satisfy such growth. In fact, relative to growths in enrolments, the smaller number of agribusiness faculty are likely to face greater teaching demands than their peers. This appears to be borne out in Detre et al.'s survey of agribusiness faculty that finds agribusiness faculty not only tend to face higher teaching commitments, but also face pressures to develop research programs that satisfy both agricultural economic and management related fields (see also, Harling 1995). Given that pluralism is a high risk strategy in the promotion process, a department's ability to satisfy its agribusiness teaching commitments may need to concurrently examine both facets when overcoming such faculty constraints. It is also important to note that the subject content of an

agribusiness faculty member's teaching and research programs are not mutually exclusive, and underfunding the research component marginalizes the quality of undergraduate and graduate programs in agribusiness.

Early faculty retirements and faculty departures are likely to pose challenges to a department's ability to maintain its undergraduate and graduate agribusiness teaching commitments. Staffing challenges are likely to be amplified by current fiscal pressures. Overcoming such faculty resource constraints will likely be an ongoing concern. Partnerships with business schools are one way to address staffing shortfalls in management, finance, marketing and related fields. Examples of successful partnerships include jointly administered Undergraduate, Masters and Ph.D. programs in Agribusiness and Managerial Economics by the Department of Agricultural Economics and Mays Business School at Texas A&M. Purdue University's MS-MBA in Food and Agribusiness Management is jointly offered by the Department of Agricultural Economics and the Kelley Business School at the University of Indiana and also serves the dual role of contributing to executive education and outreach programs in agribusiness. However, business school partnerships create their own set of challenges. Business school administrators and faculty are generally unfamiliar with agribusiness programs and they may be skeptical about the value of such partnerships.

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Volume 14, Issue 5, 2011

An Epistemology for Agribusiness: Peers, Methods and Engagement in the Agri-Food Bio System

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Abstract

Agribusiness scholars face a significant tension between the research demands of industry peers and academic peers. This tension is created by the difference in how the two sets of peers know what they know—a difference of practical knowledge versus positivistic knowledge. The article explores the epistemologies of practice and positivism, and proposes a third epistemology, grounded theory, that can allow agribusiness scholars to produce rigorous research acceptable and relevant to both sets of peers. A more recent and growing need to address "wicked problems" pushes agribusiness scholars even further toward an epistemology of engaged scholarship. Seven recommendations are provided for guiding future agribusiness research efforts.

Keywords: agribusiness, epistemology, research methods, wicked problems, engaged scholarship, research rigor, grounded theory

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Personal Prologue and Introduction

If one envisions a continuum from scholarly scholar to practical practitioner, I am somewhere between a practical scholar and a scholarly practitioner. As Director of the MSU Product Center, I lead a boundary organization where we translate (1) practitioner knowledge and needs for scholarly work to scholars, and (2) scholarly knowledge and needs for empirical work to practitioners. Those of us who are scholars in the field of agribusiness management often find ourselves in this translational space serving two sets of peers—our academic peers in agricultural, food and resource economics (convert this phase into whatever your department name may be these days) and our industry peers in agricultural, food and bioeconomy firms. What these two sets of peers want from us are distinctly different, and this difference creates pressures on our scholarship that can be difficult to manage.

On the one hand, our industry peers want relevant, actionable prescriptions for firm and market behavior. They are critical of "ivy tower" vocabulary and method. These peers want us to be much the same as they are—to use methods that mimic their ways of knowing and understanding. On the other hand, our academic peers want elegant, rigorous contributions to knowledge. They decry much of agribusiness research as inappropriately qualitative or subjective. These peers also want us to be much the same as they are—to use methods that mimic their ways of knowing and understanding. Two distinct sets of peers, two distinct sets of demands for our behavior. The differences between our two sets of peers arise largely from two distinct ways of knowing what they know—differences of epistemology. If agribusiness researchers cannot find a reasonable epistemology for serving both sets of peers, we will not be effective either because (1) our scientific credentials will be continually at risk within the academy, or (2) our relevance will be continually questioned in industry.

I have taken on this topic before. In 1997, I presented an invited paper to the Agribusiness Research Forum. The paper was never formally published but it has been used nonetheless in various research methodology courses in several agribusiness graduate programs. A significant portion of this paper is an updating and recasting of this earlier work. The message is still needed as long standing tensions between our academic and industry peers are even more relevant today than 14 years ago. The next to last section of the paper is entirely new and comes from recent work in "wicked problems." The paper ultimately argues that agribusiness scholars need to base their research on an epistemology of grounded theory and, for some particularly complex messy problems, an epistemology of engaged scholarship

The Traditional Tension: Epistemologies of Practical and Positivistic Knowledge

The Epistemology of Industry Peers

Our industry peers have knowledge that arises from doing. Their epistemology is straight forward: They know what they know because their knowledge works. Their knowledge is derived from action. Their methods of learning are through practice, stories, rules of thumb, and imitation. Practical knowledge is concrete, emerging from the actual complex and ambiguous context in which action is taken. Since it arises from action, practical knowledge is actionable. It is used

to predict and to prescribe. Such knowledge is in part intuitive. The decision maker may be guided by nothing more than a gut feel or a nearly instinctual response.

Practical knowledge is non-scientific.[1] It is inherently subjective in that it is dictated by the unique perceptions, experiences, and practices of the actor. Practical knowledge has low data integrity (Bonoma 1985) in that it can be prone to error and bias. This in turn makes practical knowledge highly specific and thus weakly generalizable. In addition, the decision maker makes little explicit attempt to discern any underlying structure to the situations faced. Situations can thus be either viewed as largely unconnected or too easily assumed to be alike. In either case, past experience tends to be consulted as a guide, rightly or wrongly.

In the vocabulary of the knowledge management literature, practical knowledge is largely tacit (Takeuchi and Nonake 2000) being context-specific and informal arising from experience and practice. It is only made explicit in the form of how-to manuals and best practices lists, but these explicit versions can never carry the full knowledge and nuance embedded in the practitioner's experience. Transferring practical knowledge to others is thus best accomplished through apprenticeship and mentoring (Takeuchi and Nonaka 2000) when knowledge can arise from guided practice.

The agribusiness scholar cannot take on the decision maker's epistemology of practical knowledge for two reasons. First, the agribusiness scholar is part of the academy and thus needs to take on a scientific perspective in order to have legitimacy with academic peers. Knowledge needs to be discovered and communicated in explicit form. Second, even if adopting the epistemology of practical knowledge were legitimate academically, it would add no value to what decision makers already do. To adopt the decision maker's epistemology is to become a decision maker. We cannot in our classrooms, our research, or our outreach merely mimic the decision maker. We can add no value by doing so because we can never know the complete context of the decision situation as well as the decision maker does. Adopting the decision maker's epistemology is thus not a feasible strategy for knowing. Agribusiness research methods should not adopt the epistemology of our industry peers. However, we cannot be so far removed from the decision maker's way of knowing that we cannot contribute to it. We are, in the end, applied scientists.

The Epistemology of Academic Peers

The most obvious contrast with practical knowledge is scientific (or theoretical) knowledge. However, our academic peers tend to pursue a specific form of scientific knowledge that tends to sharpen the contrast with practical knowledge. As evidenced by the American Journal of Agricultural Economics and closely related professional journals, the prevailing academic epistemology of agricultural economists is that of positivism. Its methods are nearly always quantitative (Derbertin and Pagoulatos 1992). This way of knowing is inherently scientific. Positivistic knowledge is derived from theory and learned through deduction. Such knowledge is abstract in

[1]Science like many terms is used extensively but we fail to be precise about its meaning. For this article, science is defined as a method of obtaining knowledge that is objective and verifiable (Titus). The problem is discerning what is objective and verifiable when in practice they are not absolute terms.

that the detail and noise of context are filtered and reduced in search of an underlying cause-and-effect structure and thus it aspires to be objective knowledge. Yet, it attempts to be correspondent with actual data (Johnson 1986), to have construct validity (Yin 1994) and be verifiable. The knowledge is generalizable (has external validity) within the bounds of appropriate assumptions. When positivistic knowledge is properly correspondent, generalizable, and strongly causal, it can have significant predictive power. Such knowledge is, in this sense, often useful to decision makers, even if it solves no specific problem.

So central is the notion of objectivity to positivistic knowledge that some further exploration of what objectivity means is in order. Knowledge is in part deemed objective when it has high data integrity (Bonoma1985); it is free of error and bias. The desire for data integrity drives the academic researcher to seek statistical validity in empirical findings. Objectivity also arises in knowledge that has clarity and coherence (Johnson 1986). Knowledge has clarity if it unambiguous with a unique interpretation, as in a just-specified econometric system. Knowledge has coherence if it follows logically from relevant theory and has no internal contradictions. Coherence and internal validity are comparable concepts. The desire for clarity and coherence drives the academic researcher toward mathematical models with well-defined variables, exact identification, and controlled measurement. In fact, the greatest strength of positivistic knowledge is its clarity and coherence. Finally, knowledge is objective in part because the researcher who discovered it was objective in the search. The researcher applies the tests of clarity, coherence, and correspondence and willingly abides by the results (Johnson 1986).

Positivistic knowledge is ultimately limited by its level of abstraction. The search for underlying structure, clarity, and coherence causes positivistic knowledge to ignore much of the detailed richness of a whole situation. Its currency is limited (Bonoma 1985) in that its contextual relevance is low and thus its applicability to any particular situation is limited. For example, the generalizability of statistical validity has little relevance to a decision maker who must take action in a setting that resembles but does not meet the exact conditions under which the positivistic knowledge was found to hold. Positivistic knowledge is predictive in terms of what may happen and can thus contribute to the analysis of a decision, but it alone is not prescriptive in telling a decision maker how to make it happen. In sum, positivistic knowledge has limits on its ability to guide action precisely because its clarity and coherence does not lead to adequate detail about how and why to do specific actions. Further, positivistic knowledge is weakened if the underlying cause-and-effect structure it claims to explain is itself under change. If the structure is changing, then all insights gained from the knowledge are open to question.

Examining the Tension between Peers

The practical knowledge of industry peers and the positivistic knowledge of academic peers are in clear tension with one another. Agribusiness researchers are pushed in two directions. Industry peers want enhancement of practice while academic peers want confirmation of theory. Certain types of research questions (many of which have been the forte of traditional agricultural economists) allow the distance between practical knowledge and positivistic knowledge to be relatively small resulting in little tension between peers.

Bonoma provides a critical characteristic of research problems that exhibit this short distance. This characteristic is the nature of the phenomena of interest, and here he proposes two subcategories of concern. First, can the phenomena of interest be studied separate from their natural setting? Second, are the phenomena amenable to quantification? If the answer to both questions is yes, then positivistic knowledge and research methods are likely preferred. In this case, concerns about correspondence and prescription can be minimized, and clarity and coherence can be given primary sway. Industry peers will find the research reasonably applicable. On the other hand, if the answer to either question is no, then positivism is of far less use.

The research problems of agribusiness management often exhibit both characteristics of phenomena that fall outside the strengths of positivism. For example, the nature of effective practice in the strategic management of an agribusiness firm is not reducible to a quantifiable issue due to its complexity, but it is an important one for agribusiness researchers to examine nonetheless. The claim here is that in reducing strategic management to its quantifiable elements so much of reality is lost that the positivistic results are of little use. The issue is not merely one of small numbers of observations; the issue is relevant complexity that defies quantification and separation from context. Likewise, if one wishes to understand the dynamics of contract negotiations as they are evolving in the vertical coordination of the agri-food-bio system, some aspects of the phenomenon cannot be easily studied separate from being immersed in the full context of both parties to the negotiation. Some quantification of contract terms and frequency of application can be achieved, but positivistic research alone cannot reveal full insight into the dynamics of how and why. These examples also suggest that institutional economics generally is not likely successfully studied by positivistic methods. Again, the limiting factor is not a matter of small numbers of observations or some restricted ability to quantify, but the fundamental inability to separate the phenomena from context.

Beyond Bonoma's two characteristics, one additional characteristic of the research setting determines when a positivistic epistemology is appropriate: To what extent is the underlying causal structure stable or changing? If the structure is stable, positivistic knowledge is possible and its methods can be pursued. However, positivistic knowledge can be of very limited use in times of significant structural change.

Again, most research issues of greatest relevance to agribusiness scholars fall outside the purview of positivism. First, the fundamental shifting of agricultural business structures and market arrangements (for example, the emergence of the food and fuel controversy as energy and food markets synchronize) suggests that underlying structure is changing dramatically. No stable underlying structure exists to study in many key situations. Second, research into the area of business strategy for agribusiness firms is the study of how firms can create and choose strategic alternatives that have as their fundamental motivation altering the structure of the industry in which the firms operate. When the goal of the phenomenon being studied is to alter structure, how can the phenomenon be studied with methods that assume the stability of structure? Third, even when phenomena of interest appear stable, there may be no fundamental underlying structure to find. Long ago management researchers gave up the notion of a general theory of management in that there is no one true way to manage. The study of management only gives rise to what can be termed contingency or substantive theory (Gummesson 1991)—theory only made relevant in specific contexts. Management research seeks to define the contingent characteristics

of circumstances that determine which of many alternative managerial approaches is best suited to a particular situation. Positivism is of limited use in this effort.

When the theory is strong, the phenomena are quantifiable and separable from context, and the structure is stable, positivistic epistemology and methods are appropriate. The distance between our academic peers and our industry peers is relatively short in that theory leads to application rather efficiently and effectively. However, most current phenomena of greatest interest to agribusiness scholars (the food and fuel controversy or strategic management generally) are amenable in only limited ways to the positivistic approach. Positivism can address side questions (frequency, trend, and correlation) but not the main questions (how and why).

Further, when underlying cause-and-effect structures are shifting or too complex to be reasonably understood even in the abstract, practical knowledge is probably also at its weakest usefulness. Rules of thumb cease to apply, standard operating procedures become ineffective, and normally reliable business instincts mislead. It can be hypothesized that the distance between our peers becomes a chasm in this case. Industry peers want scholars to provide guidance precisely because the changing context takes them beyond the bounds of their experience. Our traditional scholarly peers respond based on their normally reliable models, but end up making recommendations that prove ineffective precisely because the changes take them beyond the bounds of their theory. Our industry peers become very distresses with scholars at that point. When this occurs, there is an alternative epistemology that can resolve the tension between our peers and offer a unique contribution for agribusiness research endeavors.

An Alternative Epistemology: Grounded Theory

Practical knowledge and positivistic knowledge both have great strength in their relevant domains—practice and theory respectively. Both face limits (perhaps severe) when: (1) new phenomena fall outside the realm of their existing domains—in which either practice fails to be transferable or known theory does not apply, or (2) the causes of phenomena are so complex that practice cannot effectively deal with them and positivism provides ineffective partial explanations.

Professional schools—law, medicine, business—have recognized the limits of practice and positivistic science for a long time. They have a history of case research and teaching as a significant part of the answer to the epistemological limits of other approaches. More generally, so-called qualitative methods have emerged to fill the gap identified. The methods are not themselves an epistemology but imply the existence of one. Qualitative methods encompass a wide variety of approaches: hermeneutics (Gummesson 1991; Jankowicz 1995) as well as naturalistic inquiry, social constructionism, and new paradigm inquiry (Easterby-Smith, Thorpe and Lowe 1991); reflection-in-action (Schon 1995); various forms of direct reference as qualitative research methods (Jankowicz 1995; Cassell and Symon 1994; Easterby-Smith, Thorpe and Lowe 1991; Ghauri, Gronhaug and Kristianslund 1995). Bitsch also lists ". . . phenomenological research, ethnomethodology, ethnography, qualitative case study, participatory action research, and grounded theory." (Bitsch 2005, 77) All of these approaches have at least some intellectual ancestry in philosophical pragmatism (Johnson 1986).

In the 1997 version of this paper, phenomenology was used as the term to reference these collective approaches. More compelling for this update is Bitsch's use of grounded theory as the best representation of these methods and one that comes closest to describing an epistemology. As she states, "Grounded theory, first published in 1967 by Glaser and Strauss, is the master metaphor of qualitative research." (Bitsch 2005, 77) Grounded theory is about extracting theory from the data and information of actual context. It involves a cycle that starts with a phenomenon of research interest, moves to collection of rich context-based information, induces a first round of theory based on the concepts and constructs that arise from the information, continues with another round of data gathering and induction, and ends when the induction-deduction cycle ceases to evolve the theory. Bitsch is highly effective in elaborating the approach in substantial detail. An abbreviated discussion is presented here.

At the heart of a grounded theory epistemology is the notion that the phenomena of interest cannot be separated from their context. To study human phenomena, the researcher must understand the holistic nature of the situation that created it. Behavior and context are fundamentally interdependent. In this view, reality is socially constructed by the actors involved in the phenomena. To understand the phenomena, the researcher must understand the meanings and motivations of the actors.

Similar to Schon's concept of reflection-in-action, grounded theory knowledge can be thought of as built upon making explicit what decision makers know implicitly; and, by making it explicit and testable, the knowledge can become more objective rather than merely subjective. Schon argues that knowledge arises from "subjecting to critique and testing the strategies, assumptions, or problem-settings implicit in a whole repertoire of situational responses." (Schon 1995, 31).

Grounded theory knowledge is derived from an iterative process that is both inductive and deductive. The academic researcher must observe the actual situation and the actions taken. To these observations, the researcher attaches meaning through classification and comparison based on existing theory and/or the logic of the situation itself. The researcher forms a tentative hypothesis about the action, its causes, and its results. This hypothesis can then be tested against other decision situations. Subsequent testing will determine whether the hypothesis holds, needs to be modified, or abandoned. This is what Bonoma calls the theory/data/theory revision cycle that he recommends to drive the process of case research. It is also akin to some of the defining characteristics of qualitative research more generally in which the researcher seeks "to formulate new hypotheses and alter old ones as the research progresses, in the light of emerging insights." (Cassell and Symon 1994, 4).

Decision makers themselves often engage in such an iterative process in real time. Schon gives an example of how a decision maker engages in action, is surprised by the results of the action, and instantly restructures his or her understanding of the situation. "On the basis of this restructuring, he invents a new strategy of action and tries out the new action he has invented, running an on-the-spot experiment whose results he interprets, in turn, as a 'solution,' an outcome on the whole satisfactory, or else as a new surprise that calls for a new round of reflection and experiment." (p. 30) The academic researcher can make this process explicit, expand it to multiple situations, and bring theory and objectivity to the iterative process.

Grounded theory knowledge is scientific. Its Kantean cycle of induction, deduction, and verification is a form of the scientific method (Kenemy Titus). Grounded theory knowledge is abstract in that it is articulated in the medium of words and ideas. It can meet the criteria of objectivity, clarity, coherence, and data integrity. (The degree to which it meets these criteria will be addressed in the next section.)

The ability to generalize grounded theory knowledge is an obvious and central issue in its legitimacy as an epistemology. Citing and elaborating on Guba and Lincoln, Bitsch presents transferability as paralleling external validity and generalizability in quantitative research. "Transferability refers to determining the extent to which findings can be applied in other contexts or with other respondents . . . . the burden of prove shifts from the researcher to the person who wants to apply the research results." (Bitsch 2005, 85) The user is aided in transferability by the researcher's use of (1) "thick description" (Geertz) that provides interpretative and rich enough detail for judging probable alternative applications, and (2) purposeful sampling that assures the research process examined typical and atypical cases to test the limits of application scope. (Bitsch 2005) Schon calls for generalization ". . . not as covering laws[2] but through what I call 'reflective transfer,' that is, by carrying them over into new situations where they may be put to work and tested, and found to be valid and interesting, but where they may also be reinvented." (p. 31) Yin posits that generalizing case findings is not the same as statistical generalization in positivism. Rather, case studies, as with experiments in the natural sciences, rely on *analytical* generalization from a particular set of results to some broader theory. Gummesson argues that local theory applicable to particular situations has value in and of itself even if broad generalization is not possible. The situation adds new richness to the understanding of possible behaviors and responses.

Grounded theory knowledge has an inherent dynamism that makes it highly useful in times of change. Grounded theory methods can be used even if the underlying structure is not stable. Working hypotheses can be readily altered and expanded in order to maintain correspondence with emerging conditions. The methods of grounded theory reflect the claims of Cassell and Symon for qualitative methods more generally in that these methods ". . . are sensitive enough to allow the detailed analysis of change. . . . With quantitative methods we may be able to assess that a change has occurred over time but we cannot say how (what processes were involved) or why (in terms of circumstances and stakeholders)." (p. 5)

The differences between practical, positivistic and grounded theory knowledge are presented in Table 1. Grounded theory knowledge can add value for decision makers because of its increased levels of objectivity and generalizability versus practical knowledge. Decision makers can be less given to error in experience transfer and in understanding what factors actually matter in the decision situations faced. In contrast to positivistic knowledge, grounded theory knowledge finds its greatest applicability to research settings in which established theory is weak or nonexistent, the phenomena of interest are not readily quantifiable nor separable from context, and the underlying cause-and-effect structure is unstable or not given to general theory.

[2]By covering law Schon means "a general, perhaps statistical, proposition applicable to all instances in which certain combinations of variables are present." (p. 31)

Table 1. Comparative Aspects of the Three Types of Knowledge

Aspects of Knowledge	*Practical Knowledge*	*Grounded Theory Knowledge*	*Positivistic Knowledge*
Goals for Understanding	How things are done. Replication of past success. Development of standard operating procedures.	Why things happen in a socially-constructed world. Development of "local" theory.	Why things happen in an external and objective world. Development of "general" theory.
How Learned	Practice, story, experience, rules of thumb, imitation. Trial and error.	Induction-deduction-validation cycle with emphasis on induction. Scientific method.	Induction-deduction-validation cycle with emphasis on deduction. Scientific method.
Relevance of Context	Mostly concrete Holistic	Moderately abstract Holistic	Mostly abstract Reductionistic
Form of Knowledge	Mostly tacit with explicit expression of best practices or procedures	Mostly explicit with cautions about users sensitivity to tacit practice	Explicit to the point of precise replication
Objectivity	Mostly subjective	Mostly objective with qualitative safeguards	Mostly objective with quantitative safeguards
Reliability			
• **data integrity**	Low	Potentially high	High
• **construct validity internal validity**	N/A	High	Potentially high
• **clear causality**	Low	Moderate	High
• **coherent causality**	Low	Moderate	High
Ability to Generalize (External Validity or Transferability)	Limited by experience	Analytically transferable	Statistically transferable
Predictive Power	High within bounds of experience	High within bounds of working hypotheses	High within bounds of theory
Prescriptive Power	High	High	High to limited depending upon level of detail needed
Actionable	High	High	High to limited depending upon complexity of context
Ability to Address Changing Structure	Moderate	High	High to limited depending upon method of derivation

The three types of knowledge—practical, positivistic, and grounded theory—lie on a continuum. Some decision makers pursue practical knowledge in a nearly scientific manner, searching for underlying structure and attempting to drive out bias and thus moving across the continuum toward grounded theory knowledge. Positivists can and do give up some of their clarity and coherence to improve the correspondence of what they know about the world, and thus they move across the continuum. Some quantitative techniques, such as factor analysis, occupy a spot on the continuum between grounded theory and positivistic knowledge (although purists on both sides may not agree.) Objectivity and subjectivity, as well as concreteness and abstraction, are not absolute terms empirically. The issue really becomes what tradeoffs scholars or practitioners are willing to make in order to know what they know.

Grounded Theory Knowledge and Rigor

To a strict adherent of positivistic epistemology, the objectivity and generalizability of grounded theory knowledge may appear questionable. Positivists will argue that this third way of knowing lacks what has come to be called "rigor." Ultimately, academic legitimacy hinges on whether or not an appropriate rigor can be defined for grounded theory knowledge. If for no other reason, agribusiness scholars must find reasonable ways to signal in journal articles and other scholarly writings that the standards of grounded theory rigor were known and followed by the author. This signaling will not be easy since the more qualitative nature of grounded theory knowledge necessitates lengthy output that may strain usual editorial standards for article length or the reader's patience in wading through the material (Cassell and Symon 1994). A corollary to this point is that the reviewers for journals must accept the legitimacy of grounded theory methods and be prepared to provide appropriate critique.

If rigor is defined by the careful adherence to tests of scientific validity and reliability, the evaluation of grounded theory research can achieve both tests. Appropriate standards of rigor can be articulated, but these standards differ from positivistic standards. Based on the complexity and ambiguity of real decisions, grounded theory knowledge will never achieve the level of clarity or coherence argued earlier to be the hallmarks of positivistic knowledge. The tradeoff is heightened correspondence and improved prescription. Grounded theory knowledge is actionable in that the richness of context can be significantly preserved while some level of abstraction is sacrificed.

Table 2 attempts to provide a starting point for defining rigor for grounded theory knowledge. It is beyond the scope of this paper to go further. (See Bitsch for a more extensive examination of this issue.)

First, grounded theory knowledge has been rigorously derived if appropriate research methods were used. The preferred methods of conducting grounded theory research include, but are not limited to, case studies, archival analyzes, semi-structured or fully-structured interviews and surveys, field experiments, critical incident analyzes, repertory grid techniques, cluster analysis, factor analysis, conjoint analysis, and structural equation modeling. The earlier entries in this list are largely qualitative, but the latter entries involve quantitative analysis, albeit mostly of qualitative (often categorical) data. Rather than define and elaborate on each of these techniques here, the author simply wants to establish that these techniques exist and have a supporting literature of their own.

Second, construct validity, internal validity, reliability and external validity can be achieved for grounded theory approaches, and the key questions related to assessing each of these is presented in the table. Most especially, researchers should focus on high correspondence and effective prescription as standards by which grounded theory knowledge is judged. In addition, data integrity must be a critical concern and should be based on (1) proper triangulation (Bonoma, Cassell and Symon, Yin, Bitsch) in one or more of four forms self-reported and archived information, multiple investigator perspectives, multiple theoretical perspectives, or multiple methods of gathering and interpreting data, and (2) appropriate precautions against researcher bias arising from close interaction with decision makers. Clarity arises from careful description, classification, and

Table 2. Comparative Characteristics of Grounded theory and Positivistic Knowledge

Characteristics of Knowledge	*Grounded Theory of Knowledge*	*Positivistic Knowledge*
Researcher Goals:	Focus on meanings. Try to understand happenings. Look at the totality of each situation. Develop ideas through induction from data. Develop "local" theory.	Focus on facts. Seek causality & fundamental laws. Reduce situation to simplest elements. Formulate hypotheses and then test them. Develop "general" theory.
Applicable Research Setting:	Theory construction Phenomena need not be quantifiable Phenomena not separable from context Unstable or nonexistent structure	Theory confirmation Quantifiable phenomena Phenomena separable from context Stable underlying structure
Preferred Methods:	Using multiple methods to establish different views of phenomena. Small samples investigated in depth or over time.	Operationalizing concepts so that they can be measured. Taking large samples.
Construct Validity	Has the researcher gained full access to the knowledge and meaning of informants?	Does an instrument measure what it is supposed to measure?
Internal Validity (Clarity and Coherence)	Has the researcher uncovered the logic of the phenomena observed either by applying existing theory or laying bare the inherent order of the situation itself in new theory?	Has the researcher properly deducted and tested the hypothesis?
Reliability (Data Integrity)	Will similar observations be made by different researchers on different occasions? Has triangulation of data been appropriately handled?	Will the measure yield the same results on different occasions (assuming no real change in what is to be measured)?
Generalizability (External Validity or Transferability)	How likely is it that ideas and theories generated in one setting will also apply in other settings?	What is the probability that patterns observed in a sample will also be present in the wider population from which the sample is drawn?

Source. Rows 1, 3, 4, 6 and 7 are adapted from Easterby-Smith et al.

comparison of observed situational phenomena rather than from precise definitions and measurements. Thus clarity is qualitatively achieved (based on experience) rather than quantitatively. Coherence arises by bringing logical order to the phenomena observed either by applying existing theory or laying bare the inherent order of the situation itself in new theory. Objectivity arises from the clarity, coherence, and data integrity already mentioned, and in addition from subjecting both the methods and results to peer review. Rigor is attainable for grounded theory knowledge, and agribusiness scholars have a responsibility to properly define it and practice it.

The New Tension: Wicked Problems and Engaged Scholarship

An epistemology of grounded theory rigorously carried out in methods can go a long way toward allowing agribusiness scholars to serve their two sets of peers, industrial and academic. But, such an epistemology may not be enough for a certain class of problems that we are increasing asked to address, so-called wicked problems (Rittel and Webber 1993; Conklin 2006; Batie

2008). Wicked problems, a term from the 1970s social planning literature, have the essential characteristic that they are not solvable; they can only be managed. As part of their management, special roles exist for both new knowledge and full stakeholder engagement in the research process itself.

Sustainability serves as one example of a wicked problem that many agribusiness scholars (as well as many agricultural natural scientists) are being asked to address today. Table 3 presents a list of defining criteria for a wicked problem and how sustainability meets these criteria. Fuel vs. food, global warming, and even business strategy itself (Camillus) are other examples.

Table 3. Sustainability as a Wicked Problem

Criteria for a Wicked Problem	**Sustainability**
No definitive formulation of the problem exists.	Ideal definition lacks specificity and is reduced to slogan or tagline such as triple bottom line (economic, social and environmental) performance
Its solution is not true or false, but rather better or worse.	One can never know if sustainability has been achieved. Only progress in its trajectory can be predicted.
Stakeholders have radically different frames of reference concerning the problem, and are often passionate in their position on the problem.	Businesses strongly favor economic outcomes. Environmental groups strongly favor environmental outcomes. Social justice groups strongly favor social outcomes, such as fair wages and equitable access.
System components and cause/effect relationships are uncertain or radically changing.	Many claims are made about what is sustainable (such as local food systems are sustainability while global food systems are not) with unclear knowledge of what system characteristics assure or even promote sustainability.

Based on the criteria, one realizes why wicked problems cannot be solved—they have no closed-form definition, their "solution" can only be thought of in relative terms, stakeholders will be in conflict over solutions and actions, and the system is not understood well enough to effect entirely purposeful change. Wicked problems can be managed and their effective management focuses on actions toward two desired system outcomes:

- *Improved impact*, moving system components in a desirable direction
- *Meaningful process*, effectively responding to the relevant stakeholders who can veto as well as enable action in any direction

Potential options to improve impact can be meaningless if the process results in stalemate, while endless process can result in no action to improve impact. Impact and process outcomes must be achieved simultaneously.

Further, each stakeholder brings strongly held existing knowledge to the management process. This existing explicit and tacit knowledge is deficient in two respects:

- Existing knowledge of one stakeholder is suspect to other stakeholders because of issues arising from trust, transparency and credibility of sources.
- Existing knowledge freezes the system tradeoffs that give rise to the conflicting system outcomes that divide the stakeholders in the first place.

The argument runs that only new knowledge can overcome these deficiencies. The process has legitimacy when the new knowledge is derived together with the stakeholders. When the creation of the new knowledge centers on system innovation, then more acceptable impact tradeoffs can emerge even to the point of converting existing tradeoffs into new complements through deeper systems understanding and redesign.

Knowledge institutions and their scholars have a role in managing wicked problems like sustainability when they understand how research can be beneficial to the process outcomes as well as the more traditional impact outcomes. Given the messy underlying understanding of the system at work in a wicked problem, the grounded theory epistemology already advocated in the paper would seem to have great fit to this context. Agribusiness scholars would seem to be of significant value to the context as well.

An epistemology of grounded theory may be a necessary condition for contributing to the management of wicked problems, but is likely not sufficient on two counts:

- Many more disciplines are needed than those of agribusiness scholars to address the full system analysis and synthesis needed for impact outcomes. These problems are even beyond multidisciplinary approaches (pooling individual disciplinary knowledge) demanding instead transdisciplinary approaches (collective disciplines creating new knowledge together).
- The stakeholders need to be engaged throughout the research enterprise in order to have its results be meaningful and legitimate to the desired process outcomes. The stakeholders cannot merely be there at the beginning of process (to articulate their needs) and at the end of the process (to receive the results). They must be there throughout the process to assure that the research stays on track and will have stakeholder credibility when the results are known. The researcher will need to manage the rigor of the research, but the research will be done in a fishbowl unlike our traditional research expectations of objective separation.

An epistemology of engaged scholarship that encompasses all of the above is essential when working in the arena of wicked problems. This realization is entirely consistent with the historic and contemporary literature that surrounds wicked problems. (See Peterson 2009; Batie 2009; Fear et al. 2006; and Bitsch (2009) for contemporary analyses related to agricultural and natural resource systems.) If agribusiness scholars are to excel in this arena, then they must work with rigor not just in grounded theory but also in engaged scholarship. There is no rest for the weary. We are called to even greater challenges by our peers.

Recommendations

What then should we do as agribusiness scholars to assure that we serve our traditional industrial and academic peers and the even broader set of stakeholder peers facing wicked problems? Seven recommendations are made.

First, we should pursue grounded theory knowledge and adopt its methods when our research calls for such an approach. As already argued, grounded theory knowledge adds value for our

business peers and keeps us in the academy with our academic peers. But beyond that, the rapid changes occurring in the agri-food-bio system and the presence of wicked problems signal that causal relationships are in a state of flux or system complexity makes them extremely hard to uncover. In either case, grounded theory knowledge is especially appropriate. The phenomena we study, both inter-firm and intra-firm, are not easily studied separate from the richness of context and are not readily given to quantification. Grounded theory knowledge fits well with the situations in which we conduct the vast majority of our research as scholars.

Second, as members of the academy, we bear a responsibility to define further an appropriate level of rigor for grounded theory knowledge and its methods. This paper only begins this process. We need to consult the research methods of related social sciences and mine the richness of methodological diversity found there.

Third, we must teach grounded theory methods to our graduate students and learn how to use them ourselves. As agricultural economists, most of us have been trained in positivistic methods and most of our graduate programs require that our students learn positivistic methods. Qualitative and grounded theory methods must be adequately represented in our curricula. Quantitative techniques more appropriate to qualitative data, including conjoint analysis, factor analysis, cluster analysis, structural equation modeling, must also be part of the curricula. We will quickly need to determine to what extent the traditional agricultural economics doctoral program can produce scholars that have adequate backgrounds to do both positivistic and grounded theory research. Two distinct, yet compatible programs may well be called for.

Fourth, as agribusiness scholars, we must willingly recognize when positivistic knowledge will be most helpful. When the theory is strong, the phenomena are quantifiable and separable from context, and the structure is stable, we need to recognize the legitimacy of the positivistic epistemology. In addition, our grounded theory insights can enhance positivistic theories and methods in order to improve their correspondence to the world we encounter. We need broad collaboration across methods, and not intellectually pure camps trading barbs. At the same time, our research cannot be merely derivative of or subservient to our traditional agricultural economics peers. We must add value through our different perspectives and approaches.

Fifth, in a world of wicked problems, we must use our command of grounded theory to contribute to transdisciplinary research and to engage with stakeholders in this arena. Our contributions here may be even more challenging to our existing peers in the academic, but I suspect that our industry peers need our participation in managing these even more intractable problems.

Sixth, we must test our research-derived knowledge with our industry peers and not just our academic peers. Do practicing managers find our research results actionable? Do our research results further the evolution of management practice? Industry peers need to answer these questions in the affirmative if we are to be judged relevant. Further, we need to have our industry peers engage in our work in exchange for our delivering relevant research-based knowledge. We need access to qualitative and quantitative data and information. Continuing privatization of data and limiting access to industry decision makers make meaningful grounded theory research harder to pursue effectively. Industry peers need to open appropriate access to us, and we need to honor that access with appropriate confidentiality. We also need them to open their minds to

the limitations of their own practice and to the usefulness of science and theory when it comes to transferring knowledge from one application to another or one situation to another. We need to intellectually spar with each other and not merely have one side or the other represent what they know as ultimate truth (practically or theoretically) rather than the best available knowledge for the moment. This process requires rich, vital relationships between industry and scholars, and not incidental meetings here and there at conferences, nor encounters merely about students for employment.

Finally, we must reach out to our two sets of peers and ask that they understand our potential and our limitations as well as their own if we are to work together effectively. Our business peers must understand that we cannot mimic their way of knowing or that of practicing business consultants. Their world is one of practical knowledge. Our academic peers must understand that we cannot mimic, in most instances, their positivistic knowledge because it removes us from the context in which actual decisions must be made. In return, we must strive to retain our commitment to science and to a research rigor that is appropriate to grounded theory and ultimately to engaged scholarship.

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International Food and Agribusiness Management Review
Volume 14, Issue 5, 2011

Exclusivity of Agrifood Supply Chains: Seven Fundamental Economic Characteristics

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Abstract

This analysis focuses on defining and describing the unique economic characteristics of agrifood supply chains. The analysis includes seven specific economic characteristics of agrifood supply chains that distinguish them from other industrial manufacturing and service supply chains. The seven characteristics are: 1) risk emanating from the biological nature of agrifood supply chains, 2) the role of buffer stocks within the supply chain, 3) the scientific foundation of innovation in production agriculture having shifted from chemistry to biology, 4) cyberspace and information technology influences on agrifood supply chains, 5) the prevalent market structure at the farm gate remains oligopsony, 6) relative market power shifts in agrifood supply chains away from food manufacturers downstream to food retailers, and 7) globalization of agriculture and agri-food supply chains.

Keywords: agrifood supply chains, exclusive economic characteristics, risk, market power, globalization

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Exclusivity of Agrifood Supply Chains: Seven Fundamental Economic Characteristics

Are there meaningful economic characteristics that serve to make some supply chains unique and different from others? This analysis identifies and describes seven fundamental economic characteristics of agrifood supply chains that serve to distinguish them from other supply chains in the manufacturing and service sectors of the economy. The focus here is on the uniqueness of agrifood supply chains in terms of their economic character. This uniqueness has powerful implications for managers within agrifood supply chain firms and the long-term strategies that they might craft to enhance the long-term performance of their firm.

The complexity and length of agrifood supply chains serve to distinguish them from manufacturing and service sector supply chains. One example of complexity is the perishability of commodities and postharvest technology, such as hydrocooling sweet corn, that is used to assure quality and safety from the field to a processing facility or directly to a downstream consumer of a fresh product. Evidence of these complexities exclusive to agrifood supply chains is plentiful. For example, food chain management books are available which provide best practices for managing temperature controlled supply chains (Smith and Sparks 2007). Adding to the length of these complex agrifood supply chains is the long-term trend toward globalization where large-scale commercial operations, located and coordinated on an international basis, produce and process food sited globally to minimize costs.

Seven unique economic characteristics of agrifood supply chains are defined and described. The meaning, context, and consequences of each characteristic are discussed in some detail. Each characteristic serves to differentiate agrifood supply chains from manufacturing, service, and nonagricultural manufacturing supply chains.

