



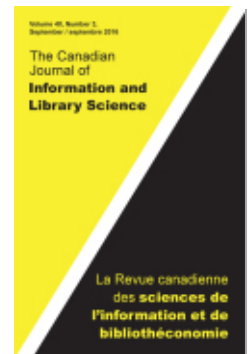
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Knowledge Translation in Agriculture: A Literature Review

L'application des connaissances dans le secteur agricole : une revue de la littérature

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Abstract: Knowledge from research should be disseminated not only to advance knowledge but also to inform practice and policy decisions. Research knowledge has the potential to influence practice and policy and result in tangible outcomes. Agriculture plays a vital role in the economies of many nations. Given the value placed on the transfer and use of research knowledge, and in light of the importance of agriculture research, this review article explores studies that have been carried out with respect to knowledge translation in agriculture to determine the amount, focus, and nature of such studies. The main procedures for conducting the review were: (1) searching for studies; (2) selecting studies based on relevance; (3) extracting data; and (4) reporting the findings. The findings are presented according to five key points derived from Lavis' framework for knowledge transfer: the message; the target audience; the messenger; the knowledge translation process and support system; and evaluation. Out of 268 studies identified through various search strategies, twenty-seven were deemed to be relevant to the objectives and were included in the review. Findings from this review elucidate that while there was a variety of knowledge transferred, agriculture researchers are the most popular messengers for the transfer of agriculture research knowledge and farmers are the most popular target audience. This review demonstrates that although there are studies on knowledge translation with an emphasis on agriculture knowledge to farmers indexed in scholarly databases, it advocates for more empirical studies to investigate how research knowledge is translated to policy-makers in the agriculture domain. It also calls for studies to explicate the role of libraries and library and information science professionals in the translation of agriculture research knowledge.

Keywords: knowledge translation, knowledge transfer, agriculture, research, Lavis' framework, literature review

Résumé : Les connaissances provenant de la recherche devraient être diffusées pour contribuer non seulement à leur propre avancement, mais aussi aux pratiques et aux décisions stratégiques. Les connaissances résultant de la recherche ont le potentiel d'influencer les pratiques et les politiques, et d'aboutir à des résultats tangibles. L'agriculture joue un rôle vital dans l'économie de nombreux pays dans le monde. Étant donné la valeur accordée au transfert et à l'utilisation des connaissances résultant de la recherche, et compte tenu de l'importance de la recherche agricole, cette recension de littérature fait le tour des études qui ont été réalisées dans le

domaine de l'application des connaissances dans le secteur agricole afin de déterminer la quantité, le point central et la nature de ces études. Méthodes : les principales procédures pour mener à bien cette recension ont été les suivantes : (1) la recherche d'études; (2) la sélection des études sur la base de leur pertinence; (3) l'extraction de données; et (4) la présentation des résultats. Les résultats sont présentés en suivant les cinq points clés empruntés au cadre Lavis de transfert des connaissances : le message, le public ciblé; le messenger; le processus de transfert des connaissances et l'infrastructure de communication en appui ; et l'évaluation. Sur les deux-cent-soixante-huit études identifiées grâce à diverses stratégies de recherche, vingt-sept ont été jugées pertinentes par rapport aux objectifs et ont été incluses dans la recension. Les résultats de cette recension montrent clairement que même s'il y a un grand choix de connaissances transférées, les chercheurs du domaine de l'agriculture sont les messagers les plus populaires pour le transfert des connaissances de la recherche agricole, et les agriculteurs sont le public cible le plus populaire. Cette recension démontre que bien qu'il existe des études effectuées auprès d'agriculteurs indexés dans les bases de données scientifiques sur l'application des connaissances et mettant l'accent sur les connaissances en agriculture, des études plus empiriques sont préconisées pour étudier comment les connaissances de la recherche sont appliquées par les décideurs dans le domaine de l'agriculture. Cette recension préconise également des études expliquant le rôle des bibliothèques et des professionnels en bibliothéconomie et sciences de l'information dans l'application des connaissances provenant de la recherche en agriculture.