The seven characteristics are: 1) risk emanating from the biological nature of agrifood supply chains, 2) the role of buffer stocks within the supply chain, 3) the scientific foundation of innovation in production agriculture having shifted from chemistry to biology, 4) cyberspace and information technology influences on agrifood supply chains, 5) the prevalent market structure at the farm gate remains oligopsony, 6) relative market power shifts in agrifood supply chains away from food manufacturers downstream to food retailers, and 7) globalization of agriculture and agrifood supply chains. Each of these economic characteristics is examined and implications for agrifood form managers are provided.

Risk Emanating from the Biological Nature of Agrifood Supply Chains

Unlike other industries where manufacturing takes place in controlled and closed-loop environments, agrifood production faces high yield risk both in terms of quantity produced and quality delivered. Production agriculture is different from numerous industries because of the supply risk due to weather, biological aspects of production cycles, and perishability. Risk is pervasive for all parties in the agrifood supply chain. The biological nature of agricultural production results in less predictable supplies of various grades or characteristics compared to manufacturing and service sector supply chains. Prices are meaningful in their allocative role within supply chains if and only if they relate to products of identified homogeneous quality. In the case of

agrifood supply chains, this entails grading systems that are accepted and used by most supply chain participants for a particular commodity.[1]

Quantity risk is the temporal shortfall in supply, embedded in the biological nature of agricultural production (e.g., cows freshening, trees not bearing fruit, pest infestations in fruits and vegetables, etc.) to shortfall from weather vagaries or other unforeseen calamities. These issues impact supply and result in short-run or seasonal limits on available quantities to the market. Such haphazard supply limits are unanticipated and are not systematic. Numerous examples exist in the literature that highlights such phenomenon, including apples (Boland, Mancia, and Taylor 2010) and oranges (Seftel 1995). Beddow, Pardey, and Alston (2009) examine global variability in crop yields over the 1900 to 2006 time period and find that maize has the largest increase in productivity, measured by average crop yield increases relative to soybeans, wheat, and rice since 1960. Volatility in yields also has been the greatest in maize. This has an obvious impact on profitability of agrifood firms. Crop yields have greater uncertainty relative to milk or meat yields from animals due to greater unforeseen or unanticipated events.

Price risk is the fluctuating prices from changes in supply and demand. The typical methods for managing this type of risk are hedging in the futures market or entering into a fixed-price contract that often specify delivery quantities and quality attributes. For example, an examination of the contracts available on the Chicago Mercantile Exchange reveals that agricultural commodities are one of nine inputs that have futures contracts available for use by buyers. Others include metals, interest rates, exchange rates, energy and weather. Index funds are one of the largest traded futures but food commodity futures, although smaller volume, are essential for use by agrifood processors and producers in managing price risk. The Food and Agriculture Organization (2011) provides monthly price indices for food, meat, dairy, cereals, oils, and sugar. An examination of the 1990 to 2011 data shows substantial volatility since 2004 relative to the preceding years. This has an impact on agrifood firm profitability. The relative impact on profitability depends upon where the agrifood firm is embedded in the value chain. Upstream firms closer to production experience greater variability in profitability relative to those downstream firms closer to consumers.

Quality risk refers to the specific qualities or grades of a commodity or a product that are necessary as an input but that may not be available at a certain time. Various qualities or grades of a commodity are not fungible across processors, often because the complement of equipment in a processing line dictates use of a narrow range of existing commodity qualities. One example is a cotton mill processing line that is equipped to use only long staple cotton. In this instance, short staple cotton is not fungible for long staple (Hyson 1944). A similar example is processing tomatoes (Goodhue, Mohaptra, and Rausser 2010). A specific complement of machinery within a processing plant may influence the range of qualities or grades that can be an acceptable input in the production process.

[1]The broadest authorization for commodity grading systems in the United States is provided by the 1946 Agricultural Marketing Act, although commodities such as cotton, grain and tobacco also have their individual authorizations. The United States Department of Agriculture has a long history of involvement with commodity grades and standards.

Commodity characteristics include perishability and seasonality in production and/or consumption. Examples include fresh fruits and vegetables, fluid milk, and some meat animal production. Substantial price swings within a marketing season can result for commodities with these characteristics (Breimyer 1976; Rhodes, Dauve, and Parcell 2006). For example, price typically is lowest at the end of harvest and gradually begins to rise as supply begins to decrease (e.g., inventories are lowered) until the new marketing season begins. For crops in the northern hemisphere, the marketing year is generally September of the current year until August of the following year, except for summer crops such as hard red or hard white winter wheat.

Increases in global distribution channels have eliminated some of this seasonality, especially in horticulture production. Historically, fresh fruits and vegetables were available only during certain times of the year within season. Globalization has resulted in supplies now available year-round and, consequently, seasonal price variability is dampened, except for seasonal quantity or quality issues such as supplies damaged from frost or disease. This price effect, at least partially, is attributable to the biological nature of agricultural production. Adjustments in aggregate within-season supply through private or public inventory adjustments typically are not feasible for perishable commodities. In some instances, the biological nature of production involves longer periods spanning several years, as is the case with perennial tree crops such as almonds, which could lead to wide price swings across seasons (Boland, Pena, and Sumner 2010).

Perishability and production seasonality give rise to the concept of orderly marketing. The foundation of orderly marketing includes concepts of supply and demand levels, price levels and price variability over both time and space. The term 'orderly marketing' for a commodity means an orderly flow of the supply to market throughout the normal marketing season to avoid unreasonable fluctuations in supplies and prices as stated in Section 2(4) of the Agricultural Marketing Agreements Act of 1937. In U.S. legislation, orderly implies dampened within-season price variability compared to the price variability that might occur if the commodity were marketed in an unregulated purely competitive open spot market. An example of this is raisins which are governed by the Raisin Administrative Committee (Sanchez, Boland, and Sumner 2008).

Seasonality in production and marketing has played an important role in the development of United States marketing policies in milk, fruits, and vegetables. Orderly marketing appears as the central component in some marketing order policies (Black 1947). For example, milk marketing orders have an explicit orderly marketing legal mandate that underlies their promulgation and provisions. Assurance of adequate supply is a portion of the economic foundation which means having a continual supply available to consumers. In this instance, accuracy is rooted in the notion of perfectly competitive market structures where price differences over space reflect only differences in transportation costs through spatial arbitrage and that, within a geographic market area, prices are identical for the same quality to all buyers and all sellers. This is often referred to as von Thunen's model (1966). Similarly, price differences among qualities within a market are sufficient to provide accurate signals to sellers on the relative value of various qualities.

Yet another risk of agrifood supply chains participants is adulteration, a separate issue from the temporally-based quality issues discussed above. Risk of unsafe food is the risk that input supplies are substandard or adulterated, as one aspect of this risk type. This risk relates to the use of

unsafe food or input supplies, regardless of whether the usage was intentional (i.e., using substandard or adulterated products) or unintentional (i.e., mistake or insufficient knowledge). This risk is typically unintentional yet supply chain interdependencies link multiple downstream participants to any one particular food safety incident. A fear of food manufacturing firm managers is that the products they distribute are unsafe and they then must issue an expensive recall (Sporleder and Goldsmith 2001). This risk can be financially devastating to a firm due to the cost burden of a recall or the diminished reputation of the firm or its brands that may result from a recall. Adulterated product, leading to recalls, is a systemic risk for the entire agrifood supply chain. Hudson Foods is one example of how devastating recalls can be for an individual firm. Hudson Foods is no longer in business because of their recall of hamburger. [2]

There are no shortages of adulteration incidents. Recent examples in the United States abound: 1) dog food ingredients, imported from China, contained toxins that resulted in dogs becoming ill (Quan et al. 2010); 2) contaminated peanut butter paste from a food manufacturing firm in Georgia that resulted in several deaths in the United States (Wittenberger and Dohlman 2010), 3) fresh spinach that was widely distributed but contained food borne pathogens (Palma et al. 2010), and 4) Colorado cantaloupe recall of 2011 due to *Listeria* which was the largest recall in U.S. history. Agrifood supply chains are unique in the United States because they are regulated by four federal agencies: the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture, the Food and Drug Administration (FDA), the Environmental Protection Agency (EPA), and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. [3] The agrifood sector is unique, compared with industrial sectors, in terms of federal regulations for product and process regarding the environment, plant and animal products, and processed food products.

The Role of Buffer Stocks with the Supply Chain

In the case of nonperishable (storable) commodities, such as wheat, cotton, and corn, the stocks in storage buffer intra-seasonal and inter-seasonal price movements (Breimyer 1976). Nevertheless, perishability precludes this buffering or moderating influence on within-season price of carryover stocks from one period to the next. This is why inventories of storable commodities, such as wheat and corn, are often referred to as buffer stocks. In addition, inventory stocks can buffer against the quantity and quality risks discussed above.

When a commodity is perishable, such as fluid milk, buffer stocks are not feasible. In these cases, contracts tend to replace spot market transactions and buffer stocks (Sporleder 1992; MacDonald and Korb 2011). In most conventional industrial supply chains, privately-held buffer stocks are a common means of hedging quality, quantity, and price risks by manufacturing firms in the supply chain. For example, if a supplier cannot make a just-in-time delivery of an input,

[2] Hudson Foods Company of Rogers, Arkansas was a beef processor involved in what was then (1997) the largest recall of food in the United States. The processing plant was in Columbus, Nebraska. The company recalled over 25 million pounds of ground beef due to *E. coli 0157:H7*.

[3] The National Oceanic and Atmospheric Administration (NOAA) oversees fisheries management and fresh fish grading in the United States. By authority in the 1946 Agricultural Marketing Act, the NOAA Seafood Inspection Program provides inspection services for fish, shellfish, and fishery products to the industry. The NOAA Seafood Inspection Program is a U.S. Department of Commerce (USDC) Seafood Inspection Program.

the manufacturer may draw down buffer stock inventory to keep production lines operating in a normal manner.

For less-perishable commodities, storage helps achieve vertical coordination in the supply chain (Working 1949; Breimyer 1976). Buffer stocks are held by private firms in upstream and downstream markets in an effort to mitigate quantity and quality risk and generally deal with unexpected events. For perishable commodities buffer stocks are neither practical nor cost effective. One consequence of these phenomena is that the supply chain coordination problem is more severe and alternative exchange mechanisms emerge beyond simple spot market transactions. Contracting is an important mechanism that substitutes for privately-held buffer stocks in terms of providing a similar economic function (Martinez and Reed 1996).

Contracting of perishable commodities can be a means of enhancing supply chain coordination and act as a surrogate for the economic role of privately-held buffer stocks that are prevalent among storable commodity supply chain participants. Contracts facilitate the contractor who is typically the downstream first-handler/processor to specify the quality and quantity that can be delivered under the terms of the contract. The contract may even be a fixed-price contract. These possible features of a contract mitigate the quality, quantity, and price risk discussed above, thus substituting for the economic role played by buffer stocks in storable commodities. Such contracts might be linked to publicly reported price data such as the Agricultural Marketing Service of the U.S. Department of Agriculture, *Milling and Baking News*, *Feedstuffs*, or the *Food Institute Report* which are widely used as a starting point for some price negotiations. James, Klein, and Sykuta (2010) and Dorsey and Boland (2009) synthesize numerous examples for agrifood firms.

The Scientific Foundation of Innovation in Production Agriculture has Shifted from Chemistry to Biology

Three eras of agriculture relative to innovation are worth noting (Gardner 2002). The first era is mechanical where the most significant innovations were based on mechanization of all kinds. This era is noted for tractor power replacing horse power; in general, the substitution of capital for labor. In the United States, this era faded in the 1950s to be replaced by the chemical era. The chemical era is marked by substantial gains in efficiency through various applications of chemistry, such as chemical fertilizers, pesticides, and antibiotics for farm animals that facilitated production practices such as large-scale confinement feeding. The third and present era is agricultural biotechnology.

The fundamental science for innovation in agricultural production has shifted rather quickly from chemistry to biology (Chandler 2005). The advent of commercial biotechnology influencing agricultural industries is rooted in the 1970's. Chandler (p.10) notes that "…by the 1970's, chemical science and engineering was no longer generating significant new learning, whereas at the same time biology and related disciplines, especially molecular genetics, witnessed an explosion of new research and insights. Based on this new learning, chemical and pharmaceutical companies built new integrated learning bases, erected new barriers to entry, and defined new strategic boundaries." For example, DuPont, even though its roots were firmly in chemistry, remade itself into a company whose research and development is predominantly based on the science of biology, beginning its transformation in the mid-1980s.

The advent of the first genetically engineered crops available to farmers as a result of agricultural biotechnology was in mid-1990. For example, genetically-modified soybeans and corn were widely available for the 1996 crop year, even though some genetically-modified seed was available the previous crop year. The fundamental change from chemistry to biology as the primary source for innovation provided opportunities, as never before, to accelerate food product innovation and open the potential for food to play an expanded role as a delivery mechanism for medical technology.

The expanded role as a delivery mechanism for medicine is in addition to the traditional role of human sustenance from caloric intake (Enriquez and Goldberg 2000). Historically the purpose of food consumption was sustenance through ingesting calories and nutrients (Stigler 1945; Southgate, Graham, and Tweeten 2007). After that need was met, taste became important in preferences (Kinsey 2001). More recently, convenience is one determinant of consumer food preferences (Boland 2010).

Today's modern consumers now ask for more. In addition to nutrients, taste and convenience, some consumers now consider personal health. These attributes are based on a sense of food safety and a longer-term attribute in the form of functional foods and nutraceuticals (Kinsey et al. 2009). As obesity has become an epidemic brought on by lifestyle choices and convenient but high-caloric food products, personal health attributes for many consumers already have become an important added bundle of expectations for their foodstuffs.

The shift from chemistry to biology as a source of innovation in agrifood supply chains has made biology the science of tomorrow. Biology, through genetics, is about information storage, duplication and transfer involving the most sophisticated devices ever imagined. Indeed, the transformation is so dramatic that synbiology synthetic biology now captures an emerging area of synthetic biology. Synbiology is the engineering of biological components and systems that do not exist in nature and the re-engineering of existing biological elements. Synbiology is determined on the intentional design of artificial biological systems, rather than on the understanding of natural biology. Synbiology aims at the design of artificially modified living systems, such as specialized cells for biosensing and biobased and highly controlled synthesis, or for high yield production of biological molecules for in vivo or in vitro use. Synbiology is determined on the intentional design of artificial biological systems, rather than on the understanding of natural biology (European Commission FP6 2005). This emerging area promises to construct new biofunctional systems to build novel proteins, genetic circuits and metabolic networks based on knowledge contributions from biology, engineering, mathematics, and physics.

Molecular genetics and synthetic biology will impact preventive and curative medicine at an accelerated pace as well as find applications in the food supply (University of Idaho 2010). For example, nanoparticles may be used to target certain genes and therefore aid in genetic engineering of food animals. In another application, nanomaterials might enhance the shelf stability of food products and help assure their safety. Nanotechnology allows integration of biology and information technology through nanoscale approaches that will find direct application in human medicine. For instance, DNA markers alert individuals through adapted information and communication systems to any alteration of the biological information system. Blood pressure and quality will be monitored real-time and continuously via biosensors. Biosensors also are increas-

ingly employed in food science to detect pathogens without disrupting food processing or product flow.

The advent of personalized or individualized medicine, made possible by rapid and fundamental advances in biology, portends the day when prediction of future patient maladies is likely. The change is that medicine evolves from treatment of a condition after it is diagnosed to current active management so that the future condition is delayed, minimized, and/or avoided completely. This model for medical treatment is an evolutionary shift from reactive to proactive. The consequent change for the agrifood system is that food and even obligatory preventive diets may become commonplace. One prospect is that food and diet become a means of delivering customized medical knowledge to patients.

There are major implications of this evolution to food as a delivery platform for medical and biotechnology intellectual property. [4] One potential is for the proliferation of numerous small specialized niche markets for foods (Sporleder, Goldsmith, and Cordier 2008). Another example is probiotics in numerous foods (Sanders 1998). Rapid biotechnological advance will continue to blur the lines between food and medicine**.** Enhanced demand for nutraceuticals and functional foods results.

Cyberspace and Information Technology Influences on Agrifood Supply Chains

Cyberspace and information technology changes everything from business models to how feasible outsourcing is as a strategy for firms that operate in global agrifood supply chains.

The present and future are described as the Age of Knowledge because science and technology are integrated for increasing productivity and consumer value. The Age of Knowledge enhances the well-being of citizens and enhances the average global living standard (Federal Reserve Bank of Dallas 2006). Knowledge formation is increasing at increasing speeds to address the rapid development, shifts, and expansion of consumer demand.

Transportation and communication technology have allowed efficiency gains since the 1970's, cutting real *ad valorem* freight rates by more than 40 percent. The widening of the Panama Canal, slated for completion in 2014, will offer greater efficiencies for the eastern U.S. seaports. Goods are now moving around the world, not only at low cost but with containerized and parcel shipping from producer to final consumer using customized contracts or private third-party services. More recently, digital communications not only significantly decreased the average costs

[4] Sussex (2008) provides informative statistics on the evolution of agricultural biotechnology and how rapidly it developed globally. Sussex indicates that the first transgenic food crop to be commercialized was FlavrSavr, a delayed ripening tomato, in 1994. By 2006 transgenic crops were planted on 102 million hectares (252 million acres) in 22 countries (11 industrial countries and 11 developing countries) by 10.3 million farmers: 9.3 million of these farmers were resource-poor with small farms in developing countries. Soybean was the principal transgenic crop in 2006, occupying 58.6 million hectares, followed by maize (25.2 million hectares), cotton (13.4 million hectares), and canola (4.8 million hectares). The first field trials of transgenic crops were conducted in 1986 to test herbicide tolerance in tobacco. By 2005 nearly 3500 field trials had been conducted at more than15,000 sites in 34 countries on 56 crop species. The eight most frequently tested species were maize, canola, potato, tomato, tobacco, soybean, cotton, and melon. In 2007, it was estimated that 140 species of angiosperms had been genetically transformed.

of exchanging information, but allows knowledge transfer at near-zero marginal cost and without practical limits to speed. As a consequence, the supply of information in knowledge products is not limited, allowing increases in the quantity demanded without necessarily a rise in price.

Transactions in agrifood supply chains tend to be complex and often supply chain segments involve perishability, both in terms of spoilage and time-related degradation of product quality (Pritchett 2004). Information technology provides a foundation for cost effective just-in-time deliveries, enhanced ordering capacities, and facilitates traceback and identity preservation so that food recalls become more effective and efficient. It enables higher quality supply chain transactions at lower costs (Bailey, Jones, and Dickinson 2002).

There are two substantial direct impacts of information technology. First, processors can use economic incentives through production or marketing contracts to induce producers to grow a certain plant variety or animal breed that has some desired quality characteristic. For example, certain soybean varieties have lower levels of oil that yield a lower saturated fat (Sykuta and Parcell 2003). Certain animal breeds have less external or internal fat and processors can contract for such breeds (Roe, Sporleder and Belleville 2004). Second, processors can utilize current commodities and use research and development to remove the saturated fat or reduce the number of calories in a food as a response to economic incentives from consumers. The cost of doing so may be less than trying to acquire the seed germplasm, modify the genetics, and contract with producers to produce the plant. Many crops have potential for such differentiation. For example, Boland's (2001) *Economic Issues Series* summarizes the potential for value-enhancement in various crops provided in 15 different publications.

A large but relatively unnoticed part of information technology has been the harmonization of information used in business transactions between firms in different countries. For example, in 2002 the United States, Canada, and Mexico began using the North American Industrial Classification System. This system harmonizes industry definitions across international borders and makes data more meaningful and easier to use. In 2011, international accounting standards to report firm-level financial information emerged (International Financial Reporting System 2011). The adoption of the metric system in many countries has helped standardize weights and other measures globally. Veterinary and other scientific protocols are becoming more standardized across countries, which enhance trade (Marshall, Boland, and Conforte 2002). International Organization for Standardization (ISO) has developed similar standards for best organizational practices. In addition, the data collected on prices, volumes of imports and exports, and similar data is becoming harmonized across countries. All these efforts have resulted in better data for business intelligence and research purposes.

The ability to trace a food product back to its origin is becoming less complex due to information technology. This is useful because as food safety standards increase and trade becomes more prevalent, the need to rapidly respond to a potential food illness or product safety recall will become more important (Kinsey et al. 2009). Furthermore, as some countries adopt country-of-origin labeling in certain foods, the need for information technology becomes more necessary. Although information technology has imposed a cost on firms through regulatory compliance (e.g., food safety and/or reporting), it may reduce costs through the ability to better match consumer or societal demand for better nutrition or similar goals. Thus, information technology has

become an important competency for agribusiness firms that can adopt global standards quickly (Bailey, Jones, and Dickinson 2002). Information technology facilitates building interfirm social capital and vertical ties of many kinds (Sporleder and Wu 2006).

Prevalent Market Structure at the Farm Gate is Oligopsony

For many agricultural commodities, the market power of sellers (farmers) and buyers (processors or other first-handlers) is unequal, with substantial market power enjoyed by buyers (Marion and Sporleder 1976; Marion and Kim 1991; Rogers and Sexton 1994). There is a great deal of evidence that suggests that food manufacturing exhibits characteristics of monopolistic competition (Boland et al. 2012). In the United States, this fundamental characteristic has resulted in substantial legislation and rule-making by various governmental agencies that are intended to redress the balance of market power or protect farmers from experiencing the full force of unequal market power.

In the United States, the 1920s and 1930s were decades of concern over the market power of first-handlers and buyers of farm products. This concern resulted in legislation intended to countervail oligopsonistic market power at the producer-first handler level in the agrifood supply chain. Legislation stemming from countervailing power concerns encouraged the formation of farmer cooperative organizations and a myriad of regulatory tools that allowed producers to work together on common marketing issues. Examples include the Capper Volstead Act of 1922 and marketing orders covering several agricultural commodities. While some of the fruit and vegetable marketing orders initially had provisions designed to suppress short-term supplies, these provisions were largely eliminated in the 1970s. The annual U.S. Department of Agriculture Rural Business Service's Cooperative 100 profile indicates that aggregate agricultural cooperative market share has been increasing over time in many industries (e.g., fluid milk, feed).

In the United States, the set of antitrust policies which bears directly on economic power at the producer-first handler level begins with the Sherman Antitrust Act of 1890 and continues through the 1970s with additional interpretations of Capper-Volstead from a rather complex set of case law. The Capper-Volstead Act is an important antitrust policy regarding farm gate economic power. The economic logic of Capper-Volstead, in an antitrust sense, is to allow producers to form organizations with countervailing power. The Sherman Act and additional antitrust legislation, such as the Robinson-Patman Act of 1936, seek to constrain exercise of market power by large firms. At the same time, Capper-Volstead seeks to encourage joint marketing among farmers as a countervailing activity.

The legislation influencing the nature of trade practices, together with public market information legislation, creates two meaningful sets of policies aimed at balancing economic power. The set of trade practice policies includes, but is not limited to, unfair trade regulation, prompt- and full-pay provisions, truth-in-trading requirements, and discriminatory practice regulation. Legislation in the U.S. includes the Packers and Stockyards Act of 1921, the Commodities Futures Trading

Commission Act of 1974, the Perishable Agricultural Commodities Act of 1930, the Agricultural Fair Practices Act of 1967, and the United States Warehouse Act in 1916. [5]

From an economic standpoint, both market information and trade practice regulation are policies intended to equalize information in commodity markets. Collection of unbiased and statistically accurate market information promotes competition in the long-run. In general, public price reporting is justified on grounds of promoting competition, efficiency and fairness, as well as providing the federal government with information it needs for regulatory monitoring.

The U.S. Department of Agriculture (USDA) is internationally recognized and accepted to have the most reliable and timely market information systems in the world. It begins with the statistically reliable systems developed by the National Agriculture Statistics Service and the Outlook and Situation Board. Internationally, it relies on country data, weather reports, surveillance systems, and regular reports on production, supplies, and stocks supplied by Foreign Agriculture Service officers located in the embassies of countries around the world. Private intelligence is also provided by a number of companies.

Prices are meaningful only if they relate to products of identified homogeneous quality. This requires a grading system, which began early in the history of USDA and in some instances even before USDA was established. The broadest authorization for grading systems is provided by the 1946 Agricultural Marketing Act.

Public price reporting has become a controversial market information component as private reports have developed that directly compete with USDA market news reports. Sumner and Mueller (1987) show that private information is quickly embedded into USDA prices. Further complications have developed as markets become vertically coordinated (ownership integration or contractual) and rely on pricing formulas that include prices from either residual spot markets or from finished product markets. In the case of eggs and meat, private price reporting evolved as the focus of the industry rather than USDA reports.

Private reporting is acceptable to economic agents in the supply chain when the belief is that the private reports more accurately reflect market conditions compared to public reports. An issue is when contracts and integration account for a large share of total trades at a pricing point, the information value of the spot market is eroded. It is difficult to analyze when the information value of spot markets is no longer useful. The Livestock Mandatory Price Reporting Act of 1999 is one example of the policy reaction to this dilemma. This Act requires large meatpackers to report all livestock transaction prices to the Agricultural Marketing Service of USDA. The broader coverage mandated in the Act is in response to a persistent decline in the volumes traded through spot markets. Dhuyvetter (2004) shows how the prices for segregated early-weaned pigs can be determined using market prices of inputs as a way to assist in price discovery when data is private.

[5] Readers interested in more detail on these acts are urged to consult the Website of the Agricultural Law Center of the University of Arkansas [http://www.nationalaglawcenter.org/]. Details of each piece of legislation mentioned are provided along with recent case law interpretations. For a less technical treatment, see Breimyer (1976).

The market structure of oligopsony at the farm gate has resulted, over many years, in legislation that attempts in various ways to countervail or redress the imbalance of market power. This has evolved into a complex of institutional and legislative aspects that serve to make commodity marketing an exclusive feature of agrifood supply. Agrifood supply chains in the U.S. economy exhibit an extensive array of institutions and legislation aimed at redressing the balance of market power.

Relative Market Power Shifts in Agrifood Supply Chains Away from Food Manufacturers Downstream to Food Retailers

A longer-term agrifood supply chain trend is that market power has been shifting away from food processors to food retailers and restaurants as downstream businesses closer to the ultimate consumer. The uniqueness of agrifood firms is that this is a much longer process and has more complexity associated with the unique aspects of food. This trend is true in the United States and in other countries. In the United States, leading grocery retailers such as Walmart are now called "chain captains" because they possess relatively more influence in many agrifood supply chains when compared to other participants in the same chain, such as food processors (Sporleder and Peterson 2003). Sporleder and Peterson argue that chain captains possess economic market power within some agrifood supply chains sufficient to influence the behavior of participants within the entire chain. [6]

Market power concerns are considered by the U.S. Department of Justice often in the event of industry consolidation, where one firm merges with a rival firm in its industry. Complex and sophisticated quantitative tests have been developed to assist courts and regulators in determining firm conduct that may not in the best interest of the public (Abere et al. 2002). Evidence from Schumacher and Boland (2004) suggests that the persistence of accounting profitability in retail grocery supermarkets was the greatest and most long-lasting of any sector of the food economy. In addition, retail grocery supermarkets and restaurants are integrating upstream into wholesaling while processors are integrating downstream towards wholesalers (Dorsey and Boland 2009). However, the authors note that such integration by processors and restaurants into wholesaling has resulted in discounted accounting profits.

Some restaurants, such as McDonalds, while not engaged in vertical integration activities, have expanded their economic influence. This market power stems from their global market share and number of retail locations. Their substantial volume results in increased negotiating leverage with suppliers, access to information on consumer demand for food products through transac-

[6] One specific example is the well-known case of Walmart's packaging scorecard for its suppliers. Walmart is now the largest grocery retailer. The packaging scorecard created by Walmart is their attempt to specify metrics useful to compare the sustainability of practices and the environmental friendliness of packaging among their suppliers. The scorecard evaluates the "green quotient" of product packaging based a number of attributes including 1) greenhouse gas emissions related to production, 2) materials used, 3) product to packaging ratio, 4) cube utilization, 5) recycled content usage, 6) innovation, 7) the amount of renewable energy used to manufacture the packaging, and 8) the recovery value of the raw materials and emissions related to transportation of the packaging materials. Walmart has sufficient market power to dictate that its suppliers will use the scorecard. This is a specific example of the Chain Captain notion within a supply chain.

tional data, and core competencies in logistics and inventory management. This culminates in lower average costs per unit of volume relative to their competitors.

Successful brands can provide enhanced market power over time. Interbrand's list of the top 100 most valuable global brands includes four restaurant brands (McDonald's, KFC, Pizza Hut, and Starbucks), six food manufacturing brands (Nescafe, Nestle, Danone, Campbell, Kellogg, Heinz), and three beverage brands (Sprite, Coca-Cola, Pepsi). Such brands suggest greater economic influence and tend to be more valuable as a percentage of total market capitalization relative to other industries. Boland, Freberg and Barton (2001) found that common indicators across successful Fortune 500 food economy firms included large market share, valuable brands, differentiated image or products, and a broad product line. The substantial market share enables global food processors, retail and restaurant firms with these brands to pursue other agendas, such as sustainability initiatives to reduce unneeded space in packaging (e.g., reduce size of boxes to minimize the amount of empty space), increase the use of recyclable materials in packaging, and improve the appearance and consistency of produce. While the substantial market share may be true of other industries, the length of the supply chain coupled with the many firms, agencies, and non-governmental organizations in the agrifood industry makes this process much more complex.

Similarly, the size of space used in cages for layer chickens, use of growth hormones in beef production, use of bovine somatotropin (bST) in fluid milk, and other issues have resulted in voluntary changes made by producers upon request from these retail supermarkets and restaurants (McCorkle 2009). Sumner et al. (2010) note that new regulations on cages in California will result in eggs being imported into California from other states rather than produced in California. Similarly, bST is no longer used by dairy producers. Scale of operation enables some retailers and restaurant chains to negotiate effectively and act in a manner consistent with chain captains.

Access to information on consumer demand also has led to enhanced relative market power for retail grocery supermarket and restaurant firms relative to food processors (Sexton 2000). Evidence suggests this holds even in emerging markets in Latin America and Asia (Cook et al. 2001). The use of scanner data and loyalty programs has enabled grocery retailers and food processors to better understand consumer buying behavior and purchasing patterns. The near instantaneous use of such data allows these firms to conduct experiments on pricing to better determine how consumers respond to relative price movements. This is especially useful when trying to determine the value of a brand relative to a store brand or private label brand (Kinsey 2001).

Globalization of Agricultural Production and Agrifood Supply Chains

Globalization is a complex reality fed by technological changes and inducing dynamics in living standards and consumer demands around the world (Gallo 2010). Globalization involves a feedback system. Information technology enables globalization, which in turn increases market size, returns to scale, competition, capital flows and therefore political pressure for multilateral trade agreements and market access among countries (Boehlje, Akridge, and Downey 1995). Globalization allows for and promotes foreign direct investments by permitting capital to seek its high-

est return anywhere in the world. The impact of globalization is extraordinary in many ways. Consumers directly benefit through better, faster, and cheaper products.

Global trade in many agricultural commodities is subject to market forces and government policy. These programs generally shield farmers from transitioning out of agriculture and provide income enhancement for farmers through numerous government programs and policies. The programs exist primarily in the United States and European Union countries. Resource adjustment over time is influenced by trade policy.

For example, U.S. farm policy is subject to a five year planning horizon since the authorizing legislation and legislation providing appropriating funds for the authorized programs is done every five years. Furthermore, trade agreements are negotiated by a President through treaties approved by the U.S. Senate. Many of the trade agreements have a provision for agriculture that is written outside of the Farm Bill (U.S. Office of the Trade Representative 2011). All of these policy issues have implications for agricultural production.

It is well-known that some U.S. agricultural programs have provided economic rents to landowners. Dhuyvetter and Kastens (2010) suggest that these rents are significant in determining farmland values and farmland leases are attributed to direct payments of income from the U.S. Treasury to landowners. These economic rents are significant enough that producers will not change cropping patterns quickly unless there are significant changes in relative commodity prices, such as during the 2005 to 2008 crop seasons. During these seasons the renewable fuels mandate drove relative corn prices high and consequently producers began moving more acreage into corn. Land retirement programs, such as the Conservation Reserve Program, are another example. This program idled millions of acres of land and slowed resource adjustment in agriculture. This program was part of the U.S. agricultural policy. In recent years, some of this land was brought back into production when agricultural prices began to increase.

Countries who are members of the World Trade Organization abide by certain rules which include not using agricultural programs that provide incentive distortions to producers and induce them to plant crops at prices not established in global markets. However, countries have undertaken other methods to enhance producer income such as direct payments, crop insurance subsidies, and marketing promotion programs. For all of these reasons, resource adjustment in production agriculture is slow to change over time.

Resource adjustment is not limited to production agriculture. The role of institutions also can limit how quickly agribusiness firms adjust. For example, Boland, Golden, and Tsoodle (2008) noted the high degree of closely-held, family-owned, or cooperative businesses in the U.S. food economy relative to other sectors of the economy. The governance structures of these firms are not unique to the United States. Indeed, family-owned businesses dominate the food economy of many countries and impact the political economy of many countries. Thus, resource adjustment may be slow to change among agribusinesses in many countries.

Globalization increases competition, making it more difficult for firms to raise prices when costs rise. Greater competition also drives managers to add value to goods or services to keep ahead of competitors. As a consequence, production is constantly transferred to the most efficient and

innovative firms in a globalized marketplace. Consumers directly benefit through better, faster, and cheaper products. Furthermore, the impact of globalization has been a topic of many case studies in the *International Food and Agribusiness Management Review* and similar publications (for an example, see Boland and Gallo 2009).

Globalization affects agribusinesses in several ways. First, firms need to have a strategy for competing globally (Busch and Bain 2004). Commodity-oriented businesses compete on low-cost of production, handling, distribution, and shipping. Food processors must have a large domestic consumption of the good that is being traded so as to be able to trade the high-valued exports and utilize the lower-valued product in the domestic market. This is often true for products with jointness or fixed proportions such as chicken (legs and thighs vs. breasts), beef cattle (steaks vs. middle meats vs. ground hamburger), wine (reserve grapes vs. regular grapes), and ethanol (fuel vs. distillers grains).

For commodities where low-cost per unit is critical, trade is most prevalent. The United States has higher cost of production due to relatively high land prices and capital inputs, but enjoys lower shipping and transportation costs. In aggregate, this makes the United States cost competitive with other countries in South America. With regard to processed food products, countries in the European Union have the most integrated level of trade in food products between countries, especially Germany (Central Intelligence Agency 2011). With regard to agricultural commodities, Brazil is becoming larger due to its unique geographical position with much of its arable land between the equator and 30 degrees south latitude. This enables it to become a larger exporter of horticultural crops, row crops (soybeans) and livestock (beef and poultry).

Implications for Research

Cost competitiveness studies are important for developing a strategy to compete in the food economy. Such cost studies must include the entire supply chain because of the uniqueness of the agrifood economy and include such global dimensions as the sensitivity of competitiveness to changes in currency exchange rates. Examples of this are the Rabobank industry studies. As an illustration, Kiechel (2010) discusses why this type of study is an important activity for strategy consulting firms. Examples of how firms and their managers compete in this environment are critical for researchers to understand. For instance, Penrose's (1960) pioneering research case on Hercules Powder was one the first to use a case study approach in a scientific manner for research on industry analysis. This is an example of how an academician can conduct an in-depth analysis of a firm and the industry in which it operates in an effort to better understand how strategy evolves. The Industry Studies Association, which was established by the Alfred P. Sloan Foundation, is designed to share such scholarship.

The Nobel Foundation has recognized the achievements of North, Coase, Williamson, and Ostrum in recent years for their work in institutional economics. It is likely that these contributions will find their way into graduate degree programs in agricultural economics and management. The National Food and Agribusiness Management Education Commission reported that only four programs were teaching these institutional economics concepts (Boland and Akridge 2004). Over time, it is likely that this will increase because as numerous authors have noted, there are many applications to the food economy of these concepts (Sykuta and James 2004). For exam-

ple, the prevalence of closely-held firms such as agricultural cooperatives as an institution globally is one aspect that requires greater exploration (Cook and Chaddad 2004). King et al. (2010) summarize much of the literature on cooperatives. As Boland, Golden, and Tsoodle (2008) note, the prevalence of family-owned firms and cooperatives are unique governance structures that are typically not studied within colleges of business programs.

The theoretical and empirical work to substantiate these theories is predominately based upon observation through the use of case studies and other qualitative data techniques. Methods such as research cases of firms within agrifood supply chains need to become part of the standard program for graduate student training in much the same way that econometric and mathematical programming are an important part of graduate training in agricultural economics and management.

This carries over to the choice of doctoral student topics. Boland and Crespi (2010) conducted a census of every dissertation published in agricultural economics and management in the United States over the 1950 to 2005 time period and among many findings, reported less than ten dissertations which used a case study type approach. In fact, there was a significant time gap between Goldberg's 1952 dissertation on the soybean processing industry and the next dissertation that used a similar qualitative approach. Many agricultural economics and management graduate faculty are likely to be uncomfortable with such methods. Two notable exceptions are Wysocki (1998) and Burress (2007). It is important to continue to promote the use of such techniques and educate our colleagues and graduate students on their use. Unfortunately, the majority of agricultural economics and management departments lack critical mass of such faculty.

The training most agricultural economists receive in their doctoral programs enables them to work with large complex time series and/or cross-sectional data sets, such as those often found in large retail groceries. These techniques are within the traditional domain of the agricultural economics discipline. The authors argue however, that a deep understanding of the uniqueness of the food economy, that can be derived primarily from case studies and qualitative analysis, is important for graduate students seeking eventual employment within agrifood industries.

A related issue, although much debated in the professional academies, is the relevance of agricultural economics and management. The short-term budget issues which are really longer-term in nature suggest that universities value the agribusiness management teaching function at the undergraduate level and the production economics and quantitative methods function at the graduate level for engaging with agricultural science colleagues on USDA National Food and Agriculture Institute mission research (Boland 2009). Cook and Chaddad (2000) provide an excellent historical perspective on agribusiness management research. In general, management research on agribusiness firms is not in that mission with the exception of cooperatives and those programs are heavily funded through faculty chair endowments and centers. Boyd et al. (2007) conducted an extensive literature review of management as an input in agribusiness firms and found little empirical evidence demonstrating that it had a significant impact on agribusiness performance. While it is evident that increased resources are needed for graduate program initiatives in agribusiness economics and management, it is difficult to see where they will emerge except through the social sciences rather than the agricultural sciences.

Managerial Implications

The exclusivity of agrifood supply chains provides a rich foundation for managerial implications that focus on industry forces that a firm must take into account when developing corporate strategy. The agrifood supply chain is globalized, requiring managerial knowledge regarding international trade and the complex labyrinth of regulations and stakeholders that influence commodity production in most countries.

Implications abound for the managers of firms in the agrifood supply chain. A clear picture emerges from the exclusivity aspects enumerated here that competition may materialize from sectors previously thought to be unrelated to food production and distribution. Big pharmaceutical companies are an example. The rapid pace of innovation in human medicine from biology and nanotechnology will influence future agrifood supply chains in unprecedented ways. Everything from new food products to new markets will develop and challenge existing firms to be nimble in planning.

The implications for agrifood supply chains and the firms operating within them are numerous. The future will be more complex than the present. The implication of enhanced complexity covers most choices that firm managers must make over time: strategic choices, external choices, organizational choices, and operational choices. The factors that comprise these choices offers some glance at the future decision-makers must face. For example, the number of products offered in the market, the geographic scope of the firm (i.e., number of countries), and the source and sustainability of differentiation (e.g., brands, products characteristics, etc.) are leading elements of strategic choices. Firms successful at growth will be adroit at knowing when to advance new products and services (strategic timing, exploiting new technology to enhance value to ultimate consumers, and at capturing this value). One small specific example of exploiting technology would be a food manufacturer taking advantage of the development of low-linoleic soybeans to produce healthier foods with little or no transfat.

Corporate social responsibility (CSR), defined in a broad sense, emerges from this analysis in several ways.[7] The so-called triple bottom line endeavors will continue to be important to firms in agrifood supply chains as well as firms in manufacturing and service sectors. However, because of exclusive aspects such as globalization and technologies like gene modification of germplasm, CSR emerges as a vital element that agrifood firm managers must recognize and supervise which differs by location within the supply chain, but becomes increasingly important to all the stakeholders of agrifood firms.

The role of trade associations, promulgating soft law self-regulation, will be more important in the future. Trade associations will have an essential future role in codification of best practices within their particular industries. The term *codification* implies identifying or creating codes, which are compilations of written statutes, rules and regulations that inform trade association members of best practices and of acceptable and unacceptable firm conduct. .The dynamics,

[7] The broad sense of CSR refers not just to 'social responsibility' but includes the additional elements of environmental responsibility and governance responsibility. While the environmental is well-known, the governance element encompasses anti-bribery, board independence, engaging outside directors, full disclosure of remunerations, and independence and effectiveness of an audit committee (UNCTAD).

length, and complexities of agrifood supply chains as discussed in this manuscript will enhance the role of trade associations and other non-governmental organizations in promulgating soft law self-regulation. Soft law self-regulation will take on renewed importance in the future. As a specific example, one only need consider the notion that food and medical technology are merging in some applications to create new food supply chains as a means to deliver certain medical technology to consumers. Complex alternatives will need resolution by managers in an unprecedented way.

The role of food manufacturing research and development is less clear in the future than it is under the current agrifood supply chain. Regulatory issues, the nature and intensity of competition within a particular manufacturing industry, and the speed of innovation within the industry are all external to the firm. The elements of organizational choice and architecture include the internal structure of the firm, the role of research and development and innovation within the firm, and other elements less well-understood by managers such as corporate culture and CSR. Grocery supply chains have trended toward chain captains with increasing market power at the retail level as noted earlier. One implication is that entire supply chains or networks may compete against one another in the future.

The future role of business policy will become more important in agrifood supply chains. The complexity, length, and number of different firms (e.g. producers, first-handlers, manufacturers, wholesalers, food service suppliers, retail groceries, and restaurants), regulatory bodies, and other agents (NGOs) make the agrifood industry much different and exclusive relative to other manufacturing and service industries. Demands by NGOs and others will continue to present dynamic situations that add complexity to the chain.

One recent example of these complexities within agrifood supply chains include the support received for fundamental shifts in the manner in which nutrition information is presented to consumers (Institute of Medicine of the National Academies 2011). The Institute of Medicine recently called for a four-star front-of-package voluntary labeling of healthfulness on all food products in the United States. The suggestion is to move away from protocols that mostly provide nutrition information to protocols that offer clear guidance to consumers about the healthfulness of the product. Even though such a shift in labeling may appear to be a food processor issue, the reality is that it is a chain issue. It must be managed from a supply chain perspective to be implemented in a credible and cost effective way. Upstream supply chain participants must be vigilant to understand the ultimate needs of downstream customers. The future, no doubt, will be toward enhanced vertical alliances in supply chains in an effort to manage these types of chain issues.

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International Food and Agribusiness Management Review
Volume 14, Issue 5, 2011

Future Agribusiness Challenges: Strategic Uncertainty, Innovation and Structural Change

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Abstract

The global food and agribusiness industry is in the midst of major changes, and the pace of change seems to be increasing. These changes suggest three fundamental critical future issues for the sector: 1) decisions must be made in an environment of increasing risk and uncertainty, 2) developing and adopting technology and new innovations is critical to long-term financial success, and 3) responding to changes in industry structure and the competitor landscape and industry boundaries is essential to maintain market position. The focus of this paper is the synopsis and application of conceptual/theoretical frameworks that can be used in managerial decision making and analyzing the implications and consequences of strategic uncertainty, innovation and changing industry structure.

Keywords: Strategic uncertainty, innovation, structural change

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Introduction

The global food and agribusiness industry is in the midst of major changes—changes in product characteristics, in worldwide distribution and consumption, in technology, in size and structure of firms in the industry, and in geographic location of production and processing. And the pace of change seems to be increasing. These changes suggest three fundamental critical future issues for the sector: 1) decisions must be made in an environment of increasing risk and uncertainty, 2) developing and adopting technology and new innovations is critical to long-term financial success, and 3) responding to changes in industry structure and the competitor landscape and industry boundaries is essential to maintain market position.

The agricultural industry exhibits a number of challenging characteristics. First, it is highly volatile, both in production and market conditions. A combination of biological production processes that are subjected to unpredictable biological predators (disease, insects, pathogens, etc.), combined with variable climatic/weather/heat/rainfall patterns, results in significant variability in production and processing conditions and thus efficiency and output. This fluctuation in output or supply combined with the inelastic or non-responsive demand for food products results in dramatic price fluctuations, particularly at the crop and livestock raw materials stages of the supply chain.

The biological production processes for raw materials are also characterized by long production cycles and batch rather than continuous flow of production/processing, which means that in general production adjustments to changing conditions are lethargic. And the time delays between a new idea and a commercially viable product are much longer than in industries characterized by continuous flow processing and short production cycles.

The food and agribusiness industry is also characterized by very complex supply chains that are not well coordinated, particularly among the up-stream stages in that chain. The production sector in general is very fragmented which provides challenges for those firms further downstream that desire traceability or guaranteed and consistent quality attributes. Changes and innovations that require adoption/adjustment across the entire value chain (e.g., systemic innovations) are much more difficult to adopt and implement if that value chain is not only complex, but also fragmented and not well coordinated (Bröring 2008).

These characteristics of the food and agriculture industries challenge the static equilibrium assumptions of traditional economic theory. Instead, the analytical frameworks used to analyze issues in the industry must be dynamic in both time and uncertainty dimensions rather than static. The decision environment is complex and characterized by nonlinear processes, open rather than closed systems, incomplete rather than perfect costless information, errors and biases in decisions, and in constant adjustment -- and thus an evolutionary process. In summary, one should view the decision process in the food and agricultural industry as a complex adaptive process that requires broader and more powerful analytical frameworks than those offered by the traditional equilibrium driven theory of the firm economic concepts (Beinhocker 2006).

The focus of this paper is the synopsis and application of these more powerful adoptive/dynamic conceptual/theoretical frameworks to analyze the implications and consequences of the issues of

strategic uncertainty, innovation and changing industry structure. For each we present useful conceptual frameworks and then describe recent applications in agribusiness research and educational programs – our goal is to present concepts not just useful in academic research and education programs, but also in actual managerial decision-making.

Future Agribusiness Challenges: Strategic Uncertainty

Historically, most of the risk and uncertainty analyses in agricultural economics has focused on risk attitudes (Binswanger, 1981), operational decisions to manage risk (Mishra and Lence, 2005; Robinson and Barry, 1987; Anderson, et al., 1980), and the implications of risk for policy choices (Just and Pope 2001; Chavas et al. 2010). These analyses have generally used empirical/numerical analysis tools to quantitatively assess choices and consequences. Such analyses are very data dependent, and recent experience with some of the analytical models such as VAR (Value At Risk) in financial markets has undermined the credibility of some of the quantitative modeling and measures of risk. Taleb (2007) has argued that much of the quantitative analyses of the past has assumed that data sets are characterized by normality when in reality many economic phenomena exhibit skewed distributions. And the tails count -- they are the events that dramatically alter the business climate and shape the world.

Knight (1921) argues that risk and uncertainty are different concepts. With risk, the firm would have a *priori* knowledge of the underlying probability distribution, but with uncertainty there is not a *priori* information about that distribution. Managers find the distinction between systematic and residual or diversifiable risk useful because the strategies to manage/mitigate that risk are different for those risks that are associated with the broader market or overall economy than those specific to a particular company or venture. Hillson (2003) notes that uncertainty is any event or set of circumstances that, should it occur, would have an effect on one or more objectives. Thus, firms must utilize all available information to form best-guess estimates about the impacts of these risks through quantitative and qualitative methods to determine the realm of possible outcomes and choose strategies based on these outcomes.

The types and sources of risks and uncertainties faced by agribusiness decision makers have exploded in recent times—"unanticipated surprises" resulting from changes in government policy and regulation; mergers and acquisitions that change the competitive landscape and disease and food safety crises such as H1N1, BSE and salmonella contamination, for example. These new uncertainties are more complex and difficult to analyze and manage than traditional business risks—they are not as predictable in frequency and consequence, and they often create opportunities for gain as well as exposures to financial losses. They are often managed most effectively by business level strategies than by operational risk management tools or procedures. Different analytical concepts and tools than those typically used in risk analyses are needed to assess and manage strategic uncertainty. We briefly review the strategic uncertainties for agribusinesses firms, a decision model for managing those uncertainties and the potential of real options approaches to uncertainty management in this section.

Assessing Strategic Uncertainty

Firms must be proactive in managing uncertainty to create long-term value because uncertainty has upside potential as well as a downside exposure (Pascale et al. 2000). Focusing only on uncertainty avoidance as is typically the case in analyzing risk could cause a firm to overlook opportunities to create value (Nottingham 1996, Talavera 2004). Table 1 summarizes the key strategic uncertainties faced by agribusiness firms and various potentials and exposures for each. Although objective measurement of risk and uncertainties is preferred to subjective assessments, the increasing relative importance of strategic uncertainties in agriculture suggests that they cannot be ignored because they cannot be quantified. Until more objective evidence is available to build actuarially sound numerical estimates of risk, a systematic procedure to assess the frequency and consequences of these uncertainties may be essential. This, in fact, is the emphasis of recent developments in scorecarding (Thornton 2002).

Table 1. Strategic Uncertainties in Agribusiness

Categories of Strategic Uncertainty		**Examples of**	
		Potentials	*Exposures*
Business/Operational	Operations and Business Practices, People and Human Resources, Strategic Positioning and Flexibility	Superior Cost Control /Operational Efficiency, Superior Workforce, Creating Synergies Through Scope	Business Interruption, Loss Of Key Employees
Financial	Financing and Financial Structure, Financial Markets	Strong Financial Position, Access to Equity Funds/Investors, Attractive Financing Terms (Amounts and Terms), Financial Reserves (Pursue Unanticipated Opportunities, Weather, Financial Shocks, Etc.)	Rising Interest Rates, Loss of Lender, Highly Leveraged
Market Conditions	Market Prices and Terms of Trade, Competitors and Competition Customer Relationships, Reputation and Image	Strong Brand, Strong Complementary Products and Bundling Potential, First Mover Advantages, Create High Switching Costs (Create Loyalty)	Pricing Pressure/ Discounting by Competitors, Loss of Market Share, Consolidation of Customer Industry, Hyper-Competition
Technology	Technological Change	Speed of Innovation and Commercialization, Niches Not Attractive to Others, Enhanced Learning Capacity	Limited Acceptance of Biotechnology, Slow to Commercialize New Products, Competitor has Preferred Standards/Platform
Business Relationships	Business Partners and Partnerships, Distribution Systems and Channels	Strong Market Position of Distributors, Strong Relationship with Processors, Enhanced Learning, Access to Future Opportunities	Dependence on Distributors, Not a Preferred Supplier to Processor, Not a Key Account to Suppliers
Policy & Regulation	Political Climate, Regulatory and Legislative Climate	Increasing Market From More Open Trade, Patent Protection, Speed of Approval	Changes in Intellectual Property Law, Changes in Industry Subsidies or Tax Policies, Local Limits on Technology Adoption

Source. Adapted from Detre et al. (2006)

The purpose of scorecarding and heat mapping is to use a mental model that frames assessment of uncertainty from both a potential and an exposure perspective. Scorecarding consists of taking qualitative discussions about strategic uncertainties and turning these discussions into ordinal rankings. Heat mapping, a process of taking the rankings from scorecarding utilizing both colors/symbols and generic strategies to communicate the impact of the uncertainty on the business, further operationalizes the assessment process. In essence, these mental models are designed to promote and generate discussion around key areas of uncertainty through a systematic framework that directs the firm in selecting an appropriate uncertainty management strategy (Detre et al. 2006).

Capturing Opportunities from Strategic Uncertainty

(a) A Decision Model

Capturing the potential or opportunities from a strategic uncertainty and simultaneously mitigating the exposures is not easily accomplished. Raynor (2007) argues that for companies to succeed in an unpredictable future, they must develop practical strategies based on multiple choices that respond to the requirements of different possible futures rather than on a single strategic commitment. He suggests that the key to such decisions is strategic flexibility. Courtney (2001) provides a useful conceptual framework for making these complex decisions. Figure 1 recasts Courtney's mental model in the more familiar and structured analytical framework of a decision tree that can be linked to a payoff matrix.

Courtney suggests that developing strategy in an uncertain environment is a two-stage process: first, choosing a strategic posture which defines the intent of strategy; and, second, selecting a portfolio of actions that are the specific moves or activities that can be used to implement the strategy. The strategic postures are contingent upon the level of uncertainty reaching from: 1) a clear, certain future, 2) alternative well delineated futures or scenarios, 3) a range of futures but not scenarios, to 4) true ambiguity. Three strategic postures are identified: 1) shaping the future where the decision-maker attempts to drive the industry toward a new structure of their own design, 2) adapting to the future where one takes the current and future structure of the industry as given and reacts to the opportunities that structure offers, and 3) a wait-and-see approach where one reserves the right to play by making incremental resource commitments to enhance one's ability to be a successful market participant in the future. These different strategic postures are illustrated in the decision tree of Figure 1.

If an adapt or shape strategic posture has been selected, three different types of actions or moves can be made to implement the strategy: 1) no regrets moves that are expected to pay off no matter what future comes to pass: 2) an option which is designed to secure high payoffs in the best-case scenarios while minimizing losses in worst-case scenarios; and 3) a big bet which involves large commitments of resources that will either pay off big or lose big. If the reserve strategic posture is adopted, only an option action may be chosen.

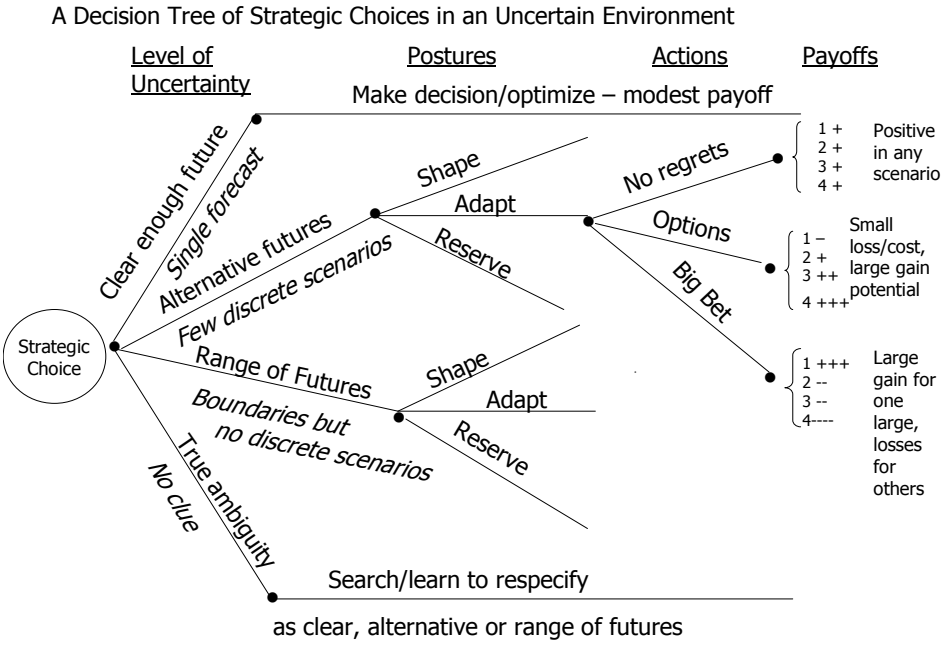

Figure 1. A Decision Tree of Strategic Choices in an Uncertain Environment
Note. The actions for the adapt posture apply to all adapt and shape postures in the decision tree. The action for the reserve posture applies to all reserve postures in the decision tree.
Source. Adapted from Courtney (2001).

An application illustrates the usefulness of this decision framework. A retail agricultural chemical supplier was assessing whether or not to introduce precision farming and variable rate application services to its customers. The level of uncertainty of the effectiveness of variable rate technology was characterized as one of alternative futures with three scenarios: 1) it is not cost-effective in general, 2) it is cost-effective for most customers, and 3) it is cost-effective only for those customers who have highly variable soils. Strategic postures and actions were identified as: 1) shape the market by being a market leader, with the action being a big bet start-up of a new division to provide the full spectrum of precision farming services; 2) adapt to the future with an options action of investing in personnel and equipment for soil testing and yield mapping that could be used to support an expanded precision farming program including variable rate application, or could be used to improve the quality of recommendations, service and application with standard equipment; or 3) reserve the right to play by developing a joint venture with an out-of-market partner who operates in an area with highly variable soils with an option to buy (or sell) the business depending on developing market conditions. Framed as these strategic choices, the company altered its initial choice from being a market leader providing the full spectrum of services to a joint venture with an out-of-market partner.

(b)Real Options

Real options concepts are useful in structuring a decision to manage downside risk while maintaining the possibility to capture upside potential. In essence, a real option is like a financial option – investing a modest amount today to take a position in the future. When the future arrives, the option can be exercised or allowed to expire. This approach is regularly used in making busi-

ness decisions where option payments are made to maintain the right to acquire a particular parcel of real property in the future, minority investments are made in startup companies with an agreement to have the first right to buy a majority interest in some future time period, or pilot plants are constructed to test an idea before a full scale manufacturing facility is built (McGrath and McMillan 2000; Luehrman 1981; Hyde et al. 2003; Purvis et al. 1995; Boehlje et al. 2005).

An options approach explicitly considers the benefits additional information will have on the value of a decision or investment. A real options framework is appropriate for situations where the manager can make incremental decisions throughout time, thus creating flexibility in the decision. Such options might include deferring, abandoning, or expanding a given project. Thus, real options are a learning model that allows management to make informed and accurate decisions over the course of time (McGrath and McMillan 2000; Luehrman 1998; Boehlje et al. 2005).

As depicted in Figure 2, McGrath and MacMillian (2000) suggest that there are four basic categories of projects when viewed from the perspective of market uncertainty and technical uncertainty[1]. *Positioning options* create the right to wait and observe what technologies or standards will develop to serve a relatively well defined and certain market. *Scouting options* are focused on taking relatively well understood technologies and products to a new and not well understood potential customer base. *Stepping stone options* face both high technical and market uncertainty, and so should be initiated with "experiments" to either gain more information as to customer wants and needs, or increased capability and capacity relative to the preferred technology to respond to those needs. *Launches (platform and enhancement*) involve full blown commitments that can be safely made because both the technology and the customer base are reasonably well understood and less uncertain.

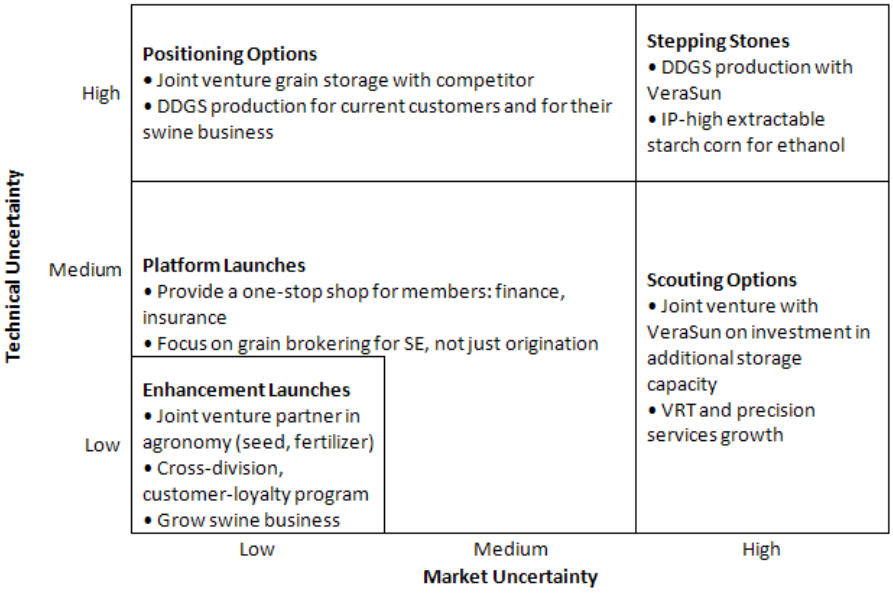

Figure 2. Portfolio of Options for a Retail Farmer Cooperative
Source. Adapted from Roucan-Kane et al. (2010).

[1] Miller and Folta (2002) present an alternative framework for assessing and managing projects and new ventures in an uncertain environment.

Portfolio arguments can be combined with these option concepts to manage risk through diversification. To reduce the risk of new ventures, a specified percentage of the financial and personnel budget available should be allocated to all four different project categories.

The use of this analytical framework by a retail cooperative responding to the rapidly expanding biofuels industry illustrates its application. The options described in Figure 2 were identified as alternatives to consider to capture the potential and mitigate the exposure of the prospect of an ethanol plant being constructed in the center of the retailer's trade territory, as well as significant expansion of ethanol plant capacity in surrounding communities.

Future Agribusiness Challenges: Innovation

Innovation is critical to the long-term success of a firm as well as the economic health of an industry and the overall economy (Gertner 2004). Brown and Teisberg (2003; p1) state that "Innovation is the lifeblood of successful businesses. […] [It] has become every firm's imperative as the pace of change accelerates". Indeed, innovations are one strategy to develop and maintain a sustainable competitive advantage (Kirwin et al., 2008; Shanahan et al. 2008; Mikkola 2001; Bard et al. 1988).

The literature on technology and innovation management combines a plethora of different streams of themes, frameworks and specific models. From a fundamental theory point of view, this paper follows the resource-based view (RBV) of strategy and firm behavior and decision-making. From a resource-based perspective, innovations are new combinations of existing and/or new resources and competencies (Penrose 1959, 85). Hauschildt argues that such a "new combination" must at least advance to the stage of market introduction as a new product, or must be utilized as a new process in production (Hauschildt 2004, 25). Since R&D endeavors can also be exploited in other terms (e.g. licensing), any new combination of existing and/or new resources and competencies which is commercially exploited is an innovation (Roberts 1988, 11). Hence, commercialization is a critical delineator between an invention and an innovation. Therefore, in this discussion, we define innovation as a product, a service, a process, a new business model, or a management system that solves a problem and has impact.

The food and agribusiness sector is no stranger to innovation. Over the last 150 years, there have been several waves of innovation related to machinery, chemistry, seed, information management (Graff et al. 2003; Gray et al. 2004; Gray and Boehlje 2007; Cloutier and Boehlje 2002) and food (Sporleder et al. 2005). In addition, innovation is and will remain essential in the food and agribusiness sector to respond to the critical concerns of society such as climate change and global warming, food/energy scarcity and security, environmental challenges and resource use/sustainability.

Most of the research on invention and innovation in the agricultural sector in the past has emphasized the issues of technology adoption (e.g., Sunding and Zilberman 2001), productivity increases (e.g., McCunn and Huffman 2000), and induced innovation (e.g., Ruttan 1997). In addition, much of the research has been conducted at the industry level and not at the firm level. In this section, we discuss invention and innovation at the firm level and focus on innovation management with an emphasis on: 1) creativity and innovativeness, 2) selection of invention

projects and management of the portfolio of inventions and innovations, and 3) organization of innovation. As will be discussed in detail in the next section, an additional important issue concerning agribusiness innovation is created by the length and complexity of the value chain (Bröring 2008; Fritz and Schiefer 2008); the challenge is bringing innovations from the input end of the chain created by the physical and biological sciences of engineering, genetics, nutrition, biotechnology and nanotechnology to successful market acceptance and adoption at the retail consumer end of the value chain.

Assessing Innovation: Creativity and Innovativeness

While innovation management research has encompassed the entire innovation process, the importance of the "front-end" – the stages of ideation and idea evaluation and selection – has drawn much attention in the current management literature (Kuhrana and Rosenthal 1998; Koen 2004; Bröring et al. 2006). Barsh et al. (2008) identify several characteristics essential for a company to successfully build and maintain an innovative culture such as encouraging innovative behaviors; no penalty for failure; openness to new ideas; making innovation part of the strategic-planning process; and implementing a fast innovation process to identify success and failure fast. They also indicate that to advance innovation, leaders should help their employees by defining the type of innovation they expect, by adding innovation to the formal agenda at regular leadership meetings, and by setting performance metrics and targets for innovation (Barsh et al. 2008).

Christensen and Raynor (2003) perceive product/service innovation as serving four potential types of customers: over-served customers, satisfied customers, under-served customers, and non-customers. Raynor (2007) suggests that although innovation projects serving over-served, under-served or non-customers are more uncertain, they potentially are more rewarding.

Roth and Sneader (2006) suggest that companies have to find new ways to learn from customers and consumers. IDEO, an innovation consulting company, assesses how consumers buy and use the products in stores, at work, in restaurants, or at home through observation, in-context interviewing and "living with consumers". This in-context analysis allows them to understand better the unfulfilled needs of the customers and brainstorm innovative ideas accordingly. For each project, consulting teams consist of employees with different skills, expertise, and cultures to maximize the results of the brainstorming process (Nussbaum 2004; Brown 2005).
Makri et al. (2006) show that technology-intensive firms can bolster innovation by aligning CEO incentives with short-term financial results and behavioral indicators of long-term innovation quality (invention resonance and science harvesting). Invention resonance refers to an invention's ability to stimulate subsequent inventions. Science harvesting reflects a firm's commitment to exploiting basic scientific research and new technologies to generate new innovation. Their conclusions are the result of an analysis using a sample of 206 publicly traded firms from 12 U.S. manufacturing industries.

Detre et al. (2009) present a conceptual model (see Figure 3) to help agribusinesses in developing a culture of innovativeness. Innovativeness is defined as a corporate culture where managers push for new, disruptive innovations and make creation their consistent message and focus. The authors provide an illustration of the conceptual model by profiling Land O'Lakes, a

food company. The vertical axis in the conceptual model in Figure 3 depicts the flexibility (from low to high) firms have to make their decisions in the context of the strengths and weaknesses of their firm, the market, and the competitive environment. The horizontal axis represents progression over time.In the first stage, a firm must commit to making innovation a key focus by establishing a culture of innovativeness throughout the organization. They also indicate that if a firm is highly dependent on its supply chain, the success of their innovation will depend on the level of commitment to innovation by other members of the supply chain. In the second stage of the conceptual model, the firm must first choose how they organize their company. The firm must choose an organizational structure (also called chain of command) that is conducive to innovation and allows for flexibility and fast decision-making. Once an organizational structure is chosen, firms must adopt policies and procedures that will encourage innovativeness and increase the profitability and success rate of innovation.

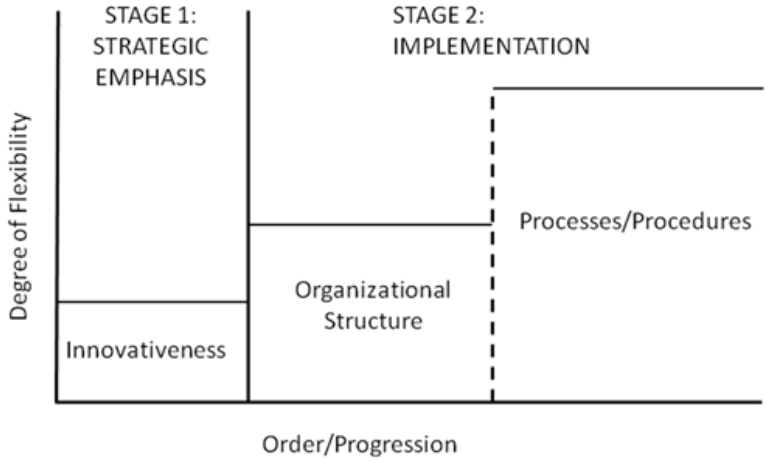

Figure 3. Conceptual Model of Managing for Innovation
Source. Detre et al. (2010)

Capturing Opportunities from Innovation

(a) Selection of Innovation Projects

After identifying innovative ideas, companies' next challenge is to select which ideas they will pursue. Selecting the right innovation projects is challenging for at least three reasons: (1) innovation has a significant impact on a firm's current and future financial position, (2) R&D funds are limited, and (3) the future success of innovation projects is hard to predict accurately (Bard et al. 1988; Hall and Nauda 1988; Tian et al. 2005; Heidenberger and Stummer 1999; Cooper at al. 1999). Most organizations find that they have several good ideas but lack the framework required to select and convert the best ideas into new revenue (Anthony et al. 2006; Huurinainen 2007).

In the past four decades, several selection methods have been proposed to help organizations make better decisions in R&D project selection; Boehlje et al. (2009) summarize and evaluate these methods. Cooper et al. (1998) and Coldrick et al. (2005) found that top performing compa-

nies use several selection methods with an average of 2.34 selection methods used (Cooper et al. 2001).

Cooper et al. (2001), Meade and Presley (2002), and Kester et al. (2009) found that economic models (such as net present value and internal rate of return analyses) are the most popular selection methods, followed by graphical methods. But Cooper et al. (2001) also found that companies relying heavily on these economic models may not generate portfolios of innovation projects that perform as well as companies incorporating more qualitative analyses (specifically, categorization of projects into strategic buckets). This result might be in part because for potential breakthrough ideas, data is often inaccurate early on and therefore economic methods would underestimate the sales and profits of such innovations (Roth and Sneader 2006).

Roucan-Kane (2010) conducted a survey of food and agribusiness companies and their use of selection methods when pursuing innovation. Companies surveyed use an average of 2.27 selection methods with the most popular being economic models followed by informal methods and more qualitative analyses such as structured peer review, checklists, and scorecarding. Smaller food and agribusiness firms (in terms of revenue) were more likely to use informal methods, while larger firms use more economic and structured methods.

Behind every selection method is a set of criteria being used to select projects. Using a choice experiment, Roucan-Kane (2010) surveyed 85 top executives of U.S. food and agribusiness companies regarding their stated preferences for innovation projects based on five criteria: distribution of potential return/market risk, risk of technical/regulatory failure, time to market, capability, and costs already incurred. She found all criteria to be critically important to this sample of executives in the selection process. She also reported that executives prefer (in decreasing order of importance) projects with low risk of technical/regulatory failure, low relative market risk, short-term to market, in-house capability, and high costs already incurred. This leads her to conclude that the food and agribusiness industry is a conservative and risk averse industry in terms of innovation, and that strategies to manage the risk of technical/regulatory failure and market acceptance merit consideration.

One way to manage the technical/regulatory and market risk is to select a portfolio of innovation projects with varying degrees of risk as suggested by McGrath and MacMillan (2000). Roucan-Kane and Boehlje (2009) illustrate the use of the McGrath and MacMillan framework described in the previous section to Deere and Company's innovation projects (Figure 4). The framework again suggests a diversified portfolio of positioning, stepping stone and scouting options along with platform and enhancement launches to manage market and technical uncertainties.

Roucan-Kane (2010) studied the portfolio of innovation projects for food and agribusiness companies using the same criteria as the one used in her choice experiment. Her survey results indicated that companies tend to diversify their innovation projects in terms of time to market and cost already incurred. They favor projects that are done in-house, and that are not characterized by significant risk of technical/regulatory failure or high relative market risk. Her analysis indicates substantial heterogeneity among the surveyed companies in terms of the time to market, costs already incurred, technical/regulatory risk, and capability considerations. Approximately 50 percent of the firms, primarily smaller firms, are more conservative in their portfolio with a large

proportion of short-term projects exhibiting low technical/regulatory risk. The remaining 50 percent of the sample is clearly not conservative with most willing to commit to long-term projects. In addition, about 13% of the companies are willing to bet on the highly technically and regulatory risky projects, and 23% are willing to share capabilities with partners to embark in their innovation endeavor.

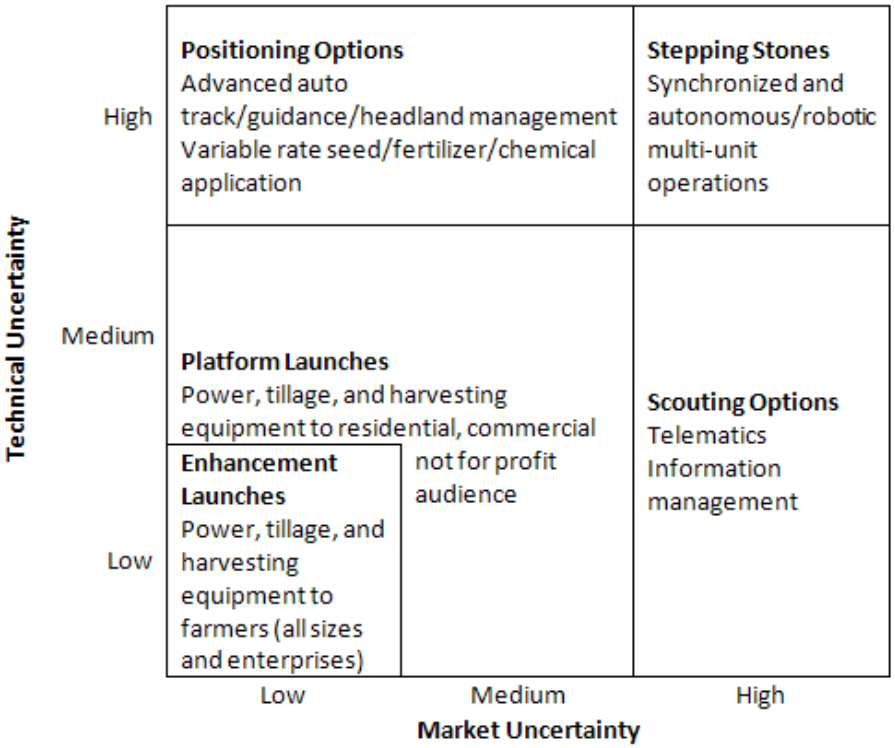

Figure 4. Deere Portfolio of Innovations
Source. Adapted from Roucan-Kane and Boehlje (2009)

(b) Organization of Innovation: The Stage-Gate Process

The selection of innovation projects should be regularly reviewed as uncertainty is resolved and new projects enter the pipeline. Cooper's stage-gate process (Cooper 2001) proposes a structure to continuously analyze the portfolio of innovations and increase the likelihood of success in an uncertain world. His process features five innovation stages (scoping, build a business case, development, testing and validation, launch); each stage (and sometimes within a stage) ends with a gate where the resource allocation and the prioritization of projects is reviewed and changed if needed. Having a stage-gate process facilitates speed to market as the stages are cross functional and involve several activities (research and development, technical, market, financial, operations, etc).

Boehlje and Roucan-Kane (2009) summarize Deere and Company's stage gate processes of the Enterprise Product Development Process (EPDP) and the Accelerated Innovation Process (AIP). EPDP focuses on incremental innovations, insuring that these innovations reach the quality

standards Deere has set before the product is launched. AIP is targeted towards radical innovations with the use of selection methods such as strategic buckets, structured assessment, and economic models.

To get the most out of the stage-gate process, innovation projects should be evaluated by cross-functional teams (Cooper et al. 2004; Christensen et al. 2004; and Christensen and Raynor 2003). Roucan-Kane (2010) found that food and agribusiness companies use cross-functional teams with an average of 3.36 functional areas involved. She also found that larger firms and firms more committed to innovation are less likely to involve salespersons in the innovation selection and review process as they tend to be too biased towards short-term innovation.

Future Agribusiness Challenges: Structural Change

The impacts and consequences of the structural change (consolidation, vertical integration and changes in the vertical and horizontal boundaries of the firms) now underway in agriculture are dramatic and profound (Rogers, 2001; Stiegert et al. 2009). They will influence almost all the participants in the food production and distribution industries: consumers, food manufacturers and retailers, producers, input supply manufacturers and retailers, and public regulators as well as educators and researchers. Because of the breadth and distributional dimensions of their impact (some will gain while others lose because of these structural changes), the realignment process will be surrounded with great controversy.

Three dimensions of those structural changes are reviewed here: a) the drivers/determinants of structural realignment within the industry; b) the unique role that risk management/mitigation plays in developing sustainable value chain governance structures, and c) industry convergence – the blurring of the boundaries of the agribusiness and related industries driven by advances of knowledge and technology applied across these boundaries.

Assessing Structural Change

(a) Drivers/Determinants of Structural Change

Useful conceptual frameworks that explain the structural changes noted earlier come from the fields of economics and management theory including: *(i) transaction cost economies*, *(ii) negotiation/power and trust*, and *(iii) strategic management*.

(i) Transaction Costs Economies

Transactions cost economic concepts have been effectively applied to structural change and governance issues in the agribusiness industries by numerous analysts (Allen and Lueck 2003; Barry, Sonka and Lajili 1992; Hennessy and Lawrence 1999; Johnson and Foster 1994).

The concepts of *transaction costs* and *principal-agent* theory as conceived by Coase (1937) and expanded by Williamson (1979) and others indicate that structure in terms of the form of vertical linkages or governance in an economic system depend not only on economies of size and scope, but also on costs incurred in completing transactions using various governance structures. Fur-

thermore, these costs and the performance of various governance structures depend in part on the incentives and relationships between the transacting parties in the system: the principal and the agent. Under various conditions, the agent may exhibit shirking behavior (i.e., not performing expected tasks) or moral hazard behavior (i.e., the incentives are so perverse as to encourage behavior by the agent and results that are not consistent with, or valued by, the other party to the transaction -- the principal).

Mahoney (1992) suggests that the form of governance structure will be a function of three characteristics of the transactions and the industry: (a) asset specificity (the specialized nature of required assets), (b) task programmability (level of common understanding of the to-be-performed tasks), and (c) task separability (ability to determine and measure the value of each contribution to assign individual rewards). On the basis of these arguments, Martin et al. (1993) build a taxonomy of expected governance structures developed from a case study of the poultry industry as displayed in Table 2.

Table 2. Predicting Organizational Forms of Alternative Business Linkages

Factors	**Low Programmability**		**High Programmability**	
	Low Asset Specificity	**High Asset Specificity**	**Low Asset Specificity**	**High Asset Specificity**
Low nonseparability	Spot market	Long-term contract	Spot market	Joint venture
High nonseparability	Cooperation (strategic alliance)	Cooperation or vertical ownership	Inside contract (hybrid)	Vertical Ownership

Source. Martin et al. (1993)

Innovation strategies can create unique challenges in developing appropriate governance structures. An empirical study by Sampson (2007) evaluated technological diversity among firms allying with each other. She defines technological diversity as the difference between two or several firms' pool of resources in terms of technological backgrounds. She found that alliances are far more innovative and successful between partners that have moderate technological diversity than between firms that have low or high technological diversity. Moderate technological diversity maximizes firms' ability and incentives to transfer knowledge and resources. Sampson also indicates that firms that are highly different from a technological capability standpoint will be more successful with a highly hierarchical governance structure. The empirical work by Ahuja and Katila, 2001 leads to similar conclusions.

(ii) Negotiation/power/trust

More hierarchical governance structures are replacing markets as the coordination mechanism in the agri-food industries. In such systems, negotiation strategy and skill, power, conflict resolution, trust, and performance monitoring and enforcement become central to effective and efficient functioning of the economic system and the sharing of risks and rewards in the system. Concepts of *negotiation strategy* and tactics as developed by Cross (1969); Greenhalgh (1987); Neale and Bazerman (1991); and others can assist in understanding not only what form a negotiated governance system will take, but also how the risks and rewards will be shared.

Trust is becoming an increasingly important consideration in the formation and performance of various forms of governance structure and in the academic studies of these systems (Puranam and Vanneste 2009; Malhotra and Lumineau 2011). Sporleder (1994) argues that "fuzzy expectations and fuzzy prerogatives" that characterize many strategic alliances "has a foundation based on trust, unlike the clearly identified expectations and prerogatives typical under a contractual arrangement between firms." And in the spirit of optimality, Wicks et al. (1999) argues that firms/managers can over-invest (i.e., proceed on faith) or underinvest (i.e., exhibit extreme, maybe even unethical opportunistic behavior) in trust—thus the concept of optimal trust. Often presumed (or ignored) and rarely identified to be managed in studies of market economies and performance, trust management or manipulation and even psychological/emotional incentives (i.e. reputation, prestige, fear, etc.) would appear to impact business arrangements and governance structures in the agricultural sector of the future and thus have a role in our conceptual models of structural change and realignment (Casson 1991).

(iii) Strategic Management

An additional set of arguments that will assist in understanding and predicting structural realignment comes from the strategic management literature. In essence, these concepts emphasize various approaches for firms to develop a strategic competitive advantage and the criteria or considerations in the coordination governance or integration (make or buy) decision. In general, this literature indicates that the coordination governance decision is driven by: (a) internal considerations of costs, technology, risks and financial and managerial resources, and (b) external competitive considerations of synergies, differentiation, and market power and positioning (Harrigan 1985). Much of the recent work builds on the prior writings of Chandler (1962) on strategy and structure. Moreover, Porter's (1980) seminal work on competitive advantages, more specifically his five forces model, provides a rich source to detect and assess structural change in industries. Besides these landmarks in the strategic management literature we eclectically present selected concepts in more detail, which may offer valuable approaches to detect and understand the drivers of structural change in the environment as well as in the firm itself.

First of all, Barney (1991) has made significant contributions to the strategic management literature within the development of the resource-based theory (RBV) of the firm (Wernerfelt 1984). Barney's arguments are especially useful in understanding the recent realignments in coordination systems in the food production and distribution industries from traditional open-access markets to more tightly aligned supply or value chains. Strategic assets relevant for the development of a sustainable competitive advantage can be assessed with Barney´s VRIN framework. Strategic assets are "Valuable" (important), "Rare" (unique), "Imperfectly inimitable" (hard to copy), and "Non-substitutable" (not replaceable). The VRIN framework can be used to foresee or detect impending structural changes.

The more recent RBV literature in strategic management provides a more dynamic perspective, which in important dimensions contradicts the classical "core competences" approach of Prahalad/Hamel (1990). The argument is that core competences can also develop into "core rigidities" preventing a firm from adapting to external structural change (Leonard-Barton 1992). The dynamic capabilities approach of Teece et al. (1997) presents a framework to understand the implications of environmental change and how firms can adapt to it. A dynamic capability is the

firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base. The dynamic capabilities approach offers a vehicle to mitigate environmental change and renew a firm's resources for a sustained competitive advantage in fast changing unstable environments (Winter 2003; Baretto 2010) such as those that characterize the agri-food sector. In fact, given an increasingly turbulent business environment, the more recent literature questions the basic concept of a sustainable competitive advantage and suggests a rather "temporary" competitive advantage (O'Shannassy 2008).

In line with the dynamic capabilities argument, the question of how to identify, assimilate and integrate external knowledge to "shape" and renew the competence base to establish a sustainable or even temporary competitive advantage arises. Here, the strategic management literature offers the construct of absorptive capacity (Cohen and Levinthal 1990). This meta-competence to benefit from external developments seems to be a challenge for the often very long and complex agri-food supply chains, e.g. how should a seed company assess the consumer preference and willingness to pay for certain health-food traits. Consumer preferences are often very difficult to evaluate for agri-input suppliers. An answer to this dilemma can be found in Kogut and Zander (1992) who introduce the concept of combinative capabilities in order to synthesize and apply acquired and existing knowledge in a company. However, the question of how many steps in a value chain need to have similar areas of either up or downstream knowledge remains unclear. Questions like: to what extent should a seed company be aware of consumer trends? Or, how much production knowledge a retailer should have will become more important in the future.

(b) Risk and Value Chain Governance Structures

Apgar (2007) argues that value chain partners are critical sources of risk and uncertainty, and they can also provide important opportunities to mitigate risks and capture opportunities that result from uncertainty. Given the difficulty of establishing sustainable risk/reward sharing arrangements, it is not uncommon for one firm in the chain to become the chain "captain". The chain manager or "captain" may choose to become the residual claimant on profits from the chain as well as assuming a major share of the risk, or to share a greater fraction of the profits while shifting more of the risk to the other participants. Failure to find a risk/reward sharing arrangement that provides appropriate incentives and is perceived as fair also encourages ownership integration of stages by one firm.

Gray and Boehlje (2005) evaluated the implications of external transactions costs of risk sharing relative to internal transactions costs of vertical ownership on the choice of value chain governance structure (arms-length transactions, contracts or vertical integration). External transactions costs reflect the additional risk sharing cost borne by the processor when the exchange is between the processor and producers in a vertical arrangement. These costs increase as producer risk aversion increases or risk management skills decrease. If the processor wants to source products from more risk adverse producers, they must design vertical arrangements to either take on more of the risk, or compensate producers more for accepting the same share of the risk.

Internal transactions costs reflect the cost of ownership to a processor that owns both stages of the chain where separate firms are replaced with employees. Internal transactions costs of owner-

ship (i. e. agency costs) do not change as a function of producer risk aversion and are initially assumed to be greater than external transactions costs.

When producers have better risk management capabilities or have low enough risk aversion that risk sharing transactions costs are low, channel partners are likely to align in an arms-length exchange such as open markets, strategic alliances, or joint ventures. As producer risk aversion rises or management ability declines, the external transactions costs rise for the processor due to increased risk sharing costs. The increase in external transactions costs lead to more formal vertical arrangements such as contracts, where the risks and returns are dictated by the channel captain (processor). As producers' risk aversion/management costs increase further, ownership of the channel (vertical integration) becomes the preferred option because the transactions costs of risk sharing exceed the internal transactions costs of ownership.

Strategies to reduce internal/external transactions costs lead to the formation of supply chains among participants who are less risk averse or have more ability to manage or mitigate risk. This suggests that, in general, most tightly aligned supply chains that seek to share risk and rewards among participants will be increasingly dominated by larger firms at both the buyer and supplier level – leading to more consolidation, particularly at the production end of those industries. However, channel captains that have the willingness and ability to absorb the risk may allow producers with less ability to manage risk to maintain a role in the industry as service providers for these risk absorbing processors.

Poray et al. (2003) in a study of the pork industry found that the primary benefit from more tightly aligned coordination or governance systems is risk reduction. The reduction in risk results from more accurate information transmission between the primal cut market and the live hog market. Primal cut prices transmit information that helps reduce risks in packer/producer systems only if the system is aligned to use this information; the spot market does not allow for accurate information sharing which results in sub-optimal solutions for both producers and packers.

Preckel et al. (2004) in a follow-on study indicate that an optimal sharing arrangement for risk and returns depends on the relative risk aversion of the packer and producers. The risk aversion level of the packer is critical in determining the sharing of expected returns and risk but, surprisingly, producers' risk aversion levels are not relevant to the packer's decision of the optimal amount of risk and reward to share. Instead, producers respond to the packer's choices of proportion of expected returns and risk shared by choosing to increase or decrease the amount of pigs delivered to the packer. If the packer is willing to accept more of the risk, individual producers will want to deliver more pigs, allowing the packer to source pigs from fewer producers. This result is consistent with the trend in the U.S. to fewer and larger pork production and processing firms that are more tightly aligned.

(c) Industry Convergence

Industry convergence is a phenomenon observed in many industries such as telecommunications, computing and consumer electronics (Katz, 1996; Duysters and Haagedorn1997; Prahalad 1998). New technologies and their rapid diffusion across industry boundaries are main drivers for industry convergence, leading to inter-industry segments and, thus, structural change of entire indus-

tries.The agricultural sector is no stranger to this phenomenon (Bröring 2010) as it is increasingly becoming a source of raw materials for industries or sectors beyond the traditional fiber and nutrition industries—energy in the form of ethanol and biodiesel, industrial products such as polymers and bio-based synthetic chemicals and fibers, and pharmaceutical/health products such as functional foods, growth hormones and organ transplants. Developments and innovations in the bio-economy have important implications for the convergence between the previously relatively independent food, energy/industrial product, and pharmaceutical industries with the potential for competition in resource use, blurring of industry boundaries and dramatic changes in the competitors in the down-stream markets. Hardy has suggested that "the bio-based economy can and should be to the 21st century what the fossil-based economy was to the 20th century" (Hardy 2002).

In this context, industry convergence will play an increasingly pivotal role in shaping markets and industry segments leading to a higher degree of uncertainty. The process of convergence leads to "new competitive landscapes" (Bettis and Hitt 1995); actors from different formerly distinct industries are suddenly becoming competitors or partners in new inter-industry segments. Moreover, due to the application of similar technologies in different sectors (e.g. biotechnology, Sonka (2010)) formerly distinct value chains are becoming increasingly interlinked and interdependent (see Figure 5). At this point it is important to ask; whether old established value chains will fade and imply a singularity of one industry which combines previously separate ones (1+1=1). This possible outcome is called "substitutive" convergence and clearly needs to be distinguished from "complementary" (1+1=3) convergence where a new value chain evolves between established ones (Bröring 2010).

Even though agricultural raw materials still are the main starting point for the value chain of many sectors of the bio-economy, other industries such as energy or chemicals are entering the downstream stages of the value chain. For instance, the chemical industry is devoting substantial R&D budget expenditures to biorenewables in order to build more knowledge and potentially use biobased feedstocks in petrochemical pathways (Lenk et al. 2007).

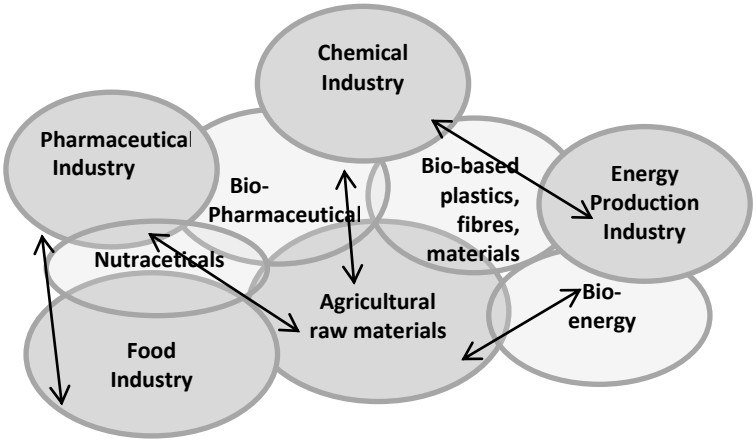

Figure 5. Fields of Industry Convergence in the Bio-economy
Source: Boehlje and Bröring (2010).

Cross-scientific research is increasingly enabling diverse sectors to utilize the technological developments in neighboring scientific disciplines (e.g. biotechnology and agriculture). Strategic alliances between food and cosmetics and/or pharmaceutical companies are increasing in the emerging subsectors of the bio-economy. These are targeting foods with health benefitting characteristics leading to the production of nutraceuticals and functional foods (a combination of nutrition and pharmaceuticals) (Bröring et al. 2006; Bröring 2005). That this "new inter-industry segment" is no longer just an academic playing field is evidenced by Nestlé´s recent announcements of the creation of "Nestlé Health Science S.A." and the "Nestlé Institute of Health Sciences" to confidently "…*pioneer a new industry between food and pharma…"* (Nestlé 2010).

Capturing Opportunities from Structural Change

(a) Anticipation of Convergence

Companies that may be affected by trends of convergence need to identify whether convergence is of substitutive or complementary nature. In the case of substitutive convergence, where two value chains merge, innovation seems to be imperative for the survival of the company since this form of convergence will lead to a phasing out of the two hitherto distinctly operating industries. Hence, firms must anticipate trends of convergence; otherwise they may vanish since the old industry sector is fading away. On the contrary, in the case of complementary convergence, a firm has the choice to either pursue an active role in the emerging segment or rather concentrate on the existing 'old' industry (Bröring 2010; Curran et al. 2010). New technologies, products, customers and regulations with the promises of substantial growth in unrivalled markets do not come without cost. With the high time-sensitivity of innovation processes, it is of particular importance to realize trends of convergence at the earliest possible moment (Curran et al. 2010).

Bibliographic data and patent data can be used to anticipate industry convergence (Figure 6). This approach is based on the assumption that industry convergence evolves after scientific disciplines (process of scientific convergence), technologies (process of technology convergence)

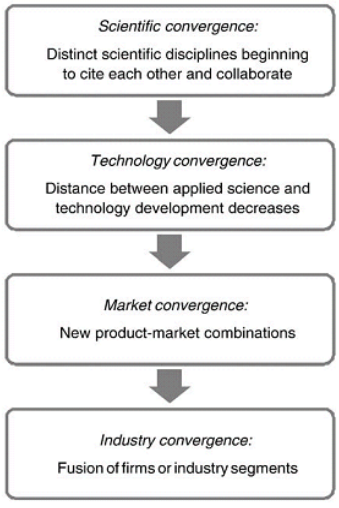

Figure 6. The Process of Convergence
Source. Curran et al. (2010)

and markets (process of market convergence) have converged (Curran et al. 2010). This means that new technologies are applied across industry boundaries. Before being threatened by industry convergence, firms may use patent and publication data to analyze whether cross-disciplinary patent citations occur and eventually develop into closer research collaborations and ultimately to technology convergence (e.g. nanotechnology and biotechnology). Thereby, firms can assess whether new competitors at the interface of two industry boundaries may emerge and what competences they need to build to be prepared (Bröring 2010' Curran et al. 2010). Bornkessel et al. (2011) have carried out such analyses to better understand the evolving segment of probiotics, a complementary form of industry convergence. This analysis shows a high involvement of agribusiness, chemical and food companies which starts with publications and results in patents, new products and a new inter-industry segment.

(b) Value Chain Analyses

As industry convergence may lead to the emergence of a new industry, value chain analyses may be helpful to further analyze the structural changes that come along with increased interdependencies of two or more related value chains. Hence, an explicit characterization of the *value chain* is an important step in structural change analysis. Boehlje (1999) identifies six critical dimensions of a value chain reaching from (a) the processes and activities that create the products or services demanded by consumers or end users, (b) the product flow features, (c) the financial flows, (d) the information flows across the chain, (e) the incentive systems to reward performance and share risks, and (f) the governance and coordination systems (e.g. strategic alliances).

More differentiation and specification in food and other bio-based products results in more complex production/manufacturing processes and thus the potential for more errors or mistakes in those processes. And as one defines the products/processes more broadly as a result of industry convergence, the complexity increases further. With increased complexity and potential errors, more structured systems of control are essential to reduce those potential mistakes. This increased control is easier to obtain in more tightly aligned supply chains in contrast to open-access markets (Boehlje1999). And due to the increasing complexity of food and agricultural systems, the chain perspective has been extended to a net chain approach (Lazzarini et al. 2001) to account for partners in the net of value creation. Value chain and net chain analyses can be used to understand how complexity increases, who will hold the needed competences, how and why vertical integration will occur, and what is needed for successfully managing systemic innovations (see Bröring 2008) which affect multiple steps of the supply chain.

A Final Comment

The dynamic nature of the agribusiness sector provides significant future business challenges and opportunities. The expected growing demand for food by itself presents potential sales and revenue growth. In addition, the expected future development of the expanding bio-economy with biological based raw materials being used in the energy, industrial and health/pharmaceutical industries adds further potential. The integration of the agricultural sector into the broader overall global industrial economy creates opportunities for innovative new product and service offerings as well as new value chains to deliver those new products and services. It adds further complexity to an already complex value chain. But that future also is highly uncertain.

Many of the management implications of the challenges of strategic uncertainty, innovation and structural change have been identified earlier – some of them will be highlighted here. Strategic uncertainty requires managers to develop additional capacities to monitor the business climate in which they operate, to anticipate as best one can the impact of the highly improbable, so-called "Black Swans" (Taleb 2007), and to regularly reassess the firm's strategic positioning to capture unexpected opportunities and mitigate potential catastrophic losses. This may require a more flexible rather than focused strategy and a real options mentality embracing more experimentation rather than making "full-blown" or "big bet" commitments.

As to innovations, searching out potentially disruptive technologies or innovations and assessing the risk and rewards of being a first mover vs. fast follower in the commercialization of those technologies or innovations will be critical to capture market potential or defend against new entrants. Systematic and frequent stage-gate processes to evaluate the success potential of innovations as they move from a new idea or invention to commercialization will reduce the risk and enhance the probability of success from innovation. Criteria such as potential return, market uncertainty, technical/regulatory uncertainty, time to market, access to capabilities, and costs already incurred should be included in the selection methods used by companies. Food and agribusiness companies should also rely on several selection methods, and on an assessment of the projects by cross-functional teams as well. Finally, systematically documenting the knowledge created in the innovation process will increase the value created irrespective of whether the product/service offering is a commercial success – learning from and communication on an unsuccessful innovation or venture has the potential to improve the chances of success in future innovations/ventures.

Finally, the significant structural changes in the agribusiness sector suggest that managers need to be increasingly vigilant in assessing the competition they will face as well as the opportunities they may have in shaping the restructuring of their industry. The evolution of new value chain structures and industry convergence will require additional leadership and management skills along with new relationships and linkages outside of what have been historical industry boundaries.

The information, knowledge base and skill set for analyzing and understanding these issues, and making the critical strategic decisions to be successful in an increasingly turbulent business climate, requires integration of concepts from economies, management, finance, decision sciences, organizational behavior, and strategy. Our goal here has been to make a modest contribution to that knowledge base with a focus on strategic uncertainty, innovation and structural change in the agribusiness sector.

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International Food and Agribusiness Management Review
Volume 14, Issue 5, 2011

Multi-Stakeholder Sustainability Alliances in Agri-Food Chains: A Framework for Multi-Disciplinary Research

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Abstract

This study provides a definition of Multi-Stakeholder Sustainability Alliances (MSSAs) based on describing the platforms formed and/or joined by the fifty largest food and beverage multi-national corporations (MNCs). It develops an inductive framework on how MNCs use MSSAs to effectively signal to their stakeholders that they are sustainable and suggests a set of methods to test the developed framework in future research. Results provide management scholars a research agenda that can be implemented with agribusiness managers and their stakeholders.

Keywords: stakeholder; sustainability; alliances; Corporate Social Responsibility (CSR); partnerships.

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Introduction

Sustainability has rapidly become a key challenge for agribusiness companies regardless of their position along the supply chain or their geographic focus (Lubin and Esty 2010; Vermeir and Verbeke 2006). As a response to this challenge, agribusiness firms are attempting to interact effectively with a much broader set of stakeholders, including not only supply chain actors and investors, but also governments, knowledge institutions, non-governmental organizations (NGO) and other civil society organizations (Jenkins et al. 2007; Rankin and Boehlje 2010; Van Latensteijn and Andeweg 2010). This process of interaction related to sustainability, especially in the last decade, has led a number of large agribusiness firms to form and/or participate in multi-stakeholder alliances.

Multi-stakeholder sustainability alliances (herewith after MSSAs) would appear to be of growing importance for the agri-food sector, yet this phenomenon has not been analyzed within the agribusiness literature and is still scarcely studied in business research (Kourula and Laasonen 2010; Selsky and Parker 2005). Introducing MSSAs to agribusiness research is thus timely and crucial. This paper uses an inductive, theory-building approach to: 1) suggest a definition of the phenomenon based on describing a set of MSSAs formed and/or joined by many of the world's largest food and beverage multi-national corporations (MNCs) (Food and Beverage International 2009); 2) propose a theoretical framework on how MNCs use MSSAs to effectively signal to their stakeholders that they are sustainable; and, 3) suggest a set of methods to test the theoretical framework in future research.

Empirical evidence supporting the development of the framework was collected from: (1) MNCs' sustainability and corporate reports, (2) press releases and reports by stakeholders both within and outside MSSAs, and (3) on-going public discussions with business managers, NGO leaders and academics participating in MSSAs (specifically, the Sustainable Agriculture Initiative Platform and Transforum) and other sustainability initiatives (the Carbon Disclosure Project and Round Table on Responsible Soy). These discussions took place during the International Food and Agribusiness Management Association (IFAMA) conferences between 2008 and 2010. The framework suggested in this study will assist agribusiness managers to develop partnerships with their stakeholders that result in effective signaling of sustainability.

Two additional points frame this analysis of MSSAs. First, MNCs are not the only users of MSSAs. Companies of smaller size and with a domestic focus form and/or join MSSAs (Van Latensteijn and Andeweg 2010) as well. Yet, MNCs appear to be more inclined to undertake these alliances and face greater complexity in their stakeholder interactions. Therefore, smaller scale, domestic companies are not treated in the analysis. Second, MNCs may form and/or join MSSAs for reasons other than credible signaling of sustainability to their stakeholders. For example, MSSAs may also be used to share resources with stakeholders in order to establish and reach jointly agreed sustainability objectives. This paper focuses on and analyzes only signaling as a reason for MSSAs existence, and leaves to future research the exploration of other reasons for MSSAs.

The fundamental research question is this: why are MNCs forming and participating in MSSAs as a significant part of their corporate sustainability strategy? The answer explored in this paper relates to the role an MSSA can play in an MNC credibly signaling to other economic, social and

environmental actors that it is committed to and engaged in sustainability practices. The intuition about the need for credible signaling arises from the complexity and uncertainty about what constitutes sustainability behavior and results. Sustainability encompasses systemic economic, social and environmental outcomes in the context of multiple stakeholders who often have dramatic and passionate differences in values and perspectives. Mistrust among stakeholders is likely high and direct observations of an MNC's sustainability efforts is likely impractical. MNC self-declarations of sustainability are not likely credible in this context. Nor are supply chain business partners credible in the eyes of governmental and societal organizations. The general proposition explored is that engagement in MSSAs is one of the few (if only) ways to credibly signal a MNC's progress in sustainability.

The rest of this paper is organized as follows. In the next section, MSSAs are described and defined. In the third section, relevant concepts from stakeholder theory, theory of reasoned action and status theory are introduced before the theoretical framework is developed in the fifth section. Based on this framework, directions for future research are presented in section five and then conclusions follow.

Description and Definition of MSSAs

In the last ten years, twenty-two out of the world's largest fifty MNCs in the food and beverage sector formed and/or joined a number of partnerships with heterogeneous stakeholders (Table 1 and 2). Actors partnering within these alliances include many, if not all, of the following stakeholders: supply chain partners, competitors, investors, governments, knowledge institutions, non-governmental organizations (NGOs) and other civil society organizations. Specifically, nine out of the ten largest MNCs participate in at least one of these partnerships. All these partnerships can be described as MSSAs.

However, MSSAs are not the only means of implementing sustainability initiatives. The majority of the mentioned MNCs have developed one or more of the following: (1) a strategic model for sustainability (such as Nestlé's "Shared Value Creation" model; Nestlé 2010), (2) pursuit of a variety of specific activities that are usually reported according to recently developed environmental and/or social standards (such as the UN Global Compact, the Global Reporting Initiative and the Carbon Footprint Disclosure), and (3) initiatives in bilateral partnerships with only one other stakeholder (such as Nestlé's Nespresso E-Collaboration with Rainforest Alliance or Coca-Cola's partnership with the WWF). MNCs have been developing sustainability models and one-partner alliances since the early 1990s; their participation in multi-stakeholder alliances has emerged more recently.

The largest MNCs such as Nestlé, PepsiCo, Kraft and Unilever – which each own a portfolio of brands diversified into a number of food sub-sectors - are participating in a large number of alliances that cover multiple food sectors with a broader focus including both environmental and social sustainability (Kraft 2010; Nestle' 2010; Unilever 2010). Less diversified and relatively smaller MNCs such as Bunge, Ferrero and Cadbury focus mainly on sustainability alliances with a particular sector (cocoa, palm oil, cashew and coffee) which corresponds more closely with their core strategy. A few MNCs, including Nestlé, Kraft and Unilever, have been very active in founding or co-founding a number of multi-stakeholder alliances, demonstrating strategic intent to build core competence and leadership in tackling sustainability issues.

Table1. MNCs in Multi-Stakeholder Sustainability Alliances in the Agri-food Sector

MNC's Name	*Total Sales 2008 (USD Millions)*	*Name(s) of Multi-Stakeholder Sustainability Alliance(s)*
Nestlé	101,580	**Sustainable Agriculture Initiative Platform**, International Cocoa Initiative, World Cocoa Foundation, Roundtable on Sustainable Palm Oil, **4C Association,** Water Footprint Network
Pepsi Co	43,251	Roundtable on Sustainable Palm Oil, Sustainable Agriculture Initiative Platform, GAIN Business Alliance, Water Footprint Network
Kraft Foods	42,201	International Cocoa Initiative, Sustainable Agriculture Initiative Platform, **African Cashew Alliance, 4C Association.**
Unilever	58,570	**Sustainable Agriculture Initiative Platform, Roundtable on Sustainable Palm Oil, GAIN Business Alliance, Dutch Sustainable Trade Initiative, Novella Africa Initiative, Global Packaging Project,** Water Footprint Network.
Coca-Cola Company	31,944	Sustainable Agriculture Initiative Platform, GAIN Business Alliance, **Community Water Partnerships,** Water Footprint Network
ADM Company	69,816	**International Cocoa Initiative,** World Cocoa Foundation, Roundtable on Sustainable Palm Oil, World Initiative for Soy in Human Health.
Mars	30,000	**IMPACT Partnership, International Cocoa Initiative,** GAIN Business Alliance, Roundtable on Sustainable Palm Oil.
Cargill	120,439	International Cocoa Initiative, GAIN Business Alliance, Soy Moratorium Working Group – GTS, World Initiative for Soy in Human Health, Flour Fortification Initiative.
SABMiller	25,302	Water Footprint Network **Initiative Platform**, GAIN Business Alliance.
Danone	22,375	**Sustainable Agriculture**
Heineken	21,030	Sustainable Agriculture Initiative Platform, Water Footprint Network
General Mills	14,691	Sustainable Agriculture Initiative Platform, Flour Fortification Initiative
Fonterra	14,560	Sustainable Agriculture Initiative Platform, Roundtable on Sustainable Palm Oil
Kellogg Company	13,750	Sustainable Agriculture Initiative Platform, Roundtable on Sustainable Palm Oil.
ConAgra Foods	12,745	Roundtable on Sustainable Palm Oil
Femsa	15,081	**Water Center for Latin America and the Caribbean, Alliance for Water Partnership,** GAIN Business Alliance.
Sara Lee Corporation	13,212	Sustainable Agriculture Initiative Platform, **4C Association**, Dutch Sustainable Trade Initiative, Global Packaging Project.
HJ Heinz Company	10,155	Roundtable on Sustainable Palm Oil
Ajinomoto	11,515	**Ajinomoto Stakeholder Dialogues**
Bunge	52,574	Soy Moratorium Working Group – GTS, World Initiative for Soy in Human Health.
Cadbury	9,960	Roundtable on Sustainable Palm Oil
Ferrero	9,135	Roundtable on Sustainable Palm Oil

Source. Sustainability Reports and Company Websites of the mentioned MNCs; Food and Beverage (2008).
Note. Alliances founded or co-founded by the MNC are in bold. Total sales include both food and non-food sales.

Table 2. Multi-Stakeholder Sustainability Alliances in the Agri-food Sector

MNCs' Multi-Stakeholder Sustainability Alliance(s)	*Sector Focus*	*Sustainability Focus*	*Stakeholders Involved*	*Year Founded*
Sustainable Agriculture Initiative Platform	Multiple	Environmental & Social	Competitors, Intl & Local NGOs, Intl Organizations, Knowledge Institutions	2002
International Cocoa Initiative	Cocoa	Environmental & Social	Competitors, International & Local NGOs, Intl Suppliers	2002
IMPACT Project	Cocoa	Environmental & Social	Intl & Local NGOs, Government Agencies, Intl Organizations,	
World Cocoa Foundation	Cocoa	Environmental & Social	Competitors, Intl & Local NGOs, Government Agencies, Intl Suppliers, Intl Organizations, Knowledge Institutions	2000
Roundtable on Sustainable Palm Oil	Palm Oil	Environmental & Social	Competitors, Intl & Local NGOs, Intl and Local Suppliers, Intl Retailers, Intl Organizations, Investors	2004
African Cashew Alliance	Cashew	Environmental & Social	Intl & Local NGOs, Government Agencies, Intl and Local Suppliers, Intl Retailers	2005
4C Association	Coffee	Environmental & Social	Competitors, Intl & Local NGOs, Intl and Local Suppliers, Intl Organizations, Knowledge Institutions	2004
Global Packaging Project, Consumer Goods Forum	Packaging	Environmental	Competitors, Intl Suppliers, Intl Retailers, Knowledge Institutions	2010
GAIN Business Alliance	-	Social	Competitors, Intl NGOs, Intl Suppliers	2002
Dutch Sustainable Trade Initiative	Multiple	Environmental & Social	Competitors, Intl & Local NGOs, Government Agencies, Intl Organizations.	2007
Novella Africa Initiative	Forestry	Environmental	Intl & Local NGOs, Government Agencies, Intl Organizations, Knowledge Institutions.	2002
Alliance for Water Partnership	Water	Environmental	Intl NGOs, Knowledge Institutions.	2007
Ajinomoto Stakeholder Dialogues	Multiple	Environmental & Social	Intl and Local NGOs, Knowledge Institutions.	2009
Soy Moratorium Working Group – GTS	Soy	Environmental	Competitors, Intl NGOs, Government Agencies	2007
Community Water Partnerships	Water	Environmental	Intl NGOs, Intl and Local Suppliers, Intl Organizations.	2005
World Initiative for Soy in Human Health	Soy	Social	Competitors, Intl & Local NGOs, International Suppliers	2000
Flour Fortification Initiative	Wheat	Social	Competitors, Intl & Local NGOs, Intl and Local Suppliers, Intl Organizations, Knowledge Institutions	2000
Water Footprint Network	Water	Environmental	Competitors, Intl & Local NGOs, Intl Organizations, Knowledge Institutions.	2008

However, these MNCs seem to interpret the role of multi-stakeholder alliances within their sustainability strategy differently. Nestlé co-founded multi-stakeholder alliances mainly with its competitors (such as SAI Platform and International Cocoa Initiative) and separately founded individual partnerships with NGOs but without its competitors (such as Nespresso E- Colaboration and Nescafe' Plan) (Nestle' 2010). In contrast, Unilever seems to be adopting a more integral "multi-stakeholder approach" to sustainability by participating exclusively in alliances with multiple stakeholders in all its sustainability initiatives (Unilever 2010).

The heterogeneity of the group of stakeholders participating in a sustainability alliance provides important insight into the mission of the alliance and the type of information shared among partners. The first type of alliance that can be observed, such as the World Cocoa Foundation, the Roundtable on Sustainable Palm Oil and the Sustainable Agriculture Initiative Platform, attempts to include the broadest possible heterogeneity of stakeholders. Private businesses, NGOs, governmental departments and development agencies, international organizations and knowledge institutions (RSPO 2010, SAI Platform 2010, WCF 2010) are all deliberately brought into the alliance. In these alliances, a key initial step is seeking consensus on an "operational" definition of sustainability. Once a common definition is developed, partners meet in smaller groups to implement specific sustainability projects where each stakeholder provides technology or human capital.

A second type of alliance has less heterogeneity among its stakeholders. Among this second type are alliances such as the IMPACT Partnership, the 4C Association and the Water Footprint Network. They are mainly driven by public development actors, including (1) local civil society organizations and international NGOs such as African trade unions and Oxfam International respectively, (2) international organizations such as the World Food Program and (3) government agencies such as the German Development Agency (GTZ) and the US Agency for International Development (USAID) (4C Association 2010; IMPACT partnership 2010; Water Footprint Network 2010). In these alliances, MNCs mainly play the role of providing capital and technical assistance to the partnership.

A third type of alliance is mainly business-driven, such as the Global Packaging Project of the Consumer Goods Forum (2010) and the GAIN Business Alliance (2010). These alliances have an organization similar to either supply chain partnerships (in the case of the Global Packaging Project) or to joint CSR initiatives (in the case of the GAIN Business Alliance). The key difference with this type of alliance is that more than one stakeholder external to the supply chain is also involved to facilitate the information exchange on sustainability.

These observations on the various types of MSSAs that have emerged suggest the following definition for the phenomenon: A multiple-stakeholder sustainability alliance is a *long-term partnership involving multiple participants from two or more categories of stakeholders (government, business, societal organizations, and knowledge institutions) with the objective of jointly defining and reaching sustainability objectives*. Consistent with Donaldson and Preston (1995) and Cronin et al. (2011), categories of stakeholders include governments, international organizations and NGOs, business entities (competitors, investors, supply chain partners, and industry groups), consumers and community representatives. Moreover, knowledge institutions (such as universities, research centers and think-tanks) are added as potential MNCs' stakeholders in the context of sustainability given their active role in many of the MSSAs observed.

This definition *excludes* (1) partnerships between only one MNC and one category of stakeholder (such as MNCs receiving Rainforest Alliance and UTZ certifications or Marine Stewardship Council accreditations, or MNCs partnering with their competitors and customers to form the Sustainable Packaging Coalition), (2) initiatives merely based on sustainability reporting to an NGO or international organization (such as the Global Reporting Initiative, the Carbon Disclosure Project and the United Nations Global Compact), (3) joint declarations of intents on sustainability (such as the European Food Sustainable Consumption and Production Round Table), and (4) joint short-term sustainability projects formed for only a limited purpose and then disbanded.

Literature Review

Three distinct bodies of literature are reviewed and used in the framework presented in the next section.

Stakeholder Theory and Sustainability

Stakeholder theory provides a conceptual basis to develop a framework for how MNCs can use MSSAs as a signal of sustainability. The central message of stakeholder theory is that organizations should aim at maximizing not only their own profits, but also maximizing benefits or minimizing damages to other organizations and/or individuals as possible effects of their activities (Freeman 1984). Specifically, the three concepts of stakeholders, stakeholder interactions as critical to corporate strategy, and the formation of alliances with stakeholders are crucial to the development of this framework.

First, stakeholders are broadly defined as "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman 1984, p. 46). However, in the case of large and trans-national companies, this definition of stakeholders can potentially include every member of society, leaving managers without a strategic direction for managing interactions with them. Narrower definitions identifying stakeholders in terms of their necessity for the firm's survival (Nasi 1995) lead to pragmatically exploring under which conditions a firm's manager should give attention and priority to stakeholders' claims (e.g., Mitchell, Agle and Wood 1997). Consistent with these definitions, Donaldson and Preston (1995) mentioned national governments, international organizations and NGOs, competitors, investors, supply chain partners, consumers and community as categories of any firm's stakeholders. Together with knowledge institutions, these categories are considered as "stakeholders" in the proposed framework.

Second, firms' interactions with stakeholders play a central role within their corporate strategy. According to Mitchell, Agle and Wood (1997), firms' managers take stakeholders into consideration when they are powerful (Pfeffer 1981) and when their claims are considered both as legitimate (Davis 1973) and urgent (Mitchell, Agle and Wood 1997). However, managers have to consider the whole stakeholders' network in which they are embedded, as this determines the direction of influences between a firm and its stakeholders (Rowley 1997). Initially, stakeholders' claims on sustainability were perceived as legitimate but not urgent nor powerful by firms' managers (Brummer 1991) and therefore sustainability strategies were left to the morality or ethics of firm's managers (Carroll 1991). However, as time passed empirical evidence grew that stakeholders were pressuring firms on social and environmental issues and they gained sufficient influence to affect the value creation of firms (Kassinis and Vafeas 2006). More recently, it

was found that firms' developing environmental (Baker and Sinkula 2005) and social strategies (Luo and Bhattacharya 2009) in interaction with stakeholders had a positive impact on the development of their own capabilities (Brown and Dacin 1997, Hult 2011), marketing assets (Krishna and Rajan 2009) and ultimately on their own financial performance.

Third, firms' alliances with their stakeholders are not an optional part of their sustainability strategies. Given its distinctive characteristics, sustainability is an example of a "wicked problem: complex, ill-defined, messy and unsolvable in any traditional sense" (Peterson 2009). Complexity mainly arises from the need to have economic, environmental, and social systems all interact to produce sustainability while the messiness springs from the situation that the plurality of a firm's stakeholders has very different definitions, capabilities, values and perceptions related to sustainability (Porter and Kramer 2006). These potentially significant differences in values means that stakeholders outside the supply chain can be motivated to take actions that will constrain a firm's strategies through governmental assaults on the right to produce or through citizen-lead efforts to curtail the right to sell if the firm does not behave more sustainably either in reality or in the perception of any one of the stakeholders. Given its "wicked problem" nature, building sustainability alliances was found to have a positive impact on both firms and their alliance partners' marketing assets and financial performance (e.g., Brown and Dacin 1997; Lichtenstein, Drumwright, and Braig 2004; Sen and Bhattacharya 2001). A narrower research strand has started conceptualizing the role of cross-sector social partnerships (Selsky and Parker 2005) among companies, governments and/or NGOs (Kourula and Laasonen 2010).

Yet, empirical evidence of the impact of cross-sector social partnerships or sustainability alliances on a firm's financial performance is still scarce since most of the research in this field has focused on the process of alliance formation and development rather than on its outcomes (Kourula and Laasonen 2010). Moreover, the specific effects of multi-lateral alliances for sustainability have not been explored yet. This paucity has recently called for further business research in the field (Cronin et al. 2011).

Theory of Reasoned Action and Sustainability

The framework proposed in this paper also uses Fishbein and Ajzen's psychology theory of reasoned action (1975) to provide insight into what drives the behavior towards MNCs of stakeholders within and outside MSSAs. According to this theory, a person's behavioral intentions are driven by his/her attitude towards that behavior and by his/her subjective norms. Specifically, a person's attitudes towards a behavior are based on his/her perception that the behavior will have consequences as well as on his/her evaluation of these consequences. Finally a person's behavioral intentions predict behavior if the intention measure corresponds to the behavioral criterion in terms of action, target, context, time-frame and/or specificity (Figure 1). The theory has proven useful to predict behavior accurately, although with identified limitations (Sheppard, Hartwick and Warshaw, 1988). The theory of reasoned action provides three essential concepts to the framework developed in this analysis: perceptions, subjective norms and behavior. First, MNCs' stakeholders have perceptions about the extent a company is sustainable or not, however they define, conceptualize and measure sustainability. These also drive their perceptions on the consequences of their behavior supporting or contrasting MNCs' sustainability strategies. For example, consumers may perceive that stopping buying from a company which is believed not to be truly sustainable will make them feel that they are doing something positive for the environment

they live in. Policy-makers may perceive that tightening regulations affecting companies that they not believe are sustainable will have a positive impact on their chances of being re-elected. On the other hand, shareholders and equity funds may perceive that they will have relatively lower-risk future returns if they invest in a company which they believe is truly sustainable. In turn, stakeholders' perceptions of the consequences of such a behavior drive their attitudes towards the behavior and ultimately their behavior.

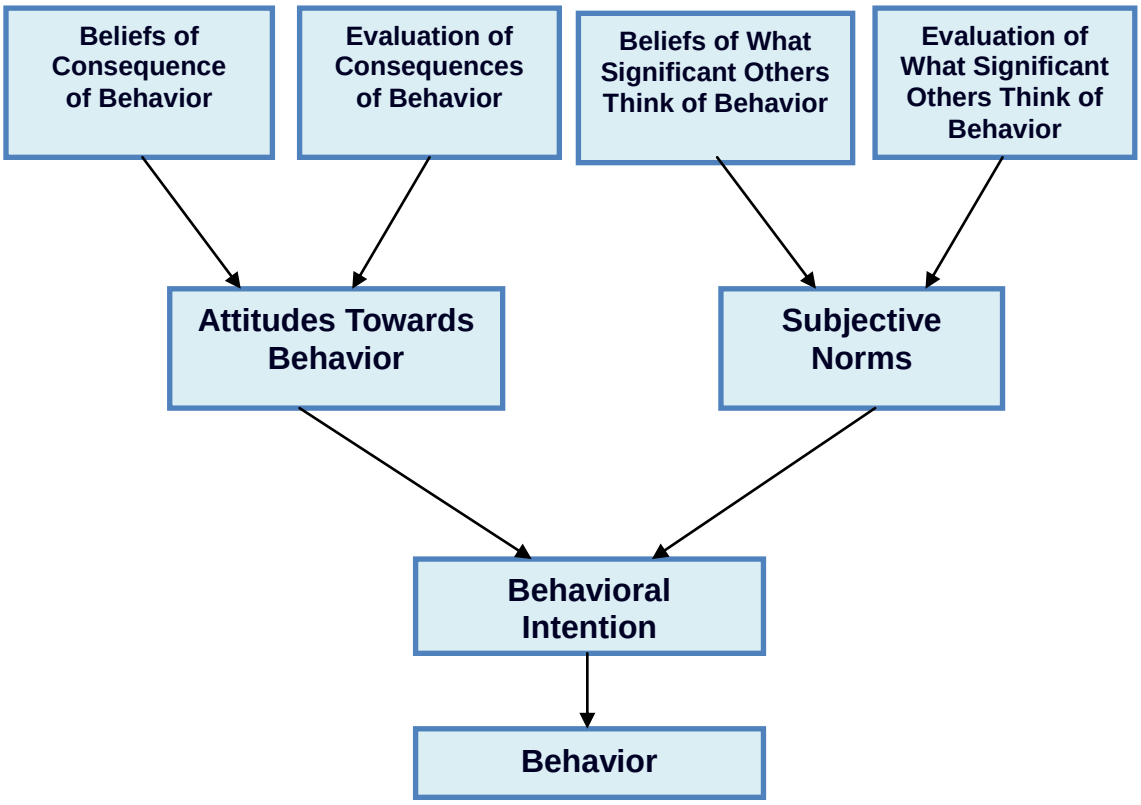

Figure 1. The Theory of Reasoned Action
Note. Boxes represent variables and arrows represent positive relationships between two variables.

Second, MNCs' stakeholders have subjective norms that also influence their intended behaviors supporting or contrasting companies. Subjective norms are defined as "the person's perception that most people who are important to him or her think he should or should not perform the behavior in question" (Fishbein and Ajzen 1975). In other words, a person's intention of taking action also depends on how he/she thinks other people would view him/her if he/she performed the desired behavior. For example, when deciding whether buying products from a company which is perceived to be unsustainable or not, consumers may have subjective norms based on the opinions that their friends and family would have about their behavior. Similarly, policy-makers, NGOs, investors and business partners have subjective norms based on the opinion that their electors, supporters and customers would have of their behavior towards a company.

Third, stakeholders' behaviors are driven by their perceptions of and attitudes towards their actions and by their subjective norms. Importantly, their behaviors towards MNCs have an impact on that company in terms of marketing assets and financial performance. A number of studies

focused on how consumers behave based on their perceptions and subjective norms related to the sustainability of the firm (Ogle, Hyllegard, and Dunbar 2004; Van Trijp and Fischer 2011; Vermeir and Verbeke 2006). A few studies also applied the theory of reasoned action to explain and predict other stakeholders' behaviors towards a firm as a reaction to its sustainability strategy, including policy-makers (Marshall, Cordano, and Silverman 2005), civil society (Ballantyne and Packer 2005), competitors and employees (Gilder, Schuyt, and Breedijk 2005). Yet, the theory of reasoned action has not been used to explain the effects of a MNC forming a MSSA on its stakeholders' behavior.

Social Status and Sustainability

The idea of status, i.e. an actor's position in the social structure, as a key driver of social and economic rewards is a fundamental insight of the sociological theory (Simmel 1950). Status is strongly linked to the concept of deference from other actors (Goode 1978); while deference can be understood as a "flow", then status is the "stock" that corresponds to this flow (Parsons 1963). Although reaching a high status can be considered as an end in itself (Frank 1985), an actor's status also brings economic rewards by influencing the relative opportunities open to that actor in comparison with those available to its competitors (Podolny 1993).

There are two fundamental ways an actor's status can open opportunities to that actor and generate economic rewards. First, status is a signal of quality (Podolny 1993), as it raises potential buyers' expectations of a product's qualities and value (Spence 1974). Importantly, the larger the uncertainty or difficulty in observing a product's quality, the stronger status becomes a signal (Podolny 1994). For example, in an artistic genre one in which objective standards are limited, and therefore uncertainty about quality is high, the perceived quality of a painter's work depends on the painter's relations to high-status actors and institutions in the artistic community (Greenfeld 1989). Similarly, when great uncertainty surrounding scientific quality is pronounced, for example during times of pronounced intellectual conflict or paradigmatic transition, the professional regard for a scientist and interpretations of the quality of the scientist's work are based on the status of those with whom the scientist actively and visibly affiliates himself/herself (Camic 1992; Latour 1987). Second, status can be considered as a means toward enhanced power over other individuals (Weber 1978). As such, the higher the status of an actor, the higher the probability of being considered as a "significant other" by other actors when undertaking their psychological process from attitudes to behavior.

In this paper, we argue that the dual role of an actor's status as a signal of quality and as a means of enhanced power over other actors is crucial to understanding – in integration with stakeholder theory and the theory of reasoned action - how MNCs use MSSAs to signal sustainability to their stakeholders. Researchers have analyzed the role of other signals of MNCs' sustainability, such as adhering to voluntary reporting standards (e.g., the Global Reporting Initiative, Nicholaeva and Bicho 2011), yet no studies have explored the key role of stakeholders' status within MSSAs in this context.

Theoretical Framework

The proposed framework is presented in Figure 2. Its general flow of logic is taken from the theory of reasoned action. Alliance partners' favorable behavior toward an MNC's sustainability

strategy derives from the beliefs and attitudes of key stakeholders as defined by stakeholder theory and the status of these key stakeholders within the alliance as defined by the theory of status. The alliance partners' behavior in turn influences the beliefs and subjective norms of non-alliance stakeholders with ultimate influences on MNC marketing assets and financial performance. The framework's logic incorporates all three underlying theories and explains how MNCs use MSSAs to signal sustainability to their stakeholders within and outside the alliance.

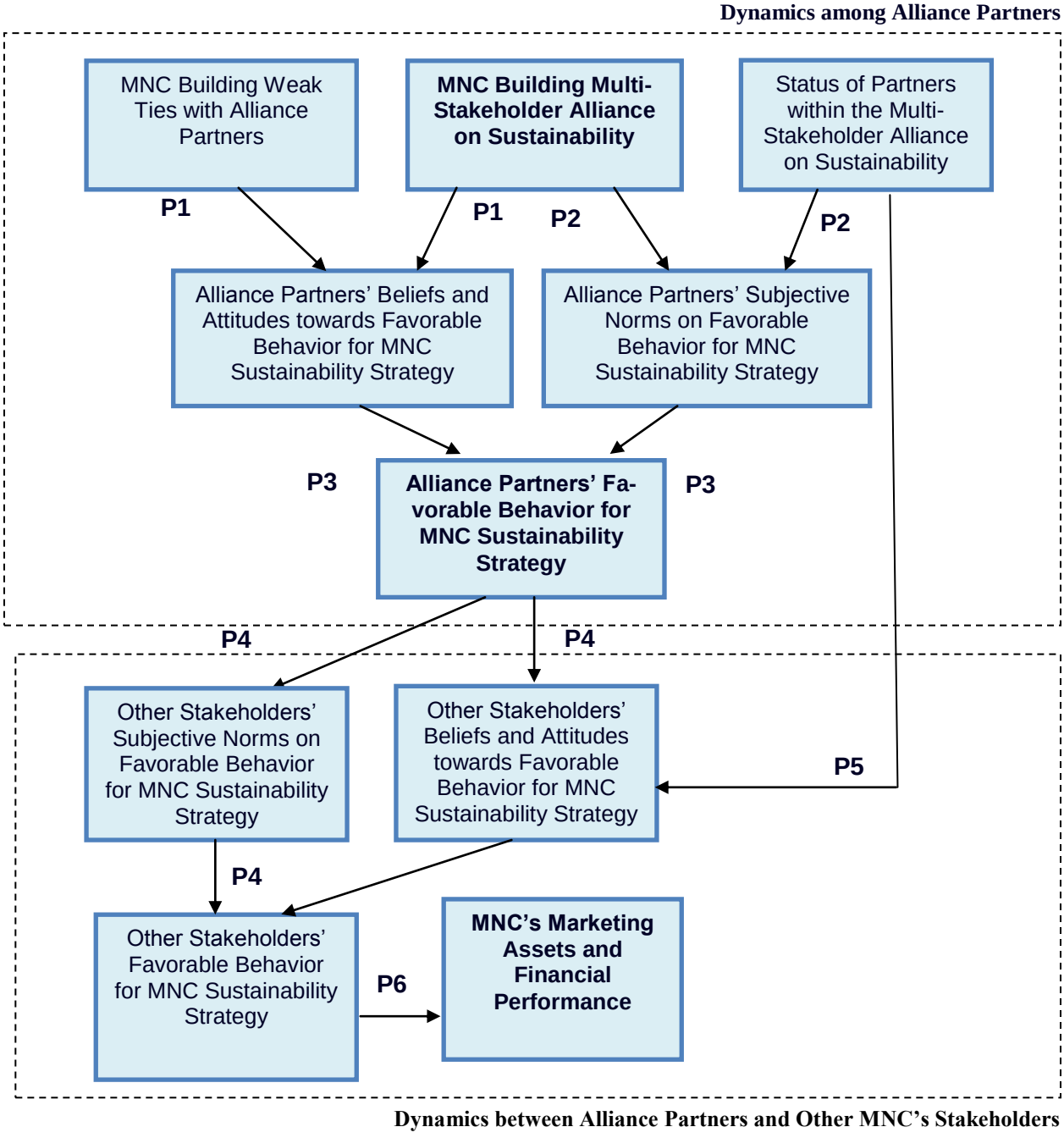

Figure 2. The Proposed Conceptual Framework: The Impact of a Multi-National Corporation (MNC) building Multi-Stakeholder Alliances on Sustainability

Note. Boxes represent variables and arrows represent positive relationships between two variables.

The remainder of the section explores the causal links in the framework through the positing of six research propositions. These propositions are divided into two sets: one relating to the dynamics among alliance partners (upper half of the framework) and one relating to the dynamics between alliance partners and stakeholders outside the alliance (lower half of the framework). The first set of propositions proposes an explanation for how MNCs signal sustainability to their alliance partners or, in other words, change their alliance partners' perceptions and behaviors. The second set of propositions describes how MSSA partners' behavior has an impact on the perceptions and behaviors of stakeholders outside the alliance and ultimately on MNCs' marketing assets and financial performance.

Dynamics among Alliance Partners

The first three propositions that follow lay out the logic that leads MNCs to build an effective signal of their focus on sustainability. MNCs often begin by developing interactions with partners with whom they had no or little prior relationship– i.e. they develop "weak ties" or "bridges" (Granovetter 1973) with these partners. The second characteristic of these partners is that they tend to have high status (Podonly 1993) in their respective arenas of influence. Once the partners are selected and the sustainability alliance formed, a MNC can use the information exchange and the joint design and implementation of sustainability initiatives within the alliance as the credible signals that favorably change its partners' beliefs, attitudes, subjective norms and ultimate behaviors towards support of the MNC's sustainability strategy.

The first proposition addresses the formation of weak ties. A first example of MNC weak ties or "bridges" with a key stakeholder is the Roundtable for Sustainable Palm Oil (RSPO) created in 2004 by Unilever and WWF together with Unilever's competitors, other international and local NGOs, supply chain partners, international organizations and investors. Up to 2004, Unilever and WWF had no relationships or structure for exchanging information, although both these organizations had interests in forests in South America, Asia and Europe. Specifically, before 2004 WWF had already been acting as watchdog and awareness leader on safeguarding forests worldwide (WWF 2004), while Unilever had supplied palm oil for its food products from the mentioned forest areas. A few months before the creation of the Roundtable for Sustainable Palm Oil in 2004, WWF denounced that seven of eight existing forest certification schemes, including the ones implemented by Unilever, were inadequate in protecting sustainability and called "upon companies and forest stakeholders to continue serious engagement for credible forest certification instead of seeking an alibi for forest destruction and business as usual". After five years of joint work with Unilever and other stakeholders, WWF announced that RSPO "developed principles and criteria on sustainable palm oil production to ensure that palm oil production is economically viable, environmentally appropriate and socially beneficial". Moreover, WWF announced that "by October 2009, some 195,000 tons of certified sustainable palm oil (CSPO) had been traded. This is a good start, but still only represents about 19% of the estimated 1 million tons of CSPO that has been produced so far. WWF is working to encourage companies to source 100% CSPO in the products they make and sell".

Two additional examples of "building weak ties" between MNCs and international NGOs through MSSAs are the 4C Association (2010) and the Alliance for Water Stewardship (2010). In the 4C Association case, Nestlé and Kraft started communicating in 2002 with the internation-

al NGO Oxfam and other stakeholders with the facilitation of the German development agency GTZ. Oxfam had been pressuring Nestle' and its major competitors through its global campaign "Make Trade Fair" prior to 2002 (Oxfam 2010), but an effective formal relationship with MNCs in the coffee sector only started with the creation of the 4C Association. Through a constant dialogue with the MSSA secretariat and partners, Oxfam has been making clear that its participation in the alliance does not mean Oxfam is endorsing the MNC products approved by the alliance code of conduct; however, Oxfam guarantees its participation only if its expectations regarding the alliance organization and practices are satisfied (Oxfam 2005). In the Alliance for Water Stewardship (2010) case, the Coca-Cola Company started a joint initiative with WWF and Nature Conservancy, while there was no record of communication between these stakeholders before the alliance. WWF recognized in 2010 that "the partnership has helped integrate performance and water stewardship initiatives into the company's operations, improving Coca-Cola's water efficiency by 13 percent since 2004, well on its way toward reaching a 20 percent improvement goal by 2012" (WWF 2010). All three cases cited show how the establishment of weak ties through MSSAs was followed by a change in attitudes about MNC partners.

On the other hand, there are MSSAs where no weak ties or "bridges" among partners need to be built, as the partners were already collaborating or sharing a common culture before the alliance start-up. Three examples are the Global Packaging Project of the Consumer Goods Forum (2010), the GAIN Business Alliance (2010) and World Initiative for Soy in Human Health (2010). In the first case, the alliance partners were already collaborating as global supply chain partners, while the universities involved in the multi-stakeholder alliance had already undertaken previous collaboration with Unilever. As a result, while the project has the objective of setting common sustainability standards, sharing know-how and developing reciprocal capabilities, there is no evidence that any change in alliance partners' beliefs and attitudes is taking place. In the second and third cases, the sustainability alliances link multiple MNCs to NGOs (Ashoka, Clinton Global Initiative, Helen Keller International, Catholic Relief Services) and international organizations (International Finance Corporation, UNICEF and World Food Program) which had previous dual partnerships or other types of relationships with the industry. Again in these cases, MNCs are not building new "bridges" with their alliance partners and do not need to change their partners' beliefs and attitudes.

Based on this exploratory evidence, we state the following proposition:

> *P1. If it develops weak ties (or "bridges") with multiple stakeholders through sustainability alliances, the MNC increases its partners' beliefs that the MNC has an effective sustainability strategy and the alliance partners will ultimately act favorably toward this strategy.*

Second, evidence exists that building multi-stakeholder sustainability alliances moves partners' subjective norms to be more inclined towards acting favorably to the MNCs strategies when other alliance partners have higher status. This evidence is exploratory mainly due to the tentative measurement of subjective norms and status proposed herein. First, as subjective norms are difficult to measure directly in this context, we measured subjective norms indirectly based on the responses of "significant others" to the decisions of MNCs' alliance partners to act favorably to MNCs strategies. This implies that stakeholders deciding to join a sustainability alliance implicitly need to ask themselves: "what will significant others think and how will they react and affect

me if I ally myself with a MNC?" Second, consistent with Podolny's theory (1994), we tentatively measure an actor's status based on the number of declarations of "deference" (Parsons, 1963) that the actor receives regarding sustainability. Therefore, we consider actors that have been broadly and frequently cited for their past work on environmental and social issues as having "high status", while actors receiving few citations for their past work in the same field are considered as having "low status". The tentative measurement of these variables and the exploratory nature of their relationship certainly justifies further research in this domain as discussed in next section.

Based on these tentative measures, we found that when participating in MSSAs with other high-status actors, the alliance partners have generally not been accused of "greenwashing." That is an MSSA has not been accused by stakeholders external to the alliance of collaborating to provide a superficial "green" look to MNCs that are making no real change towards sustainability. For example, we could find no cases of MSSAs being accused of greenwashing even on extremely delicate issues (such as the Soy Moratorium Group (2010) and the 4C Association (2010)) when the MSSA had a large and diversified number of high-status stakeholders including governmental agencies, NGOs, universities and international organizations. Similarly there have been no greenwashing accusations made toward the thematic working groups created within the SAI Platform (2010). They too involve a large and diversified number of stakeholders with high status.

On the other hand, greenwashing accusations have been made of (1) bi-lateral alliances or certification schemes involving only one high-status stakeholder and (2) MSSAs with a number of actors that are "low status". Bi-lateral alliances examples accused of "greenwashing" by other stakeholders include the Roundtable on Responsible Soy (e.g., GMwatch 2010; Holland et al. 2008) with the WWF (normally considered high-status), and the environmental certification schemes (e.g. Jaffee 2007) with the NGO Rainforest Alliance (considered of lower status than the WWF). Cases of multi-stakeholder alliances accused of "greenwashing" include the International Cocoa Initiative (2010), which has NGOs and trade unions of relatively lower status, and to some extent the RSPO (2010), which has a small and undiversified number of high-status stakeholders.

Based on this exploratory evidence, we state the following proposition:

> *P2. The higher the status of the alliance partners, the stronger is the impact of the multi-stakeholder alliance on other alliance partners' subjective norms for acting favorably to the MNC's sustainability strategy.*

Consistent with the theory of reasoned action, we posit that MNCs' alliance partners act favorably to a MNC's sustainability strategy when the partners' beliefs that the MNC has a sustainability focus are strong, when their attitudes towards acting favorably to the MNC are positive and when their subjective norms do not prevent them from acting favorably to the MNC. In this explorative study, we observed three types of "favorable acts" of alliance partners towards the MNC. First, some alliance partners actively endorsed or provided a positive evaluation of the MNC's effort towards sustainability within the scope of the alliance. This is the case of Amnesty International declaring the efforts of the Ajinomoto Group (2010) of moving towards socially

responsible practices and the case of the Rainforest Alliance endorsing Nestlé and Kraft for their effort in the development of dual and multi-stakeholder alliances on sustainability (e.g. Kraft 2010). Second, more often, the MNC explicitly mentions the name of "high status" alliance partners in sustainability reports and press releases to justify their effort in defining, implementing and measuring sustainability with that high-status partner as part of their core business. In this second case, the alliance partner provides a "passive endorsement" to the MNC. This is the case of WWF and Oxfam participation to the RSPO and 4C Association alliances, where these NGOs claim that their continued participation in the alliance is subject to the progress made by their business partners towards sustainability (e.g., Oxfam 2005). Third, alliance partners act favorably to the MNC by stopping the release of negative information on a certain behavior(s) of the MNC when they observe a positive change from previously unsustainable practices. For example, Greenpeace stopped providing negative information on Cargill and other MNCs on the specific themes under discussion in the alliance after the establishment of the Soy Moratorium Group (2010). Therefore, we state the following proposition:

P3. The interaction between sustainability alliance high-status partners' attitudes and subjective norms is positively associated with their behavior of acting favorably to the MNC's strategies.

Dynamics between Alliance Partners and MNCs' Stakeholders outside the Alliance

MNCs communicate the activities undertaken by MSSAs mainly through reports and press releases (e.g., Kraft 2010; Nestlé 2010; Unilever 2010). These are the potentially effectively signals of sustainability to the larger set of MNCs' stakeholders outside the alliances. At the same time, some MNCs' alliance partners - specifically NGOs with a mission of advocacy and awareness-raising on sustainability issues – use their information released through reports and press releases as "carrots and sticks" depending on MNCs' efforts towards more sustainable practices (e.g. Greenpeace 2010; Oxfam 2010; WWF 2010).

Despite the signaling intent of MNCs and of some of their alliance partners, to the best of our knowledge there is no direct evidence of the impact of multi-stakeholder alliances on the behavioral intentions or behavior towards MNCs of these other external stakeholders. Recent literature found that a set of positive information from different sources related to the sustainable practices of a firm has a positive impact on consumers' attitudes towards the firm and on intentions of acting favorably to it (Dentoni et al. 2011; Tonsor et al. 2005), but these studies are based on hypothetical experiments and involve only one category of stakeholders (consumers). The declared signaling intent of MNCs and some alliance partners and the scarce empirical evidence collected so far makes testing this relationship very important in future research. Therefore, based on the exploratory evidence provided and consistent with the theory of reasoned action, we state the following proposition:

P4. Sustainability alliance partners' behavior of acting favorably to a MNC's sustainability strategy is positively associated with other external stakeholders' (1) beliefs that the MNC has sustainability focus, (2) their attitudes towards acting favorably to the MNC and (3) their actual behavior of acting favorably to the MNC's sustainability strategy.

When presenting multi-stakeholder alliances on sustainability to other stakeholders through press releases and annual sustainability reports, MNCs often highlight the importance of their alliance partners' contribution to define, implement and measure jointly undertaken sustainability initiatives. MNCs often describe their alliance partners with deference to justify their alliance partners' choices (e.g. Cargill 2010; Fonterra 2010; Sara Lee 2010).. MNCs thus use the status of their alliance partners to signal their focus on sustainability to their stakeholders outside the alliance.

While the use of alliance partners' status as a signal of MNCs' sustainability focus is evident, to the best of our knowledge research has not analyzed the impact of MNC alliance partners' status on other stakeholders' beliefs and attitudes towards the MNC. Consistent with Podolny (1993 and 1994), recent agribusiness research found that the status of endorsing actors outside the supply chain has a role on beliefs and behaviors of a firm's customers and final consumers (Dentoni and Reardon 2010) but these findings were in a context different from sustainability alliances. Moreover, other research analyzed the impact of endorsers' credibility on consumers' beliefs and buying intentions again in different contexts from sustainability alliances (Dentoni et al. 2011; Frewer, Howard, and Shepherd, 1998). The relationship between endorsers' status and credibility has not been explored.

The importance attributed by MNCs to the relationship between alliance partners' status and the beliefs, attitudes and consequent behaviors of stakeholders external to a sustainability alliance, together with the current paucity of research in this domain, makes testing the following proposition important for future research:

> *P5. The higher the status of MNC sustainability alliance partners, the stronger is the impact of alliance partners' behavior of acting favorably to the MNC on other external stakeholders' beliefs that the MNC has an effective sustainability strategy.*

Finally, through their annual reports and press releases, MNCs often declare that they consider sustainability strategies as necessary not only because they are of crucial importance to the future of planet and people, but also due to the practical relevance for their survival and for enhancing innovation by developing sustainability skills, knowledge and reputation within the MNC organization (e.g., Dutch Sustainable Initiative 2010). Through MSSAs, MNCs clearly intend to generate improved financial performance together with improved environmental and social performance. This intention is consistent with the triple-bottom line concept (Elkington 1998) and the concept of sustainability as an opportunity to learn from a larger group of stakeholders (Cronin et al. 2011; Hult 2011). Despite these MNCs' stated intentions, little empirical evidence exists on the impact of MSSAs and of MNC alliance partners' acting favorably on the value of MNCs' marketing assets and on the MNC's financial performance. This lack of evidence may simply arise because a sufficiently long series of historical data on MNC performance is not yet available to measure these relationships. This makes it interesting to test the following proposition in future research:

> *P6. Other stakeholders' behavior of acting favorably to the MNC is positively associated with the value of MNC marketing assets and with MNC financial performance. Specifically, MNC's financial performance and market value is enhanced by greater consumer acceptance*

of its products, greater access to capital from investors, and fewer obstacles to strategy implementation by non-supply chain stakeholders, e.g., governments and NGOs.

The framework and the six propositions are presented in Figure 2. They provide a first answer to the questions posed at the end of the first section. In particular, the framework proposes that MNCs' forming or joining MSSAs effectively changes alliance partners' perceptions and behaviors if multiple partners are involved in this process and if MNCs ally themselves with partners who have high status. By first influencing attitudes, perceptions and behaviors of high-status partners within the alliance, MNCs can effectively change attitudes, perceptions and behaviors of the larger group of their stakeholders outside the alliance. Under these conditions, MSSAs could ultimately have a positive effect on MNCs' marketing assets, and financial performance.

Discussion: Research Opportunities and Implications

We identify a number of opportunities to be explored in future research (Table 3) by comparing the proposed framework with the existing literature on sustainability in agri-food value chains. We posit that multidisciplinary research testing the stated propositions would lead to key implications for both MNC managers and other stakeholders deciding to participate in or create MSSAs to signal sustainability to its stakeholders.

Specifically, by testing the stated propositions P1 to P3 related to the dynamics among MNCs and their partners within MSSAs, agribusiness research has the opportunity to tackle the following broad question: how can a MNC choose partners and build relationships with them in an MSSA to effectively signal sustainability to all its alliance partners and to favorably change their behavior towards the MNC? However, testing these propositions may present a number of challenges in terms of methods of measurement and analysis. Measurement challenges are mainly given by common rater's social desirability biases (Podsakoff et al. 2003) if the variables of interest such as rater's beliefs, attitudes, subjective norms and behavioral intentions are measured with direct questions to MNC managers, alliance partners and other stakeholders. Analytical challenges mainly refer to the risk of misspecification error if a significant variable is not identified and included in the framework (Grewal, Cote, and Baumgartner 2004).

We suggest the use of the following range of research methods to tackle these challenges and test the suggested propositions effectively. First, researchers can conduct natural experiments where the creation of weak ties and of a sustainability alliance among multiple stakeholders is the "natural" treatment and alliance partners' beliefs, attitudes and behaviors are measured. Specifically, panel data (Wooldridge 2002) effectively measure the dynamic change of the measures over time and the impact of the creation of weak ties and sustainability alliances. Moreover, multivariate statistical approaches such as latent growth models and hierarchical linear models (Duncan et al. 1999; Raudenbush and Bryk 2002) allow the dynamic analysis of both individual variables (related to individual alliance partners) nested within "group variables" combining direct questions to alliance partners and the use of qualitative analysis software on alliance partners' reports and press releases (Barry 1998). Second, case-based grounded theory methods (Eisenhardt 1989) would allow the collection a richness of data which describes the process of alliance creation in detail and decreases the risk of misspecification errors in future research. Specifically, grounded theory would allow further exploration of the conditions under which the creation of sustainability alliances influences alliance partners' beliefs, attitudes and behaviors. Third, simulation

methods such as agent-based modeling (Bonabeau 2002) would allow a dynamic analysis of how stakeholders would react according to their expected benefits, costs and risks of participating in MSSAs and of acting favorably or unfavorably to MNCs' sustainability strategies. Once expected benefits, costs and risks are validated through discussions with the interested actors and experts on MNCs' sustainability strategies, agent-based modeling allows the study of a simulated iterative chain of reactions across stakeholders until an equilibrium point is reached (Bonabeau 2002). This type of simulation would effectively tackle the measurement challenges of social desirability biases of the interested actors (Table 3).

Table 3. Suggested Research Directions on the Role Multi-Stakeholder Alliances as Signals of MNCs' Focus on Sustainability

Testable Propositions	Research Method	Analytical Models	Key Variables of Interest	Research Questions of MNC Interest
P1	Natural Experiments	Panel Data, Latent Growth Models, Hierarchical Linear Models	Weak Ties between Alliance Partners (X), Alliance Partners' Beliefs and Attitudes (Y)	*How can a MNC choose partners and build relationships with them in a multi-stakeholder sustainability alliance to effectively signal its sustainability focus to other stakeholders?*
	Grounded Theory	Case-Based Analysis	Conditions under which Weak Ties between Alliance Partners (X) impact Partners' Beliefs and Attitudes (Y)	
P2	Simulations	Agent-Based Models	Alliance Partners' Status (X), Other Alliance Partners' Subjective Norms (Y)	
P3	Simulations	Agent-Based Models	Alliance Partners' Subjective Norms, Beliefs and Attitudes (X), Alliance Partners' Behaviour (Y)	
P4	Hypothetical Experiments	Latent Growth Models, Hierarchical Linear Models	Alliance Partners' Status and Alliance Partners' Behaviour (X), Other Stakeholders' Beliefs and Attitudes (Y)	*Under which conditions the behavioural change of MNC's partners in a multi-stakeholder sustainability alliance influences other stakeholders' behaviour towards the MNC and ultimately on MNCs' marketing assets and financial performance?*
P5	Simulations	Agent-Based Models	Alliance Partners' Status and Alliance Partners' Behaviour (X), Other Stakeholders' Subjective Norms (Y)	
P6	Natural and Hypothetical Experiments	Logistic Models, Latent Class Analysis, Structural Equation Models	Other Stakeholders' Beliefs and Attitudes (X), MNC's brand equity and corporate reputation (Y)	
	Natural Experiments	Panel Data, Latent Growth Models, Hierarchical Linear Models	Other Stakeholders' Beliefs and Attitudes (X), MNC's financial performance (Y)	
	Simulations	Agent-Based Models	Other Stakeholders' Beliefs and Attitudes (X), MNC's financial performance (Y)	

Note: X represents the independent variable of interest, Y represents the dependent variable of interest.

By testing the stated propositions P4 to P6 on the dynamics among partners within MSSAs and external stakeholders, agribusiness research has the opportunity to tackle the following broad question: under which conditions does the behavioral change of an MNC's partners in a MSSA influences external stakeholders' behavior towards the MNC and, ultimately, the MNCs' marketing assets and financial performance? To test the suggested propositions, we propose the use of the following range of research methods. First, hypothetical experiments can be used to test the potential change in beliefs, attitudes and behavioral intentions of stakeholders that are outside the sustainability alliance under study. In this case, depending on the stakeholder under study, treatments can be manipulated by the researcher with pieces of information on the creation or outcome of MSSAs, similarly to a large established strand of consumer economics and behavior research (Lusk et al. 2004; Rao and Sieben 1992). Second, through both hypothetical and natural experiments with stakeholders, research can also test the moderation role of alliance partners' status on the relationship between their favorable behavior towards the MNC participating to the alliance and the reactions of other stakeholders external to the alliance and the mediation role of alliance partners' credibility (Frewer, Howard, and Shepherd 1998). Ultimately, both hypothetical and natural experiments can be used to test the impact of the reactions of stakeholders external to sustainability alliances on MNCs' brand equity, corporate reputation and financial performance. Finally, to avoid social desirability biases in hypothetical experiments, simulations such as agent-based models (Bonabeau 2002) can be used to analyze how other stakeholders react to information about MNCs and their sustainability alliances.

Conclusions

This study had three objectives. First, it aimed to introduce a new and still scarcely studied phenomenon of great importance for the current global agri-food context, which is the formation of MSSAs by MNCs in the food and beverage sector. Second, it suggested a multidisciplinary conceptual framework to analyze how MNCs use MSSAs to signal sustainability to their stakeholders. Third, it discussed the use of a set of methods to effectively test the developed multidisciplinary framework in future research. The importance of key concepts from the domains of management, psychology and sociology can be effectively applied to the agribusiness arena and specifically to the analysis of agri-food firms' sustainability strategies. As described, the application of concepts from different disciplines and of the appropriate methods of measurement and analysis can open up wide opportunities for future research and collaboration between business and academia.

The results of this study can be synthesized as follows. First, there is exploratory empirical evidence that MSSAs have recently become a key element of the largest MNCs' sustainability strategy in the global food and beverage sector. Second, MNCs are more likely to change alliance partners' beliefs, attitudes, subjective norms and behaviors towards MNCs when they develop weak ties with their partners and when partners have a higher status. Third, MNCs and their partners in MSSAs aim at influencing external stakeholders' beliefs, attitudes and behaviors towards MNCs, which in turn affect MNCs' marketing assets and financial performance. Future research has the opportunity to validate and deepen these exploratory results to provide useful guidance for decision-making in sustainability strategies to both MNC managers and their stakeholders.

This study has three major limitations which can be overcome in future research. First, the evidence presented in this paper is largely exploratory. In particular, variables of interest such as alliance partners' beliefs, attitudes, subjective norms and status are measured indirectly and that is to say that they are implied based on related observable outcomes such as behaviors and acts of deference from other stakeholders. Moreover, the relationship stated in the suggested propositions among the variables of interest has analytical validity but no statistical validity. We suggested a number of research methods to overcome this limitation by testing the conceptual framework developed in this paper. Second, the paper does not explore in depth the structure, organization and processes of multi-stakeholder sustainability alliances and their role in changing alliance partners' beliefs, attitudes and behaviors. Among the methods suggested for future research in this field, we indicated case-based grounded theory as an appropriate approach to explore these variables. Third, the developed conceptual framework contributes to explaining only one aspect of why MNCs form sustainability alliances with a large and heterogeneous number of stakeholders. As discussed in Figure 2, MNCs' use of alliance partners as signals of their sustainability focus vis-à-vis other stakeholders represent only one of the two major incentives justifying MNCs' formation of such an alliance. As recently discussed in the literature, MSSAs are also an opportunity for MNCs to share and co-create knowledge and capabilities on sustainability (Berger et al. 2006; Peterson 2009) and ultimately to generate innovation based on an orientation towards a larger set of stakeholders than merely customers and final consumers (Cronin et al. 2011; Hult 2011; Nikolaeva et al. 2011). By following both these discussed directions, future research has the opportunity to fully develop a theory of the formation of MSSAs that provides a guide for both MNCs' managers and their stakeholders.

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International Food and Agribusiness Management Review
Volume 14, Issue 5, 2011

Food Risks and Type I & II Errors

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Abstract

The global food supply network is becoming increasing vulnerable to food safety and food defense risks due to failures in prevention and control measures. We develop the idea of control oriented supply chain security management in the context of global food supply networks. We identify a variety of failure points where security systems can produce Type I (false positive) and Type II (false negative) errors that create disruptions, and explain how the use of ex-ante prevention measures can lead to opportunities for continuous reductions in costs and food risks..

Keywords: Food safety, food defense, error based disruption, control oriented supply networks

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Introduction

Food processing and distribution involve risk (USDA 2009). Food supply networks are increasingly exposed to food safety and food defense risks partly due to the large volume of shipments from domestic and import sources (USDA AMS 2008; Acheson 2007).[1] However, these risks could be magnified as a result of error based disruptions from Type I and II errors which cause failures in prevention and control measures.

A false positive or Type I disruption occurs when an inspection system incorrectly identifies a threat or a diagnostic system incorrectly identifies a food risk cause, so that a safe product is excluded from the supply chain. Type I disruptions would lead to increased seller's risk, since the seller is exposed to the risk that safe products will be incorrectly devalued. Type I errors are seldom publicly recognized, since they don't affect consumers, but they can have real economic costs to industry. An example of a Type I disruption would be losses incurred when a produce shipment is delayed or destroyed at a Port of Entry (POE) due to a false positive "swab" pathogen test result that could be different from a detailed "culture test", or a producer initiates a mass recall of finished products, rather than a targeted or limited recall, due to ineffective traceability.

A false negative or Type II disruption occurs when a defective product is distributed to the consumer and causes harm that is extensive enough to create market failure (inefficient allocation of goods and services) as a result of the failure to detect the problem or correctly diagnose the cause. Type II disruptions would lead to an increase in buyer's risk, since the buyer experiences the costs associated with the resulting illnesses or deaths. Examples of Type II disruptions are failures to detect accidental contamination from foodborne pathogens, counterfeiting, and adulteration. Some obvious recent examples of Type II disruptions are the melamine adulteration in powder milk powder and the 2006 - *Salmonella* contamination of spinach, both of which led to multiple fatalities. The melamine adulteration episode resulted from an inspection system's failure to detect an intentional, commercially motivated set of actions by some individuals.

The purpose of this study is to assist management, in a business to business (B2B) supply chain that "exceeds" minimal government requirements, to design systems to detect, prevent, and respond to food safety/defense risks in the food supply networks by learning from error based disruptions. While the overarching goal of a control oriented security system is to simultaneously minimize Type I and Type II errors, system improvement can take the form of a reduction in one or both types of error based disruptions or from achievement of cost reductions. We propose that

[1] Food safety can be defined as food system *reliability* – reducing *exposure* to natural hazards, errors, and failures. It is the unintentional contamination of food, which may have dangerous and lingering consequences (Acheson, 2007). Food defense, on the other hand, is system *resiliency* – reducing the *impact* of intentional system attacks from disgruntled employees, terrorists, etc. Chalk (2003) noted that, in the last century, there were several documented cases where pathogenic agents were used to intentionally infect livestock or contaminate food. In September 1984 *Salmonella* food poisoning occurred in The Dalles, near Portland, Oregon when a Rajneeshee group intentionally contaminated restaurant salad bars and caused 751 cases of food poisoning. These individuals were trying to influence a local election. This group also had possession of strains of the causative organism for typhoid fever (Torok, Tauxe, and Wise, 1997). Similar eco-terrorist factions have used plant toxins in Africa (Carus, 1999), anthrax in the UK (Chalk, 2003) and potassium cyanide in Sri Lanka (Cameron, Pate, and Vogel, 2001) to intentionally contaminate food. The term "food protection" is an umbrella term used to define food supply system safety and defense.

control oriented systems differ fundamentally from systems designed to protect against disruptions caused by uncontrollable rare events such as hurricanes, strikes or earthquakes. One way that this difference can be understood is to note that error based disruptions only occur if there are inadequate detection and diagnostic processes intended to control potentially disruptive defects or events (Lee & Wolfe 2003). Once a detection or diagnostic system fails, the normal function of the supply network delivers the defective product to the consumer. This type of problem is thus qualitatively distinct and is further complicated by the complexity of the supply network system.

Error Based Disruptions and Network Complexity

We discuss error based disruption from our understanding of trans-border food supply networks. These networks meet our requirement of including distributed inspection, diagnosis and prevention systems that can be the focus of continuous improvement in control. Trans-border food supply networks are also distinct as they might be easier targets for food terrorism or be subject to multiple risk factors, including smuggling drugs and human trafficking. The first issue we need to address is that of threat. We assume, drawing on the threat-vulnerability-consequence model (Cox 2008; Nganje et al. 2009), that threats are the risk of a food safety outbreak or food terrorism attack arising in any part of the supply network. The kinds of security problems that give rise to threats may be unintentional, as most food borne pathogens contamination appears to be, or intentional, as in adulteration episodes by disgruntled employees or terrorist actions. Food adulteration, whether as a terrorist act or a commercially motivated one, is a principal concern in this kind of security system.

The motivations of the individuals or groups who engage in these behaviors may be political or economic. In either case the intention is to pass unsafe product through the system without detection. This is a significantly important issue because, in adulteration episodes, intentional concealment can be designed to exploit weaknesses in existing security systems. One favorable aspect of intentional behavior is that it often has a point source that, if identified, can lead to the elimination of the threat. Many more error based disruptions will be unintentional, resulting from combinations of events in the food supply network or from normal conditions. Because the cause of these threats can be complex (i.e. have no point source) and because contributing events can be dispersed across the supply network, detection and prevention of unintentional, error based disruptions can be very difficult.

Figure 1 presents a control oriented process map of shipment, inspection, detection, trace, and prevention in the trans-border food supply, identifying error based disruption points and subsequent opportunities for improvement. We discuss the potential failure points in the flow in terms of risk, protection and safety, and then discuss patterns of response that can improve prevention and thus reduce risk while increasing food protection (safety and defense).

The product is shipped and inspected, as shown in the central horizontal axis of Figure 1. Inspection can be performed by a third party (government inspectors at a port of entry), by the carrier, or by the buyer. Every inspection has the potential to generate an error based disruption (Baker & Shuck. 1975; Fortune. 1979). The risk that inspection will generate an error is termed vulnerability in the threat vulnerability and consequence (TVC) model (Cox. 2008). This model will be

extended to include the preventive actions management could implement to mitigate Type I and Type II errors associated with food protection.

Inspection can fail to detect a threat or can incorrectly identify a threat. If a threat is identified, it can either be verified (as in a two stage inspection process) or not. A positive test that is not verified represents a potential false positive or Type I error. If a threat is detected, the shipper and buyer are likely to take action to remove the supposedly unsafe food product from the system, resulting in the loss of the load and, potentially, in the disruption of all products from the source associated with the threat. This is the seller's risk of inspection (Nganje et al. 2009).

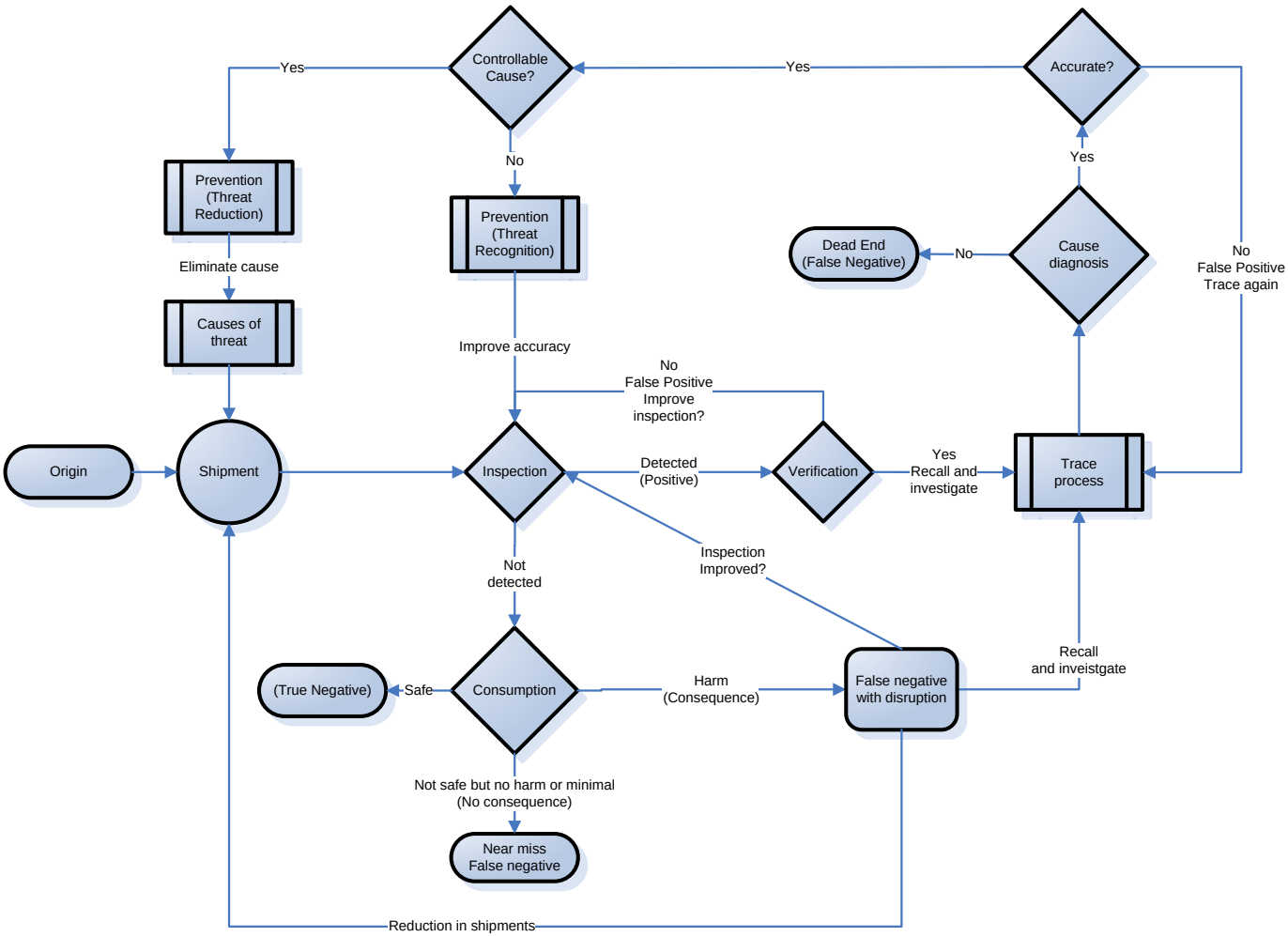

Figure 1. Control oriented supply network security process map

Every Type I error that occurs and is detected in verification represents an opportunity to improve the inspection system (Scazzero & Longnecker 1991; Stewart et al. 2007) in ways that directly reduce cost. Because systems that are overly sensitive will generate a larger number of Type I errors, the resulting opportunities for continuous improvement in inspection are more likely to focus on increasing accuracy and timeliness rather than increasing sensitivity (Baker &

Shuck 1975; Fortune 1979; Scazzero & Longnecker 1991; Stewart et al. 2007). More accurate systems may require more frequent sampling or information sharing between stakeholders and more timely results may require the co-location of testing facilities with inspection stations. Because Type I errors only occur when an inspection system has a specific target, the frequency of these errors also depends on the variety of threats the inspection systems are designed to detect. Most inspections at borders are primarily concerned with agricultural pests and trafficking in people or contraband (Nganje et al. 2009). Because more encompassing, more accurate and more timely inspections presumably increase costs, managers will assess the risk of these disruptions relative to those costs. Because the cost of a false positive may be low (no illness or deaths) relative to other types of disruptions, managers may accept the cost of these disruptions rather than improving the inspection system to prevent false positive results. This may be especially the case when defect rates are very low, since low defect rates may be associated with a greater incidence of Type I errors, such as swab pathogen tests which catch borderline cases.

If a threat is correctly detected during inspection and verified (a true positive), the threat will be removed, and the system may initiate an investigation into the failure to prevent the threat, as we discuss in greater detail below. This should be a normal practice in a continuous improvement orientation in supply chain security (Lee and Whang 2005). In a complex supply network, continuous improvement will require an improvement process that extends to the carrier, the supplier, and any intermediate agents.

If a true threat is not detected in inspection, the potential for a disruption resulting from a Type II detection error is created. For an actual disruption to occur the product must both be consumed and consumption must show recognizable consequences, such as a reported food borne illness or death. In a food supply system, products that are not consumed will not cause illness or deaths. In addition, some defective products may be consumed without actually creating consequences. These scenarios represent 'near misses' – Type II errors that are non-consequential but still represent opportunities for continuous improvement.

We therefore see the consequences of Type II errors as being driven by the risk that an error will be costly – that it will actually have a noticeable effect. These food risks are characterized by class I, II, and III recalls by the Food and Drug Administration (FDA). A Class I recall is a situation in which there is a reasonable probability that the use of or exposure to a contaminated food product will cause serious adverse health consequences or death. A Class II recall is a situation in which the use of or exposure to a contaminated food product may cause temporary or medically reversible adverse health consequences or where the probability of serious adverse health consequences is remote. A Class III recall is a situation in which use of or exposure to a contaminated food product is not likely to cause adverse health consequences (USDA-FDA 2009).

Based on studies of accidents in other complex systems (Perrow 1999; Sagan 1993; Weick & Roberts 1993) it is very possible that lapses in inspection programs represent the majority of Type II errors in food supply systems. This is because the observed rate of disruptions is a function of the effectiveness of inspections[2], the consumption rate and the use of alternative risk re-

[2] FDA operations inspect about 1% of the imported foods it regulates, down from 8% in 1992 when imports were far less prevalent (Schmidt, 2007).

duction strategies (e.g., cooking the product well). If the severity of Type II errors is underestimated it leads to inaccurate assessments of systemic risk which, in turn, influences decision processes concerning internal and external security policy (Cox 2008; Nganje et al. 2009; Verduzco, Villalobos & Vega 2001; Voss et al. 2009; Voss, Whipple & Closs 2009). Inaccurate assessment of Type II severity is a potential major failing in many food supply chain security systems, with frequent occurrences of food recalls resulting from the system failing to identify contaminated products.

The most extreme consequence of a Type II disruption in the food supply system is that one or more consumers gets sick or dies. Product recalls and supply disruptions are the almost inevitable consequences of Type II disruptions. Far more than Type I disruptions, Type II disruptions lead to calls to improve inspection systems. Unlike inspection improvement efforts resulting from Type I disruptions, efforts following Type II disruptions nearly always involve increasing the sensitivity and scope of inspections and policy. Once supply chains, brands and firm survival are threatened by a Type II disruption, managers become much less concerned with the cost of inspection and prevention improvements. The need for inspection to be seen as taking action can create new occasions for increased seller's risk, since the actions taken will not necessarily improve diagnosis, inspection or prevention (Verduzco, Villalobos & Vega 2001). For example, the Bioterrorism Act of 2004 only requires improvements in record keeping that improve traceability, without requiring changes in inspection or prevention methods. Improvements to traceability may create opportunities for improved protection and safety, but these opportunities must be exploited to achieve actual improvements. This risk of ineffective controls legitimizes our emphasis on cost, since it provides a basis for making choices between investments in inspection, diagnosis and prevention.

Investments following Type II disruptions resulting from inspection errors can be aimed at improving inspection or at diagnosing causes, thereby enabling prevention oriented investments aimed at reducing threats. Diagnostic processes, which are usually called traceability processes, have the potential to fail, which we call diagnostic risk. Diagnostic systems can produce false positives (Type I diagnostic error) and false negatives (Type II diagnostic error), by providing timely and targeted recalls when there is a known food borne disease outbreak.

How likely a Type II diagnostic error is to occur depends in large part on the structure of the supply network. Because traceability involves identifying and verifying the components and chronology of events in all steps of a process chain, Skilton and Robinson (2009) propose that its effectiveness is a function of the level of complexity in the supply network on one hand and the degree of tight coupling within the supply network on the other. In systems where supply networks are relatively simple and tightly coupled through integrated process structures and coordinated information exchange, traceability is a relatively straightforward process. We suspect that systems with these characteristics, which we associate with branded goods and processed food, are also likely to have relatively low levels of diagnostic risk. Although Pomonarov and Holcomb (2009) argue that the risk of disruption is greatest for such firms, we suggest that, because the consequences of disruption are perceived as greater, these firms are more likely to have systems that allow accurate diagnosis of errors. These food supply networks will be able to quickly trace the causes of disruptions. As network complexity increases, diagnostic risk will tend to increase, particularly if complexity reduces the timeliness and accuracy of information flows, or

compliance with security measures. Because traceability and diagnosis will be less effective, fewer opportunities for improvement will emerge. Supply chain managers will be confronted with a need to trade-off the benefits of network complexity against the costs of tight coupling and information coordination which enable rapid traces and accurate diagnosis.

Diagnostic risk will be greatest in supply networks that are loosely coupled and complex (Skilton & Robinson 2009). In these networks, which are relatively common in the commodity sectors of the food supply system, it can be very difficult to accurately diagnose the causes of disruptions. Because networks are complex and entangled, inaccurate diagnosis can create Type I diagnostic errors that compound the cost of the initial disruption. One example of a Type I disruption in tracing was the incorrect association of tomatoes with *salmonella* contamination in 2007. This false positive diagnosis led to a nationwide tomato recall that cost growers and packers more than $30 million (USDA 2008).

Although the risk of diagnostic errors is greater in complex, loosely coupled networks, security efforts are often substantially lower in these networks because the participants have significantly lower investments in brand and reputation to protect, reducing the perceived severity of failures. These factors combine to make this the sector most exposed to consequential error based disruptions. Reduced prevention and inspection increase the likelihood of Type II errors, and a loose network structure will impede traceability and improvement efforts. This environment also invites intentional food contamination. While food terrorist actions have been infrequent (Chalk 2003; Engel 2000), intentional adulteration for commercial reasons was the source of the Chinese infant formula melamine poisoning event (Chao 2007) and is probably more common than is generally recognized. The threat of supplier opportunism should be as much a consideration in supply chain security as terrorism is (Roth et al. 2007; Voss et al. 2009).

When an accurate trace is carried out and the source or agents are identified, the system has an opportunity to improve prevention. In the food supply network, preventive security measures include supplier selection standards, supplier development and certification, facility design and protection processes, employee screening and training, shipment tracking, process integration and process monitoring (Closs & McFarrell 2004; Lee & Whang 2005; Roth et al. 2007; Voss, Whipple & Closs 2009; Williams, Lueg & May 2008). The presence of known inspection processes may serve to prevent some kinds of threats from being deployed (Chao 2007), but tests that are too narrow may invite other specific kinds of threats. Supply chain security personnel should remain aware that intentional threats in particular will tend to adapt to changes in security systems (Chalk 2003; Cox 2008). When intentional disruptions occur and can be traced, managers are faced with the dubious luxury of having an identifiable point source of a set of actors who can be prosecuted or whose access to the system can be removed.

Changes to preventive measures often follow from successful traces in response to Type II disruptions at the moment when cost-based resistance is least and the perception of risk is greatest. They are often adopted as governmental initiatives (e.g., U.S. Customs initiatives such as C-TPAT and advanced electronic notice of shipping manifests) or industry initiatives (California Leafy Greens Marketing Agreement, ISO 28000 standards addressing supply chain security; the International Maritime Organization's International Ship and Port Facility Security Code). Governmental and industry level initiatives have the advantage of leveling the playing field in terms

of implementation costs, but may not provide enough incentives for all parties along the supply chain to fully adopt food risk mitigation strategies (e.g., smaller firms may be given more time to implement a policy or acquire more resources). Strong central players in supply networks can complement federal efforts by imposing their own more stringent standards on producers and distributors, such as Wal-Mart's sustainability and food safety initiatives (Rosenbloom 2008). In the next section we discuss a comprehensive detection, prevention, and response framework that managers and policy makers could use to mitigate food risks and error based disruptions.

A Control Oriented Framework and Reduction of Type I and Type II Errors

A comprehensive detection, prevention, and response framework would have four major components: 1) to identify the roles and synergies of multiple stakeholders, 2) to establish procedures to assess threats, vulnerability, and consequences along the food supply chain, 3) to identify incentives for management to adopt and implement controls oriented risk mitigation plans and 4) to develop a feedback system for response and continuous improvement.

A major challenge with having multiple stakeholders is how to identify synergies which may lead to developing consistent risk mitigation policies. One approach may be to use Scenario Method Analysis, a qualitative approach for determining drivers and dependent variables.[3] This would provide a framework to avoid duplication but yet facilitate validation so that the cost and risks associated with Type I and II errors are minimal.

Figure 2 describes a conceptual framework to address the last three components of the threat-vulnerability-consequence model (Cox 2008; Nganje et al. 2009). The process map visualized in Figure 1 and described above contains the elements necessary for a theoretical framework of control oriented management in supply chain security systems. This framework defines the varieties of risk inherent in security systems and relates them to the investments and commitments necessary to achieve a balance between security costs and benefits. Figure 2 provides a systemic view of costs and risks and the relationships between them. How managers respond to opportunities for controlling threats and costs governs the evolution of supply chain security systems. Figure 2 provides a road map for the definitions and propositions that follow.

Beginning in the upper left corner of the figure, it seems self-evident that threats have causes (+ indication). In most security oriented studies, the causes of threats are treated purely as exogenous. As shown in Figure 2, in a control oriented framework, this is not the case. The causes of

[3] *Scenario Method Analysis* provides a qualitative approach to identify influence and dependent factors for the short-run (direct effects) and long-run (indirect effects with second- and third-order interaction) to enable all stakeholders determine what synergies and contributions in mitigating food risks should be considered. The Micmac Scenario Method is based on the formulation by Godet (1987). The analysis involves developing a database of important variables/factors from existing literature or survey, determining the relationship between factors (with 0 = no relationship and 3 = very strong impact), analyzing and classifying variables into four major quadrants: strong dependent and influence variables, strong dependent and weak influence variables, weak dependent and strong influence variables, and weak dependent and influence variables. The method derives second- and third-order interactions between factors from three environments: *internal firm environment, external policy environment, and the competitive market environment.* The *MicMac Software* is used to perform the analysis.

threat may initially be poorly understood, but an important goal of a control oriented system should be to understand causes of contamination in order to eliminate or control them (Bohn 1994; Lee & Whang 2005). Improved knowledge of control factors achieved through diagnostic processes often results in preventive measures, to which we will return at the conclusion of this section.

We have defined threats as the perceived risk of a defect or attack in a specified supply chain. We define vulnerability as the risk of errors in detection systems. Threats can arise at any point in a supply chain. For convenience we will conceptualize threats to be associated with shipments, but threats could equally be associated with facilities or personnel. The whole purpose of control oriented supply chain security systems is to estimate and control threats. This means that threats must be perceived, since a threat that is not anticipated cannot be estimated, controlled or defended against.

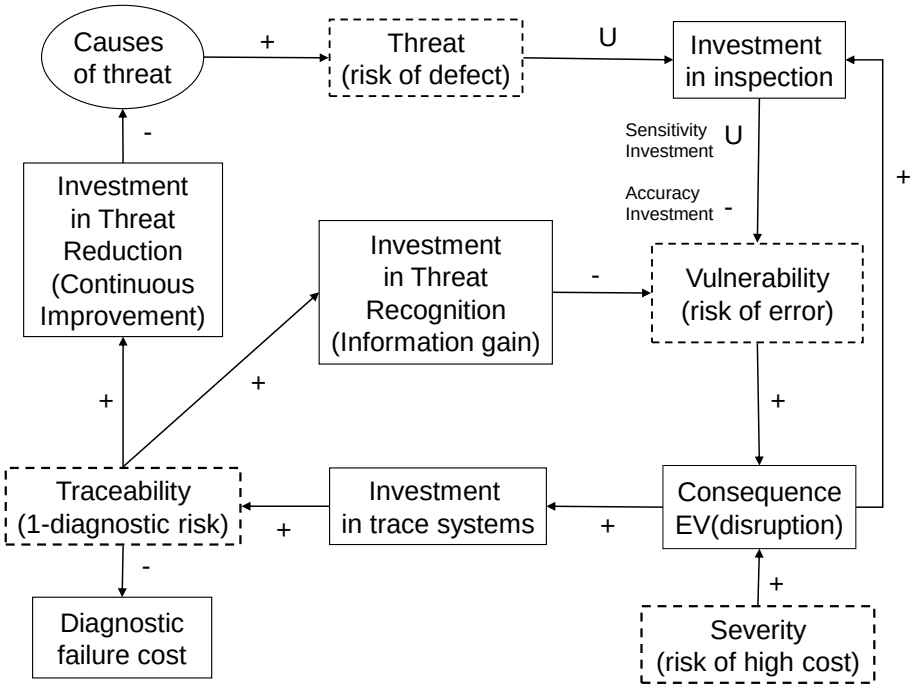

Figure 2. Control oriented supply network security conceptual model

Proposition 1 The relationship between threat, vulnerability, and investment in detection will be non-linear but positive, so that investment will grow less quickly as threats increase.

Arguments for Proposition 1. We assume, as many others have, that as threats increase, participants in supply chains will increase their investments in systems designed to detect defects and attacks before they reach the markets that are their targets. This is in contrast to protection oriented supply chain security systems that invest in hardening targets or creating back-up systems. In control oriented supply chain security systems, these investments relate primarily to inspec-

tion systems. Such investments can improve the sensitivity of inspections, the accuracy of inspections or both. We further propose that there are decreasing returns to detection systems such that, as the probability of defects or attacks increases, improvements in detection resulting from additional investments will diminish. When the threat is low, the benefits of additional investments in inspection systems (such as frequent sampling) will be constrained by the likelihood that greater sensitivity will increase the Type 1 error rate. As threats increase, benefits from additional investment will initially rise, and then plateau. Highly probable defects will be easier to detect with lower sampling rates and lower levels of investment, so that the form of the relationship between threat and investment in detection is likely to take an inverted U shape (presented in Figure 2). This could be illustrated best with the knowledge that as we increase investment in sampling and testing for pathogens we could produce both Type I and Type II errors. Investing in a more sensitive inspection system will decrease the likelihood of Type II errors while potentially increasing the likelihood of Type I errors. The real question here is whether investing in detection systems increases the net risk of combined Type I and Type II errors. We would argue that, in control oriented systems, investments to improve accuracy will decrease Type II errors without increasing Type I errors because the efficiency of all control units will be improved. On the other hand, investments in the detection of contamination will increase Type 1 errors while reducing Type 2.

Proposition 2. Vulnerability is positively related to consequence.

Arguments for Proposition 2. Consequences, which we define as the expected cost of disruptions, are positively related to vulnerability. The more vulnerable a security system is, the more likely it is that an error will occur resulting in a system disruption. How consequential a disruption is depends on the ways the product is used and by whom. A market failure resulting from a Type 1 error that leads a producer to withdraw a product that is actually safe could be as consequential as a complete market failure resulting from a terrorist poisoning a food supply.

Proposition 3. Consequence is positively related to investments in detection systems.

Arguments for Proposition 3. As a practical matter we would expect greater consequences, realized or perceived, to be positively related to investments in detection systems. Unlike the relationship between threats and investments in detection systems, we think that this relationship will be linear. Where consequences are very large, managers will take corresponding steps to invest in and improve detection. This is a central tenet of research on high reliability systems (Sagan 1996; Weick & Roberts 1993). Finally, consequences need not be realized to influence behavior. The perception that consequences will be high can lead to action.

Once we move beyond consequences, the remainder of the model deals with prevention (Nganje et al. 2009; Lee & Whang 2005). One of the principle contributions of this article is the inclusion of diagnostic systems designed to trace the root causes of disruptions. This is a key element in a prevention and control orientation generally. Only by diagnosing the causes of errors can we close the loop and achieve a control oriented system of supply chain security. The framework can also serve as a launching point for empirical research. Several of our propositions should be easily tested with the right empirical data. Finding support for this or an alternative model of these relationships will have important implications for practice in control oriented supply chain

security management. We think this is an important opportunity because most supply chain security managers are first and foremost supply chain managers. They will thus have a natural interest not only in achieving control of supply chain security, but also in finding ways to simultaneously mitigate threat and control the costs of errors.

Managerial Implications and Feedback for Continuous Improvement

Error based disruptions and risks that managers have opportunities to control are probably the most common types of disruption in food supply networks. Because food risks from an individual firm are relatively infrequent, managers are often reluctant to commit to permanent overhead costs to prevent them. As with uncontrollable disruptions, however, the consequences of allowing disruptions to take place may be much greater than anticipated. Not only can revenue flows be interrupted, often for long periods, but the value of brands can be seriously impaired when consumers become sick or die from food hazards.

In this paper we have pointed out a number of factors that make perceptions of the risk of error based disruptions inaccurate. First, Type I disruptions are often not considered as failures of the security system, when in fact they are. Shipments that are delayed, blocked or recalled when they are actually safe may be the major controllable cost in supply network security. This is an area where costs arise from compliance with regulations that are too sensitive or where tests are too sensitive or both. Type I errors represent an important opportunity for continuous improvement in inspection systems, an area that both managers and scholars may have overlooked for too long.

Second, the perceptions of risks relating to Type II disruptions may be systematically underestimated if their severity is characterized by a high proportion of near misses. There is a clear opportunity for future research to try to quantify and model these unseen costs and risks.
It is also important to recognize, as we have, that not all supply networks are exposed to the same levels of security risk. Highly integrated supply networks organized to include structured distributed detection and diagnosis processes, sustained relationships and extensive partner monitoring are much less likely to be exposed to error based disruptions. When error based disruptions do strike these networks they are more likely to be Type I events that do not threaten brand or production systems. Supply networks that rely on loosely coupled commodity trading (with complex tracing situations) are much more exposed to both Type I and Type II disruptions, and should therefore be the focus of management and regulatory agencies. Management wishing to improve control over their supply chain security should seriously consider abandoning this type of network in favor of a relatively simple, but more highly integrated structure (e.g., production with a contract/food protection environment like the Leafy Greens system). One important reason to do this is because it improves traceability, which is the key to improving the preventive measures that are necessary to achieve control in supply network security.

Management should address these issues related to information and network complexity to minimize errors and costs. Information systems designed for linear, tightly coupled networks will not meet the challenges of complex supply networks. Different network structures have to address additional problems such as preserving information through transformation processes or the comingling of shipments that simply don't occur in simple, tightly coupled networks. In tightly

coupled networks, a powerful central player can make traceability systems much more effective, but only at a high cost in terms of system resources, data quality and the opportunity costs of committing to a smaller supplier base for any product. While we think that reconfiguring complex loosely coupled networks toward this more tightly coupled model would improve traceability and security, it might come at a high economic cost. This is the risk equation that many supply networks face, and thus far the tendency has been to maintain the structure and treat security failures as an acceptable risk. One area where the rewards of future research may be great will be the study of real time information systems (electronic barcodes and radio frequency identification devices) and the ways that they can improve accuracy. There is some hope that real time information can improve control of Type I disruptions and help reduce the rate of near misses in Type II disruptions.

There have been proposals that trust and embeddedness in networks that value quality and transparency can enhance traceability at a relatively lower cost (Roth et al. 2007; Skilton & Robinson 2009). Continuous improvement in supplier relationships to increase trust and transparency (Lamming, Caldwell & Harrison 2004; Lamming et al. 2001) has to be accompanied by continuous attention to and recertification of information flows and integrated processes. While trust and transparency may reduce the cost of inspection and prevention, they are not a substitute for such measures. Because trust and transparency can reduce perceptions of risk without actually reducing it, managers need to follow Ronald Reagan's security dictum: 'Trust, but verify'.

Although we have emphasized the ways in which current systems can fail, we have done so in the spirit of continuous improvement. We think that a continuous improvement approach (Lee and Whang 2005), combined with a security orientation (Autry & Bobbit 2009) that embraces a willingness to make data based decisions about the cost trade-offs of controlling error based disruptions will be central to more successful supply chain security management. Only by achieving an accurate assessment of total risks can supply chain managers make informed decisions that lead to the least costly, most effective, control oriented supply chain security systems.

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International Food and Agribusiness Management Review
Volume 14, Issue 5, 2011

Agribusiness Extension: The Past, Present, and Future?

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Abstract

Land Grant Universities from their inception have combined extension programs with research and teaching. This makes them unique from other universities and extension programs can have a synergistic effect on both agribusiness teaching and research programs. While being relatively young, Agribusiness Extension programs have evolved from a rich history of agricultural economics programs to meet the current needs of a changing clientele and environment. While initial emphasis in extension programming focused on the needs of farmers at the production level of the supply chain, agribusiness extension programming has reached out to involve more suppliers and buyers in support of the entire chain. This paper examines the evolution of agricultural economics into agribusiness extension programs and looks at what is currently happening with agribusiness extension programs including the linkages to research and teaching. The paper then current and predicted trends and what they might mean for agribusiness extension programs in the future. Agribusiness Extension programs have evolved into many strong programs that universities in the face of budget cuts continue to support. However, these programs face many challenges and opportunities and will need to continue to build on their success of providing answers to a changing clientele to take them into a strong future.

Keywords: agribusiness extension, future

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Introduction

Land Grant Universities (LGUs) and extension programs, from their inception over 100 years ago, have had a tradition of meeting the current needs of the agriculture community through research, teaching and extension (Anderson 2004). While initial emphasis in extension programming has focused on the needs of farmers at the production level of the supply chain, agribusiness extension programming has reached out to involve more suppliers and buyers in support of the entire chain. The combination of extension with research and teaching makes LGUs unique from other universities, and can enhance both research and teaching. Agribusiness extension programs in particular have a synergistic effect on both agribusiness teaching and research programs.

Agribusiness extension, while being relatively young, builds on a strong foundation. Agribusiness extension programs have evolved from more traditional agricultural economics extension roles to meet the current needs of a changing clientele and environment. This paper will look at past, present, and future agribusiness extension programs and their interaction with both research and teaching programs at land grant universities.

Reflections on the Past

Since their inception, agricultural economics and agribusiness extension programs have been about providing science based education to producers to help them make better business decisions and hence be more profitable/successful. Extension educational programs have changed to better meet the evolving challenges producers face and the delivery methods used.
In the early 1900's, extension agricultural economists focused on three areas: management (for both producers and agribusinesses), market analysis and intelligence, and policy analysis. During the period of 1900-1914, farm management issues dealt with globalization and land allocation issues. This gave way to volatile times and an emphasis on protectionism, getting out of the Great Depression, dealing with unstable markets and many policy innovations (Chavas 2010).

Since 1945, agricultural extension economists have turned their attention to labor migration out of agriculture and the rise of farm mechanization, the increase in farm size and decrease in farm numbers, the impact on farming operations from increased productivity and the trend towards the privatization of agricultural research. (Chavas 2010). As agribusiness firms have grown in size, they continue to employ scientists and economists that increasingly conduct research activities that used to be the sole domain of universities.

The traditional role of an agricultural economics specialist was to examine the economic differences in production techniques of commodities and serve as an access point to market data collected by the USDA. In the past, the focus was on commodity agriculture and understanding how to be a low-cost producer. It was also focused on letting producers understand how supply and demand forces were affecting the prices of their commodities. Since it was based on commodity production with many producers doing similar things, the answers could be somewhat generalized. Agriculture extension economists often focused on production economics, including crop budgets showing how to optimize the choices for input uses such as

fertilizer. While their work was important, the focus was on understanding the firm-level economics associated with improved production techniques, often resulting in a marginalized role of the economist compared to crop science and animal science. Additional problems emerged relating to marketing commodities. Connections to firm-level decision making beyond the farm was largely limited to Capper-Volstead cooperative development, marketing orders, and anti-trust issues and these issues were largely left to research-oriented programs.

Much of the formative years of agricultural economics extension work centered on assisting in the formation and dissemination of agricultural outlook reports for major farm commodities. The first National Agricultural Outlook Conference was held April 20-21, 1923 at the Bureau of Agricultural Economics (BAE). With the creation of the BAE in the USDA in 1922, many in the BAE felt a procedure should be developed to disseminate the results from economic research to farmers in a manner that would serve as useful guides for their production and marketing decisions the following year (USDA 1942). The conference was designed to provide this outlook and has continued ever since (Ferris 2010).

Special committees were formed around the major agricultural commodities with additional attention provided to understanding the economics associated with domestic demand, agricultural competition and the demand in foreign countries (USDA 1942). By 1926, a few of the leading state agricultural economists were involved in preparing the annual report. The role of state research economists shifted to extension specialists who were invited to the USDA for training sessions on the outlook. A strong partnership developed between the USDA and the Land Grant institutions in which the state extension economists both gained from, and contributed to, the development of the outlook material, making it applicable to the farmer constituency (Dixon 1928).

At the outset of the Federal-State Outlook program, state specialists involved were primarily trained in farm management and served as the link between the USDA and the county extension agents to implement the program. Considerable attention was given to the process of integrating the outlook information into an ongoing farm management program, which had concentrated on budgeting, with county staff and farmers (Ferris 2010).

Over time, state outlook programs evolved and there were many common characteristics across states, including farm magazine articles, articles in departmental publications and other university and trade publications, radio programs, public speeches and the organization of state outlook meetings. Often, outlook presentations were part of programs sponsored by farm organizations. Some state specialists covered livestock and field crops, while others covered poultry, dairy, fruit and vegetables (Ferris 2010). This was an excellent foundation for today's agribusiness extension, but the needs of extension clientele began to change and so did agribusiness extension.

A traditional model of "training the trainer" is reliant on an adequate number of skilled people at both the state and county levels. This model assumes that county agents are trained by people at the state level and then deliver programming in groups and one-on-one at the county level. A considerable number of county agents in the authors' home states received their training and undergraduate education in disciplines other than agricultural economics such as animal science,

agronomy, and horticultural science. This disciplinary disconnect places the burden of transmitting agribusiness concepts on the shoulders of state specialists. Training county extension faculty in agribusiness subjects is often met with trepidation and a request by county faculty to have state specialists either deliver these agribusiness programs in person, or to provide the extension programming in the form of toolkits that can be handed out to extension clientele. This might mean even more problems for agribusiness extension that relies on different answers for different situations and using more analytical tools for the individual situation.

Cooperative extension in most developed countries like the U.S. is part of a university system, especially in land grant universities. Extension programming and advice is closely tied to the research and teaching that takes place at the university (Anderson 2004). It is this intersection of research, teaching and extension that has enabled land grant universities to serve diverse clientele bases.

A Look at the Present

What we have outlined as the history of agriculture economics extension programs describes the traditional and primarily commodity focus of agricultural economics extension. Agribusiness extension programs evolved considerably in the last 15 years. This was the time period that agribusiness programs expanded and came to the forefront, broadening the reach of the extension mission to include all businesses affiliated with food and agricultural value chains. While in some ways this was a new extension area, it was building on the foundation of agricultural economics extension programs that focused on providing science based education that helped producers make better decisions and hence improve profits and have higher probabilities of succeeding. Agribusiness extension programs were a response to a perceived need of new clientele facing new problems. They were also adapting to changes in technologies and changes in their environment including changes in how universities evaluated their budgets and programs.

State-level value-added support institutions were being created through the 1980s and 1990s, primarily attached to the Land Grant Universities, but also funded through various USDA and state programs (Woods and Hoagland 2000). These programs emphasized business development for farmers and cooperatives pursuing various forward or backward integration opportunities, as well as the creation of agribusinesses deemed to create a positive impact on farm incomes. These value-added centers created a new surge in demand for agribusiness extension programming, including feasibility study support, management and marketing training, supply chain management, economic impact studies, and financial management. As these centers expanded in scope and number, new federal programs emerged, such as the SBIR,[1] and the USDA Value-Added Producer Grant Program. The nature of these programs required ag economists that were assisting to make a careful study regarding the value-chains, competition, and financial viability

[1] Following from the stated purpose of the SBIR program which has included the USDA as a significant participant: "The SBIR program was established under the Small Business Innovation Development Act of 1982 (P.L. 97-219) with the purpose of strengthening the role of innovative small business concerns in Federally-funded research and development (R&D). Through FY2009, over 112,500 awards have been made totaling more than $26.9 billion."

of these enterprises, and to be actively engaged with the farmers and other business leaders in enterprise development.

In the past, producers relied upon agricultural extension specialists to be the gateway to access the USDA and to generate market, financial, and business planning information. Technology changes included the development and access to agribusiness planning tools. Two such tools were FINPACK and AGPLAN, developed by the Center for Farm Financial Management at the University of Minnesota. Originally, these farm financial planning and analysis tools were delivered via computer disks. With the rise of the internet and more "user friendly" programs, producers were increasingly able to access the information themselves. Today, FINPACK and AGPLAN can be immediately accessed on line (http://www.cffm.umn.edu/). While FINPACK and AGPLAN where originally the product of farm management specialists, agribusiness extension economists have adopted these tools.

The Agricultural Innovation & Commercialization Center (AICC) at Purdue University is another example of providing online business planning tools for agribusinesses (https://www.agecon.purdue.edu/planner/). Agribusinesses can assess the potential of new ventures by completing online templates, and if necessary, contacting staff at the AICC. This website allows individuals to start writing a business plan with INVenture, an online business planning tool. If participants respond to the key questions the planning tool asks, and then complete their business plan, they should be ready to present their business plan to potential partners (AICC 2011).

National online agricultural marketing web portals such as AgMRC (Agricultural Marketing Resource Center) serve as an electronic resource for producers that are interested in value-added agriculture. Producers can "browse commodities and products, investigate market and industry trends, study business creation and operation, read research results and locate value-added resources" (AgMRC 2011). This ability to search websites like the USDA (http://www.usda.gov/wps/portal/usda/usdahome) gives producers an understanding of how the greater world and national markets are affecting the commodity supply and demand and hence the prices they are receiving and paying. Once again, with additional information available to them, producers are able to take on more of this role themselves. The Extension Committee on Organization and Policy (ECOP) suggested that one of the challenges for extension programming would be keeping up with the advances in information technology (2002). However, cited examples show that agribusiness extension programs are successfully implementing new programs utilizing information technology.

This same technology shift (the internet) also opened up a window of opportunity for some producers to market their products directly to consumers. Occurring simultaneously were movements such as "buy local first" and "slow food". Farmers' markets were expanding in many U.S. states (USDA-AMS, 2011), requiring more producers to fulfill the demand. Other market trends included organic food and natural food. Many consumers were going to farmers' markets looking for these.

Producers, rather than entering commodity markets, were integrating farther along the supply chain and engaging in both production activities and the marketing to the final customer. Rather

than attempting to be the low cost producer, these producers wanted extension programming that focused more on differentiated product strategies. This involved strategic management and supply chain management, allowing producers to move past being price takers.

Today, agribusiness extension programs focus on industry-level coordination issues, looking at economic issues within the entire supply chain. Extension agribusiness economists work with entrepreneurship and business development, industry strategic planning, market and technology innovation diffusion, and firm/local industry differentiation strategies. There is more emphasis on niche marketing, looking at the consumer and market questions rather than focusing on production. This also means that producers are doing vastly different things and the programming focuses more on business management techniques and understanding consumer preferences. Various Centers for Agribusiness have emerged within LGUs that provide services such as executive education and entrepreneurship development. While the audience is mixed, the focus is on small to medium sized producers and other non-farm supply chain partners. These changes have created both problems and opportunities.

Programs like the Quinten-Burdick Cooperative Management Center, the Consumer Cooperative Management Association, and Cooperation Works have been providing a range of extension-type programming to agricultural cooperatives leveraging strong Land Grant research and teaching connections for some time. The National Value-Added Conference, a somewhat ad hoc assembly of extension professionals working with value-added businesses, are essentially sharing and developing programs targeting farm-based businesses that are forward integrating. Technical feasibility support tools are central to this group that supports national initiatives like the USDA Value-Added Producer Grant program. Other smaller scale, geographically dispersed clients that can benefit from expanded attention from agribusiness extension can include (but are hardly limited to) specialty food channels, values-based market channel partners, national trade organizations, agritourism ventures, food processors, food wholesalers, small scale exporters, and others. Many of the economic and management tools developed for localized audiences can be readily adapted for managers within these groups. The opportunities for further reach and new program development need not be confined to domestic-based firms. Many like audiences are increasingly accessible internationally.

Anderson (2004) points out that extension faces issues of scale and complexity in countries with large numbers of farmers working relatively small acreages. Although Anderson was describing extension in a developing country context, increasingly, agribusiness economists are finding a similar situation in developed countries. With the increased interest in shorter supply chains and buying local, there is a growing interest in agricultural production from people not traditionally associated with agriculture. These agricultural entrepreneurs are passionate about pursing agricultural interests, but they are often ill-equipped to handle all the production, distribution, packaging, and marketing needs demanded by today's food supply chains. Producing and delivering effective agribusiness extension programming to these clientele groups is costly, and their specific needs vary by region and supply channel.

Here is one example of how an agribusiness extension program has responded to these changing clientele and needs. In Florida, there has been an increasing need to serve the needs of small producers seeking to adapt their businesses to complex value chains. The last two years, the

University of Florida Small Farms team has organized a state-wide small farms and alternative enterprises conference. There were approximately 800 attendees each year from these "small farms and alternative enterprises." Production practices, market orientation, and philosophical viewpoints represented by the attendees varied widely along the following characteristics: organic production, traditional production, sustainable practices, fruit and vegetables, meat animals, animal products (wool, alpaca, etc.), direct marketing to consumers (on the farm, at farmers markets, pick-your-own), direct marketing to intermediaries such as restaurants and schools, selling through cooperatives and brokers, and internet sales. Surveys from the conference indicate a high level of satisfaction with the overall extension programming that takes place at the conference, but it also revealed the strong demand from these small farms and alternative enterprises are for additional extension programming.

At the same time that agribusiness extension programming has been evolving, universities have been facing budget issues and there is a trend towards more accountability and the need to evaluate the impacts of extension programs in general. The increasing complexity of the food system is making it more difficult to attribute specific impacts at the producer level to extension programs. This leads to political pressures and uncertainty in budget allocation matters. Evaluating impact means measuring the relationships between extension programming, and extension clientele's knowledge, adoption of practices, use of inputs, increased productivity and profitability, and other related improvements to their welfare (Anderson 2004). Producers are making changes over time and those changes cannot be attributed to just one conference and/or extension workshop. Instead, it is a combination of help from a variety of extension programs including workshops, conferences, one-on-one counseling and other non-extension actions. So a key question for agribusiness economists is how to properly measure the impacts of extension programming over a longer time horizon than knowledge and skills gained as surveyed upon completion of an extension program. This corresponds to ECOP's recommendations for extension in the twenty-first century which included adopting assignment-based performance measures (2002) but highlights the issues and complexities in actually adopting such systems.

Budget issues at universities have also increased the need for agricultural economists including agribusiness extension specialists to secure external funds from grants and contracts to support their agribusiness extension programs. "Formula Funds" for extension programming in general have been decreasing over time. While this has been happening, agribusiness extension programs in the authors' states have maintained funding or expanded funding allocated to them. This shows the importance that extension administrators have placed on agribusiness extension programs. However, it has not eliminated the need for external funds to support programming. Grants allow more programming to be done with increased funds available, but also take the specialists time away from other things as the extension specialist must serve as a grant administrator in addition to extension programming, research and teaching. Where grant dollars are available will also drive what programming is done as programming will need to fulfill the requirements of the grant. Agribusiness extension programs have expanded in part because of the grant dollars available for this type of programming. A shift in grant funds available, could affect the future of current programs. Many successful programs may not continue without grant funding. ECOP (2002) suggests that extension programs seek new funding sources and to provide incentives for faculty to acquire non-traditional funding sources. Agribusiness extension

programs have adapted to new funding sources, but realize that they come at a cost and in some cases funding sources now drive development and continuation of programs.

Agribusiness extension programs have also found acceptance and support from different partners. These include state and local government agencies interested in rural development. Traditionally, rural areas sought to attract a company or manufacturing facility to their area. This provided jobs. The problem was the dependence on a single industry or company. Today they would like to diversify their economies through creating and growing small businesses. They see agribusinesses and agriculture related products as good both because they build on the resources and industries in the area, and because they can provide bigger returns because they source more products locally and spend the profits in the region. Extension economists assist producers as they evaluate value-adding and vertical or horizontal integrating opportunities. Utah State University recently developed a rural business development conference. The conference has been held annually for 8 years and has had high visibility in Utah. The conference focuses on business management skills with emphasis on marketing issues, financial analysis, and showcasing producers that have developed differentiated products and businesses. This conference after the first year was listed as one of the five priorities for rural development in Utah by the Utah Governor's Rural Partnership Board. Agribusiness extension programming in some cases is seen as a resource for rural development.

Linkages to Research and Teaching

The issues being addressed by agribusiness extension programs are often focused on very applied situations of agribusiness. At its best, agribusiness extension programs can show how the concepts being researched and taught in agribusiness programs are being used by actual businesses. They can also highlight the needs for additional research and be the incubator for new research projects. They can also give students the opportunities to work with actual businesses to apply the techniques taught in classes to actual situations.

The Extension section of the Agricultural and Applied Economics Association has been proactive in building linkages between extension, research, and teaching by creating the Graduate Student Extension Competition that is held annually at the AAEA meetings. This competition is sponsored jointly by the Graduate Student section of the AAEA and gives graduate students the opportunity to learn to prepare and present appropriate analytical results for an extension (usually non-economist) audience. This can be based upon the graduate student's research for a thesis or dissertation. Participation in the competition enhances the professional growth of the participating students regarding extension programs (www.aaea.org/sections/extension/.../GradCompBrochure2011.pdf).

As a profession, agricultural economists continue to discuss ways to create stronger linkages between extension, research, and teaching. For example, Joseph Balagtas offered tips for assistant professors on how to specifically build synergies between two or three way appointment splits (Balagtas 2009).

The Food Distribution Research Society (FDRS) is also concerned with strengthening linkages between extension, research, and teaching. In addition to paper sessions during annual

conferences, FDRS has instituted the FDRS Food Marketing Challenge. During this competition, student teams are challenged to apply their knowledge of food distribution, economics, management, marketing, and/or merchandising to a real-world management situation. Representatives of the sponsoring agribusiness and related industry experts interact with the teams throughout competition. Extension components are often an integral part of the competition (http://fdrs.tamu.edu/FDRS/Student_Food_Marketing_Challenge.html).

The International Food and Agribusiness Management Association (IFAMA) is an international association whose members represent both industry and higher education. The mission of IFAMA to provide members with multiple vehicles for information sharing, knowledge advancement, discussion and debate, networking, and career development (IFAMA 2011). IFAMA is another venue that agribusiness extension economists have to strengthen the linkages between extension, research, and teaching.

This integration of the agribusiness teaching, research and education programs can elevate all three providing a better, more interesting, educational experience for students, increased ideas and contacts for research and better information and techniques to supply to extension clientele. With the increased focus on professors needing to show impacts of their work, it is more important to get multiple uses out of projects. For professors with 2- and 3-way splits, it is often imperative that they integrate their programs to increase their efficiency.

Exhibit 1 highlights some of the relationships between agribusiness extension, teaching, and research. Agribusiness extension draws heavily from supportive and collaborative efforts from other departments in colleges of agricultural and life sciences, from business schools, and economics (and related social science) departments. Agribusiness extension programs serve many groups outside the university. These external groups (e.g., agribusiness trade groups, input

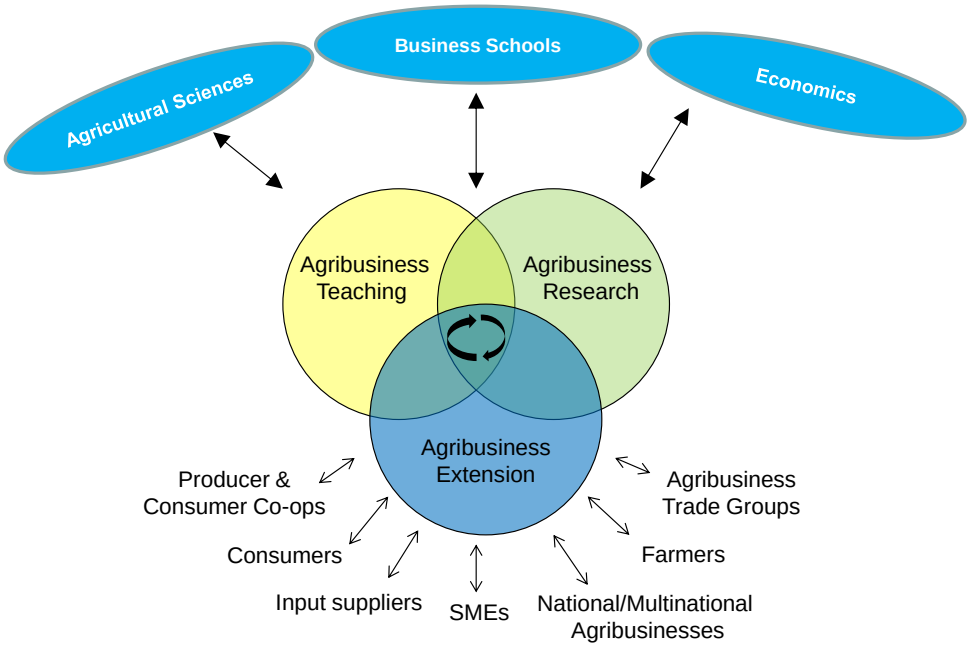

Exhibit 1. The Interconnectedness of Agribusiness Extension, Teaching, and Research

suppliers, producer and consumer cooperatives, etc.) are used to support both teaching and research through an iterative process of programming to them and learning from them. While the authors acknowledge the affect clientele groups have on teaching and research, the focus of this paper is on extension and the linkages between extension programming and clientele.

While the existence of agribusiness extension programs within a department do not guarantee integration with and support of agribusiness teaching and research programs, such integration can be used to increase the effectiveness of all three areas.

The Future of Agribusiness Extension

We are in a period where more grant funding has been made available for agribusiness in general and more NIFA grants are requiring a portion of the project be aimed at extension efforts. While in the past this has been done partly in name only, increasingly we are seeing requirements for significant extension efforts. This allows agribusiness economists to be the central part of projects rather than an after-thought or a small part. The USDA-Rural Development administers the Value-Added Producer Grants (VAPG). By sharing their knowledge with grant applicants, agribusiness extension economists can play an important role during the grant process. VAPG grants may be used for planning activities and for working capital for marketing value-added agricultural products and for farm-based renewable energy endeavors (USDA-Rural Development 2011).

Colleges of Agriculture are seeing agribusiness programs as ways to increase student numbers and programs that can grow in the future. This is increasingly important as numbers for traditional programs decline and the composition of agricultural economics faculty continues to evolve. Perry (2010) has conducted an extensive study of the agricultural economics professors as our profession celebrated its 100 year anniversary in 2010. He found there were more faculty 60 and older (233) than 40 and younger (208). Faculty in their 50's outnumbered those in their 40's by 50%. Only18% of the extension FTE was held by faculty under 40 and 61% by faculty above 50. This is a significant challenge for agribusiness extension programming as extension clientele and technology continue to evolve.

Another trend pointed out by Perry (2010) that significantly affects all extension programming is that younger faculty tended to have smaller total FTE appointments, suggesting a great proportion of younger faculty on 9-month appointments. Regarding specializations in agricultural economics, two areas seem to be growing, agribusiness and resource and environmental economics. The reason for growth in agribusiness is likely tied to undergraduate programs, which have been trending upward in the last 20 years.

Universities are facing significant budget shortfalls requiring program cuts. The 2000 to 2008 period was a period of significant decline in tenure/tenure-track agricultural economists at the 1862 LGUs. There was significant attrition of tenured agricultural economist from 2000 to 2008 with an estimated 331 faculty (ages 59 and up) leaving their tenured positions from 2000 to 2008. Of the middle group (ages 47-58), there was a net loss of 83 faculty. In total, there was a net loss of 254 faculty from 2000 to 2008, or 20% of the faculty numbers. The reasons for the losses were at least partly demographic. The first spike of faculty born around 1941 largely

retired from 2000 to 2008. Most agricultural economics departments have experienced a net loss of positions in the early part of this century (Perry 2010).

These losses in tenured positions and budgetary pressures may cause fewer resources to be available for extension efforts and having extension be a smaller portion of the roles of professors. This can cause professors to have less time to develop new projects as they scramble to fulfill current teaching and extension needs. Additional challenges and opportunities in the future regarding agribusiness extension include potential/need for more electronic delivery of agribusiness extension programs, and developing an extension methodology that does more than just document our reflections and understanding using literature review, anecdotal information and our collective experience.

All extension programs are not the same, nor should they be. There are differences and similarities. For example, the small farm conferences in Florida and Utah are similar in scope. Many agricultural economic departments have reduced the number of extension specialists over the years due to retirements and budget cuts. A few notable exceptions to agribusiness extension efforts being limited to a few agricultural economists in a given department can be found at Texas A&M University and Oklahoma State University, where these departments appear to have a critical mass of people with agribusiness extension appointments.

There is a potential need for more electronic delivery. Whether it is the development of additional business planning, financial planning, or risk management tools, today's extension clientele are seeking online solutions to their problems. Extension entomologists at the University of Florida, for example, have developed iPest1, a downloadable iPad application that provides color photos and text describing almost 40 pest species (http://santarosa.ifas.ufl.edu/documents/lg_ipad_apps.pdf). It would not be too hard to imagine the development of agribusiness tablet applications. For example, an application that allows the user to forecast pricing trends, or an application that can help a producer to assess the risk of a given business decision. Extension programs also need to look at new information outlets to disseminate information. This does not mean just putting traditional communication forms such as fact sheets online, but also using information tools such as social media to connect with clientele. This is in line with ECOP's (2002) call for educational approaches with appropriate use of technology.

As they have in the past, agribusiness extension programs will need to continue to evolve to meet the changing needs of clientele. In doing so, they can continue to play a vital role in the LGU mission as it provides feedback to the research and teaching roles. In a similar vein, it is vital for research that creates new knowledge needed by agribusiness extension clientele. All three LGU missions are needed to maintain strong programs in agribusiness.

Agribusiness Extension programming will continue to focus on improving management skills, decision making, and strategic thinking within value-chain development. Additionally, traditional focus on improved value chain performance through coordination strategies, new roles for institutions, and management education on new business models, policy design and impact, market outlook, and firm-level feasibility and risk management strategies will continue to be important contributions from agribusiness Extension specialists. Some important changes

for agribusiness-oriented extension programs seem imminent as extension programming more generally undergoes changes in scope and focus.

Changing communication technology is reshaping business boundaries as well as how extension programs are delivered. The internet has become a quick and low cost source of information. Increased computing capacity has opened the door for many kinds of training to be made available without regard to one's geographic location. While many pieces of useful information are available to agribusiness managers on line, not all of it is vetted through unbiased sources or developed with professional economic or management expertise. Still, this media has become a highly valued source, especially for first levels of inquiry.

Improved communication technology will lead to ever-improving instructional approaches involving distance learning. Further, with the increasing ease for wider reach to specialized audiences; it becomes more justifiable for extension specialists to devote time to developing on-line management and marketing tools. These audiences are not particularly constrained to state borders. Scale economies are critical to justify most public expenditures in extension (Antholt 1994). Antholt, writing more about extension in international development, noted that a guiding principle behind such programs needed to be the creation of institutions that were responsive to the needs of farmers, agribusiness, and the public sector. The advances in communications tools has created many new possibilities to efficiently provide wider reach, even internationally, reintroducing scale economies for program development and delivery.

Not all agribusinesses are going to lean on LGU Extension services equally. Hanson and Just (2001) noted the scale advantages larger farms face as they internalize management and technical resources. Similarly, larger agribusiness entities can more readily secure internal or privatized services compared to small-medium enterprises. Still, even the larger firms can benefit from extension programs that can reach many producers quickly, perhaps facilitating technology transfer that benefits the agribusiness, or engage producers in policy formation for the mutual benefit of the industry. Further, there are many valuable connections for the larger scale agribusiness concerns to the LGU activities in the classroom and research facilities. The agribusiness extension specialists can serve as a critical link.

Continuing management education will always be in need, and especially for the small and medium enterprises. As their businesses grow and expand, they will face new challenges and opportunities. Their educational needs will also grow and change. Agribusiness extension programs will need to continue to adapt and grow with them providing relevant and reliable education based on sound scientific methodology.

Looking ahead, many of the same technologies that are transforming the classroom are going to change agribusiness extension delivery, especially where agribusinesses are often better connected to more sophisticated communication and information tools than (especially smaller) farmers. Web-based platforms, media conferencing, webinars, interactive software, and shared databases are all improving. One of the strengths of the Land Grant system is the emphasis on research, teaching, and extension linkages. One should expect numerous positive spillover effects from the many advances being made in distance education.

These technologies are changing the structure of agribusinesses, as well. Firms have improved information gathering, and extension specialists can contribute significantly to the information gathering systems. Improved information management is one of the greatest challenges for managers today. These are critical success factors for firms to remain competitive and include new challenges related to information sharing and use in management decision making. More outsourcing of specialized business functions has been greatly facilitated with new ecommerce tools, document and data exchange/security, digital images, and remote management systems. Businesses in general, and agribusinesses specifically, are transitioning into much more complex supply chains and electronic commerce, making the management task more challenging. Management training from the Land Grant universities will become more important, especially for smaller and newly established agribusinesses.

Just as undergraduate and graduate instruction in agribusiness management is growing in importance, so too is education for existing agribusiness managers. Long-term success will in-part, be dependent on continuing to grow and adapt and remain relevant for the new clientele as their businesses grow and their needs evolve.

The future of agribusiness extension work would seem to be converging on collaborations to support specialized agribusinesses either in similar markets or needing to address similar issues. Tighter budgets will force collaborations that can provide synergy across borders and maximize the effectiveness of agribusiness extension specialists that will have increasing responsibilities.

There is future for agribusiness firms to grow and extension programs to grow with them. Even smaller firms are more easily connecting into a world market (Gupta and Saghaian, 2008; Swisher, Rezola, and Sterns 2009). Internationally we are seeing a strong growth in agribusiness instruction – India, Africa, Armenia, etc. extension programs in these countries will play an important role facilitating connections between these teaching programs and the local production agriculture. To remain relevant the agribusiness extension programs will need to grow with these firms and may also look internationally for clientele rather than just locally. As programs continue to grow and evolve, there will be some intersection of farm management and agribusiness as commodity operations get bigger and more integrated.

Conclusion

Agribusiness extension programs have built on a strong tradition and history of agricultural economics. These programs have developed successfully over the last 15 years within Land Grant Universities in the face of budget cuts. There are still many challenges and opportunities that agribusiness extension programs face in the future. Programs need to build on their success of providing needed answers to a changing clientele to take them into a strong future. The success of the programs was their ability to build upon what was done in the past, but reach out to new clientele with new programs, and just like they have done over the past, agribusiness extension programs will need to continue to evolve so that they continue to add value to their clientele. As the small and mid-size businesses grow, the programs will need to grow with them and/or look for new clientele.

Strong programs will need to continue to be integrated with research and teaching. With tighter budgets and more scrutiny, it will be imperative for programs to show the success and impacts of their resources. Research on developing new evaluation methodologies will be needed. Extension specialists will need to be able to document the impacts of their agribusiness extension programs.

There will also continue to be an expanding need for strong agribusiness extension programs to generate external funds both through grants and project as well as examining an increased use of fees from clientele. This creates challenges and in some cases will mean the successes of programs will be dependent on grant program dollars available. Currently, there are many grants that provide funding for agribusiness extension programs. This has led to an increase in the prominence of these the agribusiness extension programs at universities, but has also made the success of those programs somewhat dependent on the continued support of external funds. This will continue to be an important part of programs and agribusiness extension specialists will need to continue to find a way to balance being a grant administrator with their other responsibilities.

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International Food and Agribusiness Management Review
Volume 14, Issue 5, 2011

Academic Perspectives on Agribusiness: An International Survey

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Abstract

Through an international survey of agricultural economists, we shed new light on perceptions about agribusiness education, research, grantsmanship, and outreach. Results indicate that departments expect agribusiness faculty to teach more courses, yet maintain research expectations for agribusiness faculty similar to those of their non-agribusiness peers. As a result, agribusiness faculty have lowered their engagement in agribusiness extension programs. Moreover, evidence suggests an increasing trend in the amount of grant dollars obtained and the number of refereed publications reported at the time of tenure evaluation, while the number of non-refereed publications has declined. Finally, results indicate that specialized journals, such as the *IFAMR*, have improved their importance as outlets for agribusiness research.

Key Words: promotion and tenure, agribusiness, teaching, grantsmanship, research

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Introduction

Nature Publishing Group undertook a survey of higher education faculty and discussed "… a troubling reality: although scientists personally value education as much as research, they frequently align their decision making, both for themselves and on behalf of their departments, with the needs of research rather than those of education" (Savkar and Lokere 2010). In a recent interview, Gordon Gee, president of The Ohio State University, the largest public university in the U.S, noted, "The universities of the 21st century are going to be the smokestacks of the century," and "The notion of the large, massive public university that can exist in isolated splendor is dead" (Welsh-Huggins 2010). He further notes that the evaluation of professors, particularly as it relates to tenure, must change if universities are to meet the educational needs of society. This changing landscape of academia, coupled with reductions in federal funding, shifts in student credit hours from agricultural economics to agribusiness, and the need for closer ties to industry, are all likely to exert an impact on the role of agribusiness faculty in agricultural economics programs.

Many agricultural economics undergraduate programs, as a whole, have realized a loss of enrollment over time (Perry 2010). "Much of the loss in agricultural economics, however; is simply a shift of these students to degrees in agribusiness" (Perry 2010). This shift to agribusiness is interesting, given the lack of consensus within the field concerning what agribusiness specifically entails (Harling 1995). The earliest and most often accepted definition of agribusiness can be found in Davis and Goldberg (1957) (King et al. 2010). While their definition reflects that agribusiness has its foundation in agricultural economics, much has changed since this definition was introduced more than a half a century ago. In particular, agribusiness has grown so that in now encompasses the domain of management sciences. King et al. (2010) conclude that agribusiness scholarship emphasizes an integrated view of the food system that extends from input supply through production, processing, and distribution to retail outlets and the consumer. Thus faculty, who identify themselves as agribusiness faculty, likely conduct scholarship activities in one or more of the subspecializations of agribusiness (agribusiness management, agricultural chemicals, agricultural finance, biotechnology and bioenergy, food marketing, food safety, labor and human capital, nutrition, and supply chain management). While these areas all fall under the general umbrella of agribusiness, they are each unique areas of scholarship.

In this paper, we explore the perceived importance of these issues, in an effort to gain further insight into what is expected of agribusiness faculty members within agricultural economics departments. To do this we first analyze the time agribusiness professors allocate to teaching, research, extension, grantsmanship, and service relative to non-agribusiness professors. Second, we examine how agribusiness faculty perceive certain factors' influence on the promotion and tenure decision in comparison to faculty in other specialty areas within agricultural economics and where agribusiness faculty publish their work. We then turn our attention to understanding how non-agribusiness faculty members evaluate issues related to agribusiness relative to agribusiness faculty. Next, we examine the portfolio of agribusiness professors at various stages of their careers when they were promoted to associate professor with tenure. Finally, based on these results, we draw conclusions and suggest implications for agribusiness

programs and faculty, as well as provide insight into what non-tenured faculty members must do to pass successfully through the promotion and tenure process.

Goals and Objectives

The objective of this paper was to gauge the perspective of the agricultural economics profession about agribusiness as an academic subdiscipline. An international and comprehensive survey queried academics about their perceptions of agribusiness, with the following topics taken under consideration:

- the role of agribusiness education, research, and outreach
- availability of funding and time for conducting quality research in the field of agribusiness
- the perceived balance and relative importance of teaching, research, and outreach in the tenure decision

We solicited the opinions of all agricultural economic subdisciplines and appointment types in understanding the various institutional and departmental demands being placed on agricultural economists. The overriding goal of this research is to improve transparency within the profession related to the demands placed on agricultural economics faculty for tenure and promotion, as well as the impact of growing undergraduate agribusiness programs on departments and faculty across agricultural economics disciplines. We have five primary goals in conducting this research:

1. to examine whether the types of work conducted by faculty varies by primary specialty area;
2. to determine what faculty members perceive to be the most important factors and activities influencing promotion and tenure decisions;
3. to examine where faculty with agribusiness primary specialty areas publish their work;
4. to assess the perceived differences between faculty with a primary specialty in agribusiness and faculty with non-agribusiness specialty areas on teaching, research, and grantsmanship; and,
5. to determine benchmark output levels for assistant professors seeking promotion and tenure.

To address the aforementioned objectives, we choose questions (Appendix A) from the survey that explores current demands being placed upon faculty members in agricultural economics and agribusiness programs across the globe.[1] Moreover, they allow us to examine differences of faculty members with primary specializations in agribusiness relative to faculty members with non-agribusiness primary specialization areas.

[1] Appendix A contains a detailed listing of the survey questions and their potential response, analyzed in this paper.

Literature

The Growth in Agribusiness Programs

Across the agribusiness literature, one conclusion stands firm: agribusiness programs are growing in enrollment and thus, in importance to traditional agricultural economics departments (Dooley and Fulton 1999; Woolverton and Downey 1999; Heiman et al. 2002; Boland and Akridge 2004; Connor 2005). According to the brief history of agribusiness provided by Heiman et al. (2002), Agricultural Economics' beginnings as a legitimate field were founded primarily in the traditions of farm management and land economics. During the late 1960s and early 1970s, environmental and resource economics took hold as public interest in food and water safety increased. In response to declining student populations in traditional farm management based programs, many agricultural economics programs incorporated resource economics programs into their curriculum (Heiman et al. 2002). Interest in agribusiness as a discipline within agricultural economics emerged shortly thereafter, due to the increasing size and importance of food processors and agricultural inputs manufacturers, and the emergence of new fields of research with biotechnology and precision farming (Heiman et al. 2002).

The 1989 National Agribusiness Education Commission (NAEC) Report highlighted the need for properly trained leaders to navigate and manage the growing and ever-changing agribusiness industry. Within their report, the NAEC made six primary recommendations to meet this need through agribusiness education, which included incorporating agribusiness MBA programs into agricultural economics departments, expanding post university agribusiness education, building agribusiness Ph.D. programs, increasing agribusiness research, and reallocating institutional resources to further the development of agribusiness programs. Ten years after the report was released, Woolverton and Downey (1999) surveyed individuals who had served on the commission, as well as members of the WCC-72 committee, related to the success of meeting the proposed courses of action. From this assessment, they reported that for most of the proposals, the progress made was low to moderately satisfactory over the ten-year period. Of particular note, although student enrollment in undergraduate and M.S. programs had greatly increased, the reallocation of resources to the development of agribusiness programs was not proportionate to the growth in students experienced across departments. For example, one respondent in their study indicated that there were 10 times more Agribusiness students compared to traditional agricultural economics students in their department; however, the number of agricultural economics faculty was three times larger than the agribusiness faculty. Furthermore, although the majority of respondents felt, satisfactory progress had been made to increase agribusiness research efforts; there was approximately one-third who believed sufficient resources were not being dedicated to the cause.

In its 2006 report, the National Food and Agribusiness Management Education Commission suggested that agribusiness curricula be reviewed, industry ties be strengthened, and graduate programs be improved among six recommendations (Boland and Akridge 2006). Consequently, this shift in the focus of agribusiness teaching, combined with the need for tighter industry alignment will influence the future direction and definition of agribusiness research. Ng and Siebert thoroughly outlined the challenges of conducting research in the field of agribusiness (2009). One of the foremost challenges they noted for academics in agribusiness is the lack of agreement related to what exactly agribusiness research encompasses.

Agribusiness Faculty: What Do They Do?

Harling (1995) noted that a majority of agricultural economists saw agribusiness as a subdiscipline. Furthermore, the responsibilities of faculty within the agribusiness specialization appear to differ markedly from those of their peers within agricultural economics. In exploring academics' use of time, Harling discovered that for academics in agricultural economics, on average, the teaching/ research/extension split, was divided 30%/36%/21%, respectively, with the remaining 11% of time being spent in administrative or other responsibilities. Conversely, those who identified themselves as specializing in agribusiness indicated that, on average, they devoted 36% of their time to teaching, 19% to research, 31% to outreach, and 13% to administrative and other responsibilities (Harling 1995). From this research, it appears that academics specializing in agribusiness spend a disproportionate amount of time on teaching and outreach when compared to peers in other specializations within agricultural economics departments.

Such differences in responsibilities between agribusiness faculty and other agricultural economics faculty should be of concern given that the majority of agribusiness specialists are still tenured in agricultural economics departments of some kind. Dooley and Fulton (1999) further discussed the state and role of agribusiness within agricultural economics programs. They indicated that despite the importance of agribusiness education, since agribusiness faculty commonly have split appointments, there have been impacts on research and extension in agribusiness as well. Their survey of 39 department heads in agricultural economics revealed that when agribusiness programs were offered within departments, agribusiness students made up approximately 69% of the student population. At the time the survey was administered, the majority of department heads believed that this would increase over the following five years. Dooley and Fulton concluded that at the time of their study, agribusiness was the leading degree in the majority of programs surveyed. Their findings related to the growth and importance of agribusiness was supported by Heiman et al. (2002) and Connor (2005).

With such growth in undergraduates pursuing degrees in agribusiness, one would assume that the number of agribusiness faculty would also be increasing. Heiman et al. (2002) note that, "One of the challenges facing the agricultural economics profession is to adjust its research and personnel to changes in the demand for its product." To analyze the situation within departments, Dooley and Fulton (1999) explored the distribution of faculty full time equivalent (FTE's). On average, the department heads reported that less than one third of teaching FTE's were allocated to agribusiness. They found that the overall distribution within agricultural economics departments allocated 36.4% to teaching, 39% to research and 24.6% to extension and outreach. They determined that these averages were quite different when the appointments of agribusiness faculty were assessed. The distribution for agribusiness faculty allocated nearly half to teaching, less than one-third to research, and less than 20% to extension and outreach activities. Heiman et al. (2002) likewise explored faculty trends, but from a new hire perspective. They reported that for assistant professor positions posted during spring 2001, approximately 40% were advertised in agribusiness, with another 23.5% advertised in a management related field with an emphasis in agribusiness. They also indicated that during 2001, approximately 70% of new teaching positions carried an emphasis in agribusiness.

Studies in this area have cited that it is often more difficult for agribusiness faculty to seek competitive research grants than more traditional agricultural economics faculty (Dooley and Fulton 1999; Woolverton and Downey 1999; Heiman et al. 2002). Despite the disadvantage in obtaining public funding, Heiman et al. (2002) reported that 50% of recent articles published in *American Journal of Agricultural Economics* (*AJAE*) were devoted to either agribusiness and/or resource economic issues, indicating a shift in importance of manuscripts targeting issues facing agribusiness. Woolverton and Downey (1999) indicated that it might be difficult for agribusiness faculty to obtain funding for research and/or dedicate time to research, even if they have funding, due to the nature of agribusiness teaching appointments. Dooley and Fulton (1999) found some agreement among department heads related to the difficulties faced by agribusiness faculty when attempting to publish in traditional agricultural economics journals. However, responses likewise suggested that agribusiness faculty were finding publication outlets outside the realm of traditional agricultural economics journals. Thus, there was no perceived problem with publishing in general for agribusiness faculty.

Although no general problem with publishing exists for agribusiness research, some notable differences in impact exist between traditional and less traditional agricultural economics journals. For example, many agribusiness outlets are not included in citation reports. Information from the Journal Citation Reports Social Science Edition (2009) indicates traditional outlets such as the *AJAE* and the *Applied Economic Perspectives and Policy* (*AEPP*) currently have impact factors of 1.047 and .523, respectively (Table 1). Agribusiness journals, such as the *International Food and Agribusiness Management Review* (*IFAMR*) and *Journal of Agribusiness* (JOA) are not included in citation reports; thus, no impact factor is reported. In order for departments to assess comparability of less traditional outlets, they must review databases such as *Cabell's Journal Directories* or rely on journal reports from the respective journals' editorial boards to determine the impact of publishing in such journals on the profession.

Both Woolverton and Downey (1999) and Dooley and Fulton (1999) question whether agribusiness faculty are evaluated for tenure differently from their counterparts due to the heavier teaching loads. Woolverton and Downey (1999) suggest that due to the teaching load for agribusiness faculty, it may be difficult to meet the established criteria for promotion and tenure in traditional agricultural economics departments. They draw questions related to how agribusiness faculty members are evaluated for tenure and promotion relative to their peers. Connor (2005) likewise addressed this problem, and concluded that departments will likely have to face imbalances in teaching and research responsibilities, which may lead to difficulties for young faculty in obtaining tenure and promotion.

Table 1. 2009 Impact Factors for Agricultural Economics Journals and Other Journals Included in this Study (Thomson Reuters 2009).

Journal	Impact Factor	5 Year Impact Factor
Agricultural Economics	0.673	0.983
American Journal of Agricultural Economics	1.047	1.642
Applied Economic Perspectives and Policy (formerly Review of Agricultural Economics)	0.523	0.975
Australian Journal of Agricultural and Resource Economics	1.055	1.244
Canadian Journal of Agricultural Economics	0.552	0.787
European Review of Agricultural Economics	0.86	1.885
Food Policy	1.606	2.044
Journal of Agricultural and Resource Economics	0.474	0.827
Journal of Agricultural Economics	1.155	1.493
Journal of Soil and Water Conservation	1.033	1.386
Management Science	2.227	4.125
Marine Resource Economics	0.492	-
Review of Environmental Economics and Policy	3.645	3.645
Water Resources Management	2.013	2.218

Although much less prevalent, discussion regarding the relationship between agribusiness and extension/outreach was explored by Dooley and Fulton (1999). They measured department heads' perceptions of agribusiness extension activities via three questions. Findings indicate that department heads perceived agribusiness extension and outreach programs to be less likely to move research results to their constituent base than other areas. They also did not perceive extension activities in agribusiness to be more successful in determining suitable research topics than their counterparts. Furthermore, the department heads were neutral in their opinion of the success of agribusiness extension programs in building contacts for undergraduate recruitment. Overall, Dooley and Fulton concluded that Department Heads were not convinced agribusiness faculty made solid contributions to extension and outreach within their respective departments. Perry (2010) notes that while agricultural experiment station funding has increased the share of the pie for economists continue to decrease. Although these dollars are not broken down to a level that makes it possible to identify the share for agribusiness research, it does indicate that grantsmanship are likely to increase in importance for agribusiness faculty if they are going to have funding for their teaching, research, service, and extension programs.

Researchers agree that over time, the majority of agricultural economics departments have seen a shift in undergraduate enrollment from majors in traditional agricultural economics to agribusiness. With this shift in the environment, agribusiness faculty have undoubtedly faced unbalanced splits in their teaching, research, and extension loads. The current teaching, research, and extension portfolios of agribusiness and other agricultural economics faculty inform how resources should be allocated and performance evaluated. If a disconnect remains among assignments, resources and evaluation, the transition continues to lag.

The Omission of Agribusiness in Studies on Salaries and Departmental Rankings

Few researchers in agricultural economics have explored incentives, other than tenure and promotion, which are important to faculty (Simpson and Steele 1985; Beilock and Polopolus 1988; Kinnucan and Traxler 1994; Hilmer and Hilmer 2005). The interesting phenomenon across these articles is that they focus entirely on peer-reviewed research output and fail to consider teaching or extension in their discussion. Although not all relevant variables can be included in such analyses, one might still question the omission of teaching and extension outputs in such research.

When considering individual salaries of faculty members, research indicates that the primary incentive is to publish alone in high quality journals (Hilmer and Hilmer 2005). This might seem daunting for agribusiness faculty since many journals with a primarily agribusiness focus are not considered "high quality" journals by their peers. When considering departmental rankings, the focus has clearly been on journal article production, specifically articles published in the *AJAE* (Beilock and Polopolus 1988; Kinnucan and Traxler 1994). To date, no research has been undertaken to update these lists to include agribusiness journals and other sub-discipline journals as important and appropriate research outlets.

Methodology

Prior to survey distribution, the survey instrument was pretested in the Louisiana State University Agricultural Center's Department of Agricultural Economics and Agribusiness, the Food and Resource Economics Department at the University of Florida, and the Department of Agricultural Economics at Purdue University. Faculty who pretested the survey represented primary specializations in both agribusiness and non-agribusiness areas.

A copy of the survey instrument, along with a rationale related to why the survey was needed and its potential for influencing the profession was sent to the Agricultural and Applied Economics Association (AAEA) Board of Directors. Upon their approval, the survey was distributed to the AAEA membership list via email. In addition to the AAEA, the International Food and Agribusiness Management Association (IFAMA) Board of Directors also approved the survey to be electronically distributed to its membership list. The total AAEA and IFAMA membership population was 2,047 individuals. These represented only the members holding an academic position in an agricultural economics and/or agribusiness department and who were registered members of the AAEA and/or the IFAMA in 2010.

The first e-mail sent out by both the AAEA and IFAMA offices to the aforementioned individuals on their 2010 membership roster informed them that that they would be getting a survey, along a description of the survey, and contact information for the investigators. The next e-mail sent out by both the AAEA and IFAMA offices contained a hyperlink to the survey, a short letter that described the purpose of the survey, and contact information for the investigators. The survey was administered through Zoomerang, an Internet-based survey site. Approximately two weeks later, both of the aforementioned offices sent a reminder e-mail. Again, this e-mail contained a hyperlink to the survey, a short letter that described the purpose of the survey, and contact information for the investigators (Dillman 2000).

The survey was received by faculty who have appointments in Land Grant, American Association of State Colleges of Agriculture and Renewable Resources (AASCAR), and regional universities in the US, as well as by faculty outside the US involved in programs of agribusiness and/or agricultural economics. The survey contained questions that focused on the role of agribusiness education, research, and outreach, specifically with the perceived importance of the activities to the promotion and tenure process.

Moreover, we wanted to be able to test for differences across academic rank and specialization type. To do this we queried the respondents on their current rank. In addition, we utilized the AAEA's specialization database to allow academics to classify themselves according to one primary area of specialization and any number of secondary specializations.

To test for differences related to responses across primary specialization type, we first conducted a statistical analysis to determine whether the responses were normally distributed. Since many statistical analyses rely on the assumption of normality for comparing two data series, if the normality assumption is violated the interpretation of the results may not be valid and/or reliable. We use the *Shapiro-Wilks* and *Anderson-Darling* tests to test for normality. The null hypothesis (H_o) for both tests is that the data are normally distributed. These two tests were conducted on all sample responses for each question, by primary specialization area (agribusiness versus non-agribusiness). For all samples and for both tests, the computed p-value is less than the significance level (α=0.05); thus, we reject the null hypothesis H_o, and fail to reject the alternative hypothesis H_a (the sample does not follow a normal distribution). Since the samples are not normally distributed, we conduct a *Mann-Whitney* test (U-statistic) to determine if the samples can be considered identical based on their ranks (Lehmann 1975). The Mann-Whitney test is a nonparametric test corresponding to the parametric *Student's t* test, which serves as an appropriate method of analysis under these conditions.

Results and Managerial Implications

We received 287 fully completed surveys (74 with a primary specialization in agribusiness and 213 with a primary specialization that was non-agribusiness). We considered four broad areas: time allocation, factors influencing tenure and promotion decisions, demand for academic agribusiness outputs, and realized academic agribusiness outputs at time of promotion to associate professor.

Time Allocation

The first question we examine is the percent of time faculty members allocate to selected activities. The time allocation of faculty by specialty type (agribusiness versus non-agribusiness) shows that teaching and research take up approximately two-thirds of their time for both groups (Table 2). Of particular interest for these two categories is that while teaching consumes the most time for agribusiness faculty (38.01%) followed by research at (27.95%), the order is reversed for non-agribusiness faculty with research taking the top spot (36.37%) and teaching second (28.04%). According to our results, which are statistically significant at the 1% level, academics specializing in agribusiness devote more time to teaching and less time to research. For non-agribusiness faculty, the results are nearly identical to those found by Harl-

ing (1995) with respect to teaching and research time allocations. When comparing his results to ours for agribusiness faculty, teaching time allocation is similar, but the allocation to research activities has increased. In particular, time allocated to research has increased by approximately 9%, while time allocated to extension has fallen by almost 22%. This indicates that in order to bolster their research output, those who identify themselves as specializing in agribusiness, have sacrificed extension output. The result may also suggest that newly hired agribusiness faculty, have appointments, which are predominately teaching/research, rather than research/extension or teaching /extension.

Table 2. Percent time allocation of selected activities: a comparison between faculty who indicated primary specialization in agribusiness vs. those with primary specializations in other areas

	Agribusiness Specialization Actual Time Allocation		Non-Agribusiness Specialization Actual Time Allocation			
	Average	**Standard Deviation**	**Average**	**Standard Deviation**	**Difference in Means**	**P-Value**
Research	27.95%	21.61%	36.37%	21.84%	-8.42%***	0.0027
Teaching	38.01%	24.82%	28.04%	19.02%	9.98%***	0.0020
Extension	9.96%	18.53%	12.28%	22.04%	-2.32%	0.4637
Grantsmanship	4.79%	8.59%	5.32%	6.74%	-0.53%	0.1805
Service	7.94%	7.16%	9.00%	9.59%	-1.06%	0.7254
	N=74		N=213			

*** Denotes statistical significance at the 1 percent level

Factors Influencing Tenure and Promotion Decisions

The next area we examine is how seven factors influence promotion and tenure. As with the previous question, we will also draw a comparison between agribusiness and non-agribusiness professors. Respondents were asked to indicate the perceived impact each factor poses on promotion and tenure (5 = Strongly Affects to 1 = Does Not Affect). Research was perceived as the primary factor influencing tenure for both groups, followed by university assigned appointment (i.e. does the faculty member's university assign specific appointment percentages for teaching/extension/research for his/her position and then teaching (Table 3).

These results support the findings for the time allocation question, in which two-thirds of the time for both groups was spent on research and teaching. The only factor for which the groups differed significantly in a statistical sense was research. Agribusiness faculty gave research an average score of 4.42 while non-agribusiness faculty gave an average score of 4.73. Thus, while research is highly valued by agribusiness faculty, as evidenced by the increased amount of time they allocate to research activities over the last 15 years, research is even more valued by non-agribusiness faculty.

Table 3. Factors influencing promotion and tenure: a comparison between professors who select agribusiness as their primary specialization and professors with other primary specialization areas

Agribusiness Specialization

(number or respondents by importance level)

Importance Level	Actual Appointment	Grantsmanship Overall	Extension/Outreach Overall	Research Overall	Teaching Overall	Service Overall	Administration Overall
1 (Least Important)	0	0	0	0	0	0	0
2	4	10	15	4	6	20	20
3	12	14	17	4	15	22	20
4	33	24	11	14	23	14	7
5 (Most Important)	0	0	0	0	0	0	0
NA	4	6	10	4	5	4	11
Average	3.91	3.54	2.97	4.42	3.88	2.91	2.58
Standard Deviation	0.90	1.17	1.26	0.97	1.02	1.02	1.05

Non-Agribusiness Specialization

(number or respondents by importance level)

Importance Level	Actual Appointment	Grantsmanship Overall	Extension/Outreach Overall	Research Overall	Teaching Overall	Service Overall	Administration Overall
1	6	7	13	2	6	10	36
2	20	29	44	3	20	64	51
3	35	47	41	6	38	68	51
4	64	60	31	24	79	35	16
5	59	51	30	159	38	9	3
NA	13	8	38	8	20	8	41
Average	3.82	3.61	3.13	4.73	3.68	2.83	2.36
Standard Deviation	1.10	1.13	1.24	0.69	1.03	0.96	1.01

Agribusiness Specialization vs. Non-Agribusiness Specialization

	Actual Appointment	Grantsmanship Overall	Extension/Outreach Overall	Research Overall	Teaching Overall	Service Overall	Administration Overall
Differences in the Means	0.10	-0.08	-0.17	-0.31**	0.20	0.07	0.22
P-value	0.8132	0.7115	0.4304	0.0309	0.1921	0.6278	0.6278

** Denotes statistical significance at the 5% level

Although not statistically different, agribusiness faculty do value teaching higher (3.88) than non-agribusiness faculty (3.68). This result is intuitive, given higher teaching loads of agribusiness faculty relative to non-agribusiness faculty. These results provide a conflicting message for agribusiness faculty, i.e. we expect you to spend the largest portion of your time on teaching yet research is what is most important for promotion and tenure. These results support the findings of Woolverton and Downey (1999), Dooley and Fulton (1999), and Connor (2005). Departments must find ways to reward teaching as much as research responsibilities, perhaps even changing the way they evaluate agribusiness faculty for tenure, especially in light of the results in this research and the aforementioned comments by Gordon Gee, president of The Ohio State University (Welsh-Huggins 2010). If not, difficulties could arise for untenured agribusiness faculty as they work towards tenure and promotion.

Academic Agribusiness Research Outlets

This section examines the responses from agribusiness faculty related to their perceptions of which journals are most likely to publish their research, journals in which they should publish to meet departmental promotion and tenure requirements, and the top three journals in which they would seek to publish their research. A graphical representation of the top ten responses to each of these questions is presented in Figures 1, 2, and 3, respectively. The top three journals in which agribusiness faculty typically publish their work are the *JOA*, *IFAMR*, and *AJAE* (Figure 1). This result supports previous research by Dooley and Fulton (1999) and Heiman et al. (2002). The top two journals are directly related to agribusiness, and are not traditional agricultural economics journals, while the third is considered the preeminent journal in agricultural economics.

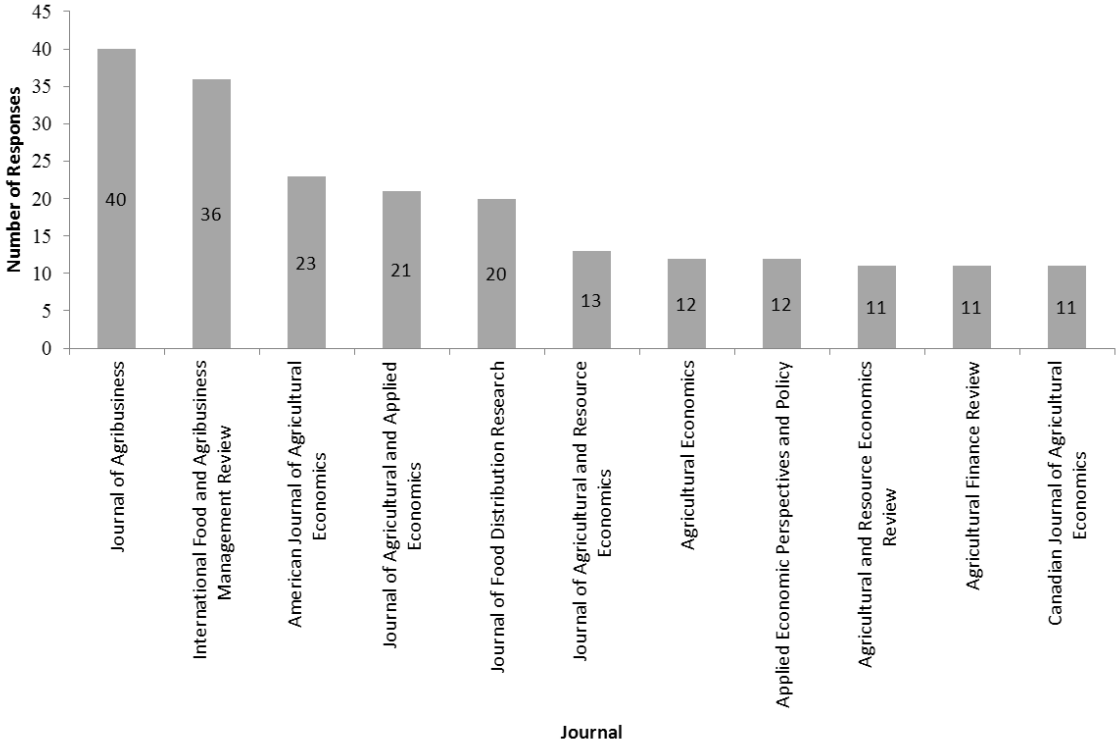

Figure 1. Agribusiness primary specialization respondents' perceptions related to the journal most likely to publish their research

Results also show that many departments do not have a journal list detailing the journals in which they are required to publish (42 responses) (Figure 2). Such a result suggests that some departments keep an open mind regarding outlets in which agribusiness faculty must publish to obtain tenure. For agribusiness faculty in departments that do require publication in specific journals, the number one journal is the *AJAE* (29 votes), followed by the *IFAMR* (16 responses), and the *Journal of Agricultural and Applied Economics (JAAE)* (15 votes). For those agribusiness faculty who reside in these departments, two of the top three are traditional agricultural economics journals. On an encouraging note, the *IFAMR* (Figure 2) is being recognized as the leading journal for agribusiness in terms of promotion and tenure. The top three choices where agribusiness faculty members want to publish their work are the *AJAE,* the *IFAMR,* and the *JOA* (Figure 1). The fact that the *AJAE* is ranked highest is likely the result of its position of prominence in the field of agricultural economics, as well as desires to meet departmental expectations. Both the *IFAMR* and the *JOA* are agribusiness related, which indicates that agribusiness faculty value having their work published in peer reviewed journals specific to their area of specialization.

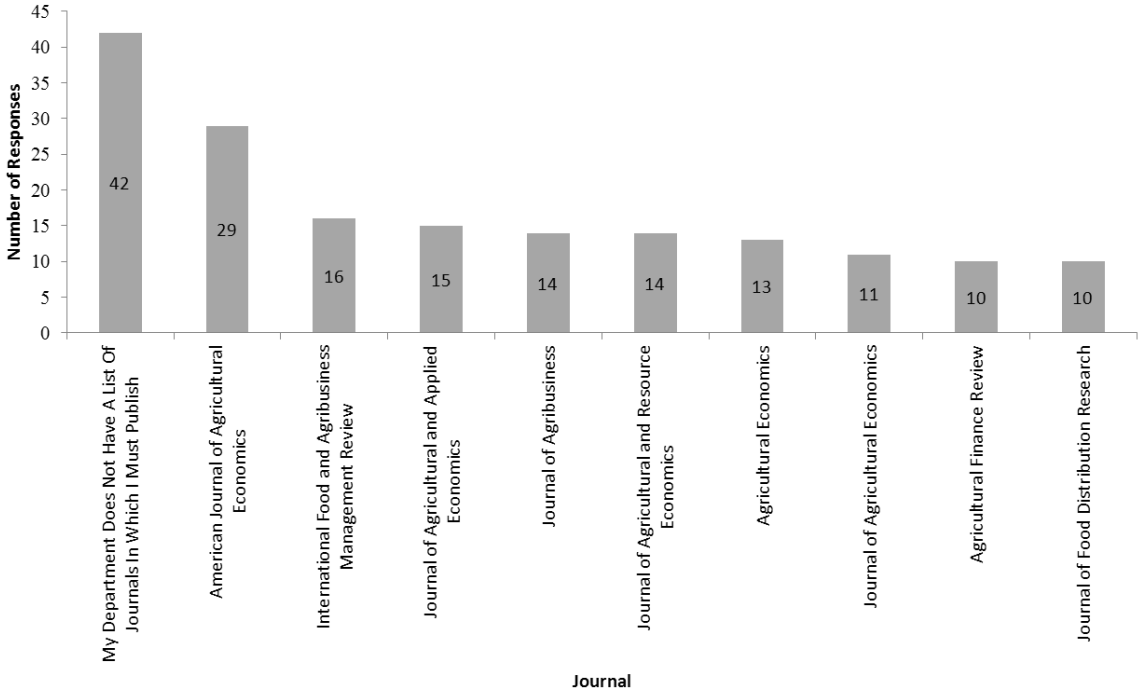

Figure 2. Agribusiness primary specialization respondents' perceptions related to journals in which they should publish to meet departmental promotion and tenure requirements

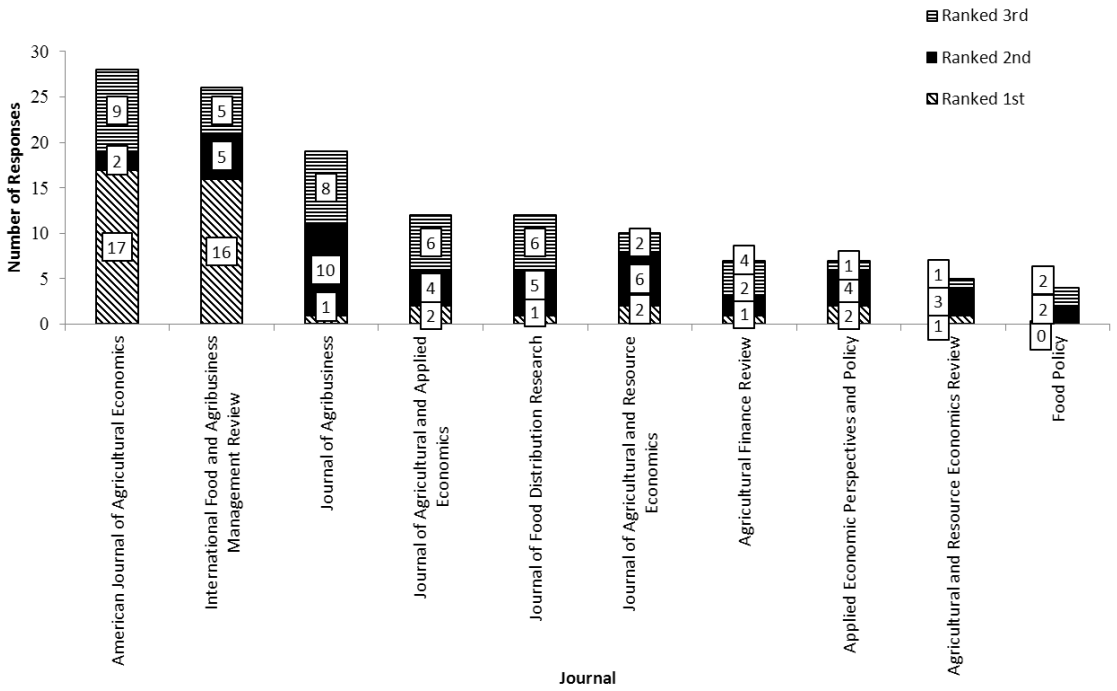

Figure 3. Agribusiness primary specialization respondents' ranking of the top three journals in which they would want to publish their Research.

Demand for Academic Agribusiness Outputs

The fourth set of questions we examined revolves around several common aspects of general concern for agricultural economics programs, particularly as they relate to agribusiness. Respondents were asked to indicate their level of agreement (5 = Strongly Agree to 1 = Strongly Disagree) to the following three statements:

1. Compared to other agricultural economics specializations, it is more difficult to obtain grant funding for agribusiness research.
2. Agribusiness faculty members have heavier undergraduate teaching loads than other faculty.
3. It is difficult to publish agribusiness manuscripts in the traditional agricultural economics journals.

First, the results find no statistical difference between agribusiness and non-agribusiness faculty related to the difficulty of obtaining grant funding for agribusiness research. Both groups scored the question at a level consistent with a choice of Neither Agree or Disagree (Table 4). These results appear to disagree with previous studies by Dooley and Fulton (1999), Woolverton and Downey (1999), and Heiman et al. (2002), all who found that it was more difficult for agribusiness faculty to seek competitive research grants than more traditional agricultural economics faculty. Most likely, all agricultural economists, irrespective of specialization, feel that all grantsmanship is difficult; thus, providing no distinction based on specialization. Alternatively, funding especially from the USDA has moved towards a multi-disciplinary and/or multi-institution integrated approach. This approach may favor agribusiness faculty relative to other

agricultural economists. In particular agribusiness faculty, have their core training in economics, but also utilize in management, finance, accounting, human resources, and marketing methodologies in their research programs. These skills might appeal to collaborators from other disciplines.

Second, a statistical difference exists between agribusiness and non-agribusiness faculty with respect to their perceptions about heavier undergraduate teaching loads for agribusiness faculty, with agribusiness professors having a stronger belief in the statement (Table 4). The agribusiness faculty members' beliefs may reflect the time allocation differences between agribusiness and non-agribusiness faculty. Perhaps, non-agribusiness faculty are unaware of how much time is spent by agribusiness faculty in the undergraduate classroom.

Table 4. Perceived differences agribusiness and non-agribusiness faculty for teaching, grantsmanship, and research

Agribusiness Specialization (number or respondents by level of agreement)			
Agreement Level	**Grant Funding[1]**	**Undergraduate Teaching Loads[2]**	**Publishing Agribusiness Journal Articles[3]**
1 (strongly disagree)	9	6	5
2	16	10	3
3	17	17	14
4	18	19	25
5 (strongly agree)	8	15	23
NA	4	4	2
Average	3.00	3.40	3.83
Standard Deviation	1.23	1.24	1.15
Non-Agribusiness Specialization (number or respondents by level of agreement)			
Agreement Level	**Grant Funding[1]**	**Undergraduate Teaching Loads[2]**	**Publishing Agribusiness Journal Articles[3]**
1 (strongly disagree)	23	35	15
2	34	26	25
3	49	46	40
4	38	39	55
5 (strongly agree)	14	22	28
NA	45	36	39
Average	2.91	2.92	3.34
Standard Deviation	1.18	1.32	1.20
Agribusiness Specialization vs. Non-Agribusiness Specialization			
	Grant Funding[1]	**Undergraduate Teaching Loads[2]**	**Publishing Agribusiness Journal Articles[3]**
Differences in the Means	0.09	0.48***	0.49***
P-value	0.6350	0.0149	0.0035

[1]Compared to other agricultural economics specializations, on average, agribusiness faculty perceive it as more difficult to obtain grant funding for their research projects.
[2]On average, agribusiness faculty members report being assigned heavier undergraduate teaching loads than other faculty. [3]Agribusiness researchers perceive, on average, that it is more difficult to publish agribusiness manuscripts in traditional agricultural economics journals than their non-agribusiness counterparts are.

Third, a statistical difference also exists for publishing, with agribusiness faculty agreeing more strongly than non-agribusiness faculty that it is more difficult to publish agribusiness work in traditional agricultural economics journals (Table 4). Our findings related to the difficulty of publishing agribusiness manuscripts in traditional agricultural economics journals supports the prior findings of Dooley and Fulton (1999). Perhaps it is the case that agribusiness faculty members have sought other refereed outlets for publishing their work. While agribusiness faculty in general might not have trouble publishing their work in refereed journals, non-agribusiness faculty may not recognize or reward these publications as they would publications in traditional agricultural economics journals due to the lack of citation reports for such journals (table 4). Although journals, such as IFAMR are improving review processes, visibility, rigor, and relevance, the lack of citation reports associated with the impact of publishing in such outlets, makes assessing such contributions more difficult at the department level and at subsequent levels during the promotion and tenure process.

Realized Academic Agribusiness Outputs at Time of Tenure

The last portion of the results section examines research output (grants, non-referred publications, and referred publications), at the time of promotion from assistant to associate professor with tenure for professors with a primary specialization in agribusiness. Table 5, contains a summary of the results, grouped by current faculty rank. The results in this section will be especially useful to non-tenured assistant professors as they prepare to navigate the promotion and tenure process. In particular, the results are in line with the changing allocation dynamic we observe between Harling's (1995) study and the present study. For example, there has been a decline in extension publications from current Department Heads/Chairs to current Full Professors to current Associate Professors, while the opposite trend exists for journal articles and grant dollars. These trends are likely the result of the time at which current Associate Professors went up for tenure (2005 on average) versus when current Full Professors went up for tenure (1988 on average), i.e. more time is being allocated to research and considerably less time to outreach. Compared to Harling's 1995 study time allocated to research by agribusiness has increased by approximately 9%, while time allocated to extension has fallen by almost 22%.

Table 5. Output, at the time of promotion from assistant to associate professor with tenure, for professors with a primary specialization in agribusiness by current rank.

	Associate Professor		**Full Professor**		**Department Head/Chair**	
	Average	**Standard Deviation**	**Average**	**Standard Deviation**	**Average**	**Standard Deviation**
Refereed Articles	15.06	8.86	13.32	7.82	9.40	7.40
Non-Refereed Articles	20.31	14.26	25.81	37.73	32.00	30.54
Grants	$1,014,417	$1,075,808	$477,062	$644,005	$240,000	$181,108
Year Promoted to Associate Professor	2005	3.40	1988	10.86	1988	12.48
		N=16		N=30		N=5

Agricultural economics departments largely determine promotion by research and some difficulty has been noted on behalf of agribusiness faculty related to the difficulty that exists concerning publishing agribusiness articles in traditional agricultural economics journals. Thus, senior agribusiness faculty must mentor junior faculty in balancing research demands with heavier teaching responsibilities. In addition, the increasing amount of grant dollars being awarded, combined with decreased reliance on public funding (especially in the U.S.), have already and will continue to spur more heated departmental debates on the importance of grantsmanship in the promotion and tenure process. In particular, this revolves around the classification of grants, i.e. should they be classified as an input or an output.

Conclusions

The results of this research has shed new light on the perceived state of agribusiness education, research, grantsmanship, and outreach, as well as the balance of these activities in the work of academics currently specializing in agribusiness. In light of growing agribusiness programs and increased demands on agribusiness faculty, this research highlights the need for additional resources and consideration for agribusiness faculty as they move towards tenure.
Progress on the 1989 NAEC report recommendations appears to be slow on at least two fronts. First, the reallocation of resources towards agribusiness research, commensurate with the allocation of resources to agribusiness teaching, is lacking. This means that the research component of agribusiness programs is being underfunded. Research is an important component of the Land Grant mission, as it serves as the bedrock for developing faculty expertise in teaching and outreach. Departments expect agribusiness faculty to teach more courses, yet perceived research expectations are similar to their non-agribusiness peers. As a result, agribusiness faculty have less engagement in agribusiness extension programs (industry engagement), despite the importance of agribusiness extension programs in identifying contemporary problems ripe for agribusiness research.

This result is of particular importance to junior agribusiness faculty members as they attempt to navigate the promotion and tenure process. In particular, there is evidence to suggest an increasing trend in the amount of grant dollars and refereed publications necessary at the time of tenure, with relatively fewer non-referred publications. Furthermore, junior faculty must do this while allocating less time to research and extension, and more to teaching relative to their non-agribusiness peers. The impact is not limited to junior faculty, as associate professors are also affected by this shift, as they progress toward promotion to full professor, and although full professors have achieved the highest academic rank, they must deal with both department head and other upper level administrator expectations that determine pay raises. The adjustment of faculty lines is a difficult issue for any department for at least two reasons. First, many departments have shrunk over time; it is difficult to reallocate a smaller pie. In addition, our profession faces broad issues in many other subject matter areas. Second, any change to a faculty is made one hire at a time.

Second, the training of agribusiness Ph.Ds. those that have training in both economic and management theory, for delivering agribusiness courses has only slowly gained traction. The creation of a joint program at Texas A&M University between the Department of Agricultural Economics and the Mays School of Business is one workable model. The Morrison School of Agribusiness

at Arizona State University resides in the W. P. Carey School of Business, making its Ph.D. program structure another working model. These two programs represent significant departures from the traditional model of training future agribusiness faculty as agricultural economists with a few management courses added to their program of study. Not unrelated to this, is the reduction in funding of Ph.Ds. in genuine agribusiness. For example, the 2011 USDA National Needs Fellowship request for applications notes Agricultural Management and Economics as "Targeted Expertise Shortage Areas," but goes on to further define that area as "agricultural trade policy, resource economics, and economics of alternative energy." One cannot argue that these are not important, growing areas for research, but as prior research shows, they hardly appear to be the source of growing undergraduate enrollment demands across departments.

Limitations

Admittedly, we took classifications from the AAEA with which members could identify for the purposes of the survey. It is obvious, though, that even our professional associations (AAEA, IFAMA, Southern Agricultural Economics Association, Western Agricultural Economics Association and others) are struggling to determine their identity and retain membership. For example, some programs, such as those at the University of Illinois, Virginia Tech, and Texas Tech, have found success in offering a personal financial planning major. These specializations are even further removed from the distant core, farm management, than many of other specializations offered. After an AAEA name change, some longtime members felt alienated. Others could finally determine where their research fit into the organization.

Despite the difficulties with identity in the profession, the flagship journal remains the *AJAE*. However, many members of the AAEA, including some with agribusiness specialty areas, have difficulty determining the relevance of their research to the premier journal in our field. Fortunately, new outlets are growing in acceptance for agribusiness researchers. The IFAMA Board of Directors and the Editorial Board have placed a continual focus on improving the rigor and relevance of the *IFAMR*. Other agribusiness journals would be wise to place similar focus on these issues so these outlets become valued in tenure and promotion decisions. These journals will need to adhere to the criteria, especially those that determine impact factors and other measures of journal quality. Inclusion in Citation Indices and Scholarly Search Engines, along with vocal support of senior level agribusiness faculty during promotion and tenure reviews is critical for their acceptance and emergence as well-respected research outlets.

Future inquiry should consider whether differences exist among specific subspecializations of agribusiness, such as agribusiness management, food safety, etc. Although the terms agribusiness and agribusiness management are often used interchangeably there are important differences that should be examined. Agribusiness management programs, clearly focus on the agribusiness sector, but require some level of management theory education, whereas agribusiness programs are generally career-oriented with a broader focus on practical application of business principals to the agriculture sector.

Implications for the Future of Agribusiness Programs

The results of this research highlight four needs for a concerted effort by those of us involved in the field of agribusiness to promote its importance in teaching/ research/ extension throughout the agricultural economics profession. One key challenge is that colleges and departments are finding it difficult to reallocate faculty positions to agribusiness, especially at the undergraduate teaching level. Second, even when agribusiness positions are approved, departments struggle to find new hires because the profession needs additional PhD programs that will provide the necessary graduate training in both economic and business theory. Third, we must continue the efforts to improve the reputation of journals that specialize in the publication of agribusiness research. These efforts should focus on seeking inclusion in citation reports and databases. Fourth, while traditional extension activities in agribusiness appear to be on the decline, outreach activities with agribusinesses at all levels of the value chain are becoming increasingly important. In particular, relationships spawned by these outreach activities often lead to additional funding opportunities for agribusiness faculty. Thus, declines in industry engagement are at odds with developing an outstanding agribusiness program because agribusiness programs (teaching/ research/ extension), are an "applied" field and geared towards teaching managerial decision-making that is informed through real world examples., An incentive structure that discourages industry engagement cannot be good for the field of agribusiness, the mangers it presumes to benefit, or the students we are trying to educate. One clear implication of this finding is that if assistants, associates, and to a lesser extent full professors, have greater teaching loads, less time can be dedicated to not only dealing/responding to industry engagement activities but as a consequence reduce their abilities to conduct research that is impactful to the agribusiness field. Finally, with a greater emphasis being placed on grantsmanship, young agribusiness faculty need to build relationships with agribusinesses early in their career to develop alternative sources of funding for their program as well as a source of new research ideas and topics.

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Appendix A. Questions in the Survey Examined in This Paper

Using 100% as your total please indicate the actual percentage of time you dedicate to each of the following activities. For example, if you spend twenty percent of your time doing research, then please put the number "20" in the text box immediately to the right of the words "Percent Research."

Percent Research
Percent Teaching
Percent Extension
Percent Grantsmanship
Percent Service (committee for department, college, university, or profession)
Percent Administration

Please choose one primary specialization.

Agribusiness
Commodity Marketing
Economic Theory
Farm/Production
International
Other
Policy
Quantitative
Resource/Environment
Rural Development

Please indicate your current rank. (Select one)

Instructor
Continuing Lecturer
Assistant Professor without Tenure
Associate Professor without Tenure
Associate Professor with Tenure
Full Professor without Tenure
Full Professor with Tenure
Department Head/Chair
If other, please specify in the text box below

Please indicate your output for the following categories at the time you were promoted from an assistant to an associate professor.

Number of refereed articles you had written
Number of non-refereed articles you had written (do not include published abstracts)
Total monetary value of the grants you had been awarded

Please indicate the year that you were promoted from assistant to associate professor.

Year

Please select the journals that are most likely to publish your work. (Select up to three)
Agricultural and Resource Economics Review

Agricultural Economics
Agricultural Finance Review
American Journal of Agricultural Economics
Applied Economic Perspectives and Policy
Australian Journal of Agricultural and Resource Economics
Canadian Journal of Agricultural Economics
European Review of Agricultural Economics
Food Policy
International Food and Agribusiness Management Review
Journal of Agribusiness
Journal of Agricultural and Resource Economics
Journal of Agricultural and Applied Economics
Journal of Agricultural Economics
Journal of Environmental Management
Journal of Food Distribution Research
Journal of Natural Resources and Life Sciences Education
Journal of Soil and Water Conservation
Journal of Sustainable Agriculture
Management Science
Marine Resource Economics
Review of Environmental Economics and Policy
Review of International Economics
Water Resources Management
If others, please specify them

Please rank the top three journals, which you strive to have publish your work. If you choose other please specify the name as well as the ranking, for any other choice enter the ranking (1, 2, or 3) in the text box to the right of the journal's name.

Agricultural and Resource Economics Review
Agricultural Economics
Agricultural Finance Review
American Journal of Agricultural Economics
Applied Economic Perspectives and Policy
Australian Journal of Agricultural and Resource Economics
Canadian Journal of Agricultural Economics
European Review of Agricultural Economics
Food Policy
International Food and Agribusiness Management Review
Journal of Agribusiness
Journal of Agricultural and Resource Economics
Journal of Agricultural and Applied Economics
Journal of Agricultural Economics
Journal of Environmental Management
Journal of Food Distribution Research
Journal of Natural Resources and Life Sciences Education
Journal of Soil and Water Conservation

Journal of Sustainable Agriculture
Management Science
Marine Resource Economics
Review of Environmental Economics and Policy
Review of International Economics
Water Resources Management
If other, please specify the name as well as the ranking

Please indicate the journals in which your department wants you to publish in for promotion and tenure. (Select all that apply)

Agricultural and Resource Economics Review
Agricultural Economics
Agricultural Finance Review
American Journal of Agricultural Economics
Applied Economic Perspectives and Policy
Australian Journal of Agricultural and Resource Economics
Canadian Journal of Agricultural Economics
European Review of Agricultural Economics
Food Policy
International Food and Agribusiness Management Review
Journal of Agribusiness
Journal of Agricultural and Resource Economics
Journal of Agricultural and Applied Economics
Journal of Agricultural Economics
Journal of Environmental Management
Journal of Food Distribution Research
Journal of Natural Resources and Life Sciences Education
Journal of Soil and Water Conservation
Journal of Sustainable Agriculture
Management Science
Marine Resource Economics
Review of Environmental Economics and Policy
Review of International Economics
Water Resources Management
I Do Not Know
My Department Does Not Have A List Of Journals In Which I Must Publish
If others, please specify all that apply

Please rank the following specific factors for their impact on your tenure decision, where 5 = Strongly Affects, 4 = Affects, 3 = Moderately Affects, 2 = Slightly Affects, 1= Does Not Affect, and NA = Not Applicable. For example, if you strongly agree that grantsmanship impacts the tenure decision, but feel that service overall is taken under light consideration, you might answer "5" for grantsmanship overall, but "2" for service overall .

Actual Appointment
Grantsmanship Overall

Extension Overall
Research Overall
Teaching Overall
Service Overall
Administration Overall

Please share with us your thoughts regarding several common aspects that are of general concern to agricultural economics programs. For each statement, indicate your level of agreement by assigning 5 = Strongly Agree, 4 = Somewhat Agree, 3 = Neither Agree or Disagree, 2 = Somewhat Disagree, 1 = Strongly Disagree, NA = Not Applicable.

Agribusiness faculty members have heavier undergraduate teaching loads than other faculty
Compared to other agricultural economics specializations, it is more difficult to obtain grant funding for agribusiness research.
It is difficult to publish agribusiness manuscripts in the traditional agricultural economics journals.