Mots-clés : application des connaissances, transfert de connaissances, agriculture, recherche, cadre Lavis, recension de la littérature

Introduction

Knowledge translation (KT) is a process that has been suggested to bridge the gap between research and policy or research and practice. Different terms are used to refer to the process of using knowledge to inform policy and practice (Bowen and Graham 2013; Grimshaw et al. 2012), such as KT or knowledge exchange. K. Ann McKibbon et al. (2010) documented that 100 different terms were used to describe processes of getting research knowledge from the researchers that produce it to its eventual users, while Graham et al. (2006) identified twenty-nine terms used to refer to the concept of moving knowledge into action. Other synonymous terms that have been used independently and interchangeably to describe the process of communicating research knowledge to potential users include knowledge transfer, knowledge transfer and exchange, research dissemination, implementation research, research translation, knowledge dissemination, evidence translation, knowledge mobilization, research uptake, knowledge utilization, research use, evidence uptake, research utilization, implementation, diffusion and dissemination, research transfer, technology transfer, communications, dissemination, and guideline implementation (Bowen and Graham 2013; Graham et al. 2006; Grimshaw et al. 2012; Oborn, Barrett, and Racko 2013; Ward, House and Hamer 2009). Ottoson (2009) inferred possible differences in the meanings of some terms used to describe KT: knowledge transfer describes

when learning moves as intended from a training site to the community context or when knowledge morphs into alternative, adapted skills; implementation theory describes when the intended beneficiaries of knowledge have the authority or opportunity to use a new skill; KT describes when ideas are translated into actionable messages for intended beneficiaries; while the diffusion of knowledge describes the spread of knowledge irrespective of use or non-use. Knowledge mobilization, on the other hand, is an attempt to integrate research evidence, using research more to improve policy and practice in education (Cooper, Levin, and Campbell 2009; Nutley, Walter, and Davies 2007). According to Levin (2011), these terms may vary across sectors and disciplines. However, regardless of the term, the underlying spirit is the same, which is trying to make research matter more in policy and practice for organizational and system improvement (Levin 2011). This point is echoed by Blake and Ottoson (2009), who note that despite its varying definitions and terminologies used, the goal is to ensure that results of scientific research are used for the benefit of humans. Considering that the use of different terms to describe the generation, dissemination, and utilization of research knowledge presents challenges to readers, for the purpose of this literature review this process is referred to as KT (Greenhalgh and Wieringa 2011).

KT (and its synonymous terms—for example, knowledge transfer, research uptake, and knowledge use) has been suggested to be the “remedy” to what is often referred to as the “know-do gap” or “knowledge-to-action gap.” This gap describes the disparity between what research studies propose to be solutions to problems and what is actually practised or implemented as policy in relation to the same problems. KT usually involves the processes of getting research knowledge from the researchers to its eventual users. It is an interdisciplinary construct that crosses the traditional boundaries of academic fields (Huzair et al. 2013). Although the World Health Organization (2012) suggests that knowledge is more than research evidence, they note that KT can harness the power of scientific evidence to inform and transform policy and practice. The idea of KT reportedly has its roots in agriculture research (Blake and Ottoson 2009; Jacobson 2007; Rogers 2003); however, in recent times, knowledge transfer practices are studied more in connection with health research, focusing on how health research knowledge is transferred and received by end users (Canadian Institutes of Health Research 2008; Cordero et al. 2008; Dobbins et al. 2009; Graham et al. 2006).

Some models and frameworks have been developed and used to understand the concept of KT. Frameworks for KT vary in their descriptions and emphasis; some approaches seem to emphasize a one-way transmission model, while others attempt to capture a more iterative understanding. However, most authors agree that KT is a complex and lengthy process and one that requires innovative and dedicated action on the part of knowledgeable strategic planners and change agents (Oborn, Barrett, and Racko 2010). Kastner and Straus (2012) have noted that although there are many theories for KT, most are not designed to cause change but, rather, to describe change. These frameworks emphasize the

need for the KT process to be feasible and adaptable to local circumstances and to involve end users.

For example, the Canadian Institutes of Health Research (CIHR)'s KT framework offers a global picture of the overall KT process as integrated within the research production cycle (Sudsawad 2007). It focuses on how KT is an integral part of the research cycle, such that within this cycle, the CIHR identifies six opportunities for knowledge exchange that go beyond the basic approach of publication after research. Those opportunities are:

- KT1: Defining research questions and methodologies;
- KT2: Conducting research (as in the case of participatory research);
- KT3: Publishing research findings in plain language and accessible formats;
- KT4: Placing research findings in the context of other knowledge and socio-cultural norms;
- KT5: Making decisions and taking action informed by research findings; and
- KT6: Influencing subsequent rounds of research based on the impacts of knowledge use.

Another framework that has been used to describe KT is the Promoting Action on Research Implementation in Health Services (PARIHS) framework (Kitson, Harvey, and McCormack, 1998). This KT related framework has been applied in many research studies (see Genuis 2007; Gibb 2013; Gozdzik 2013; Helfrich et al. 2010; Powrie et al. 2014; Rycroft-Malone 2004). The PARIHS framework posits key interacting elements that influence the use of research knowledge in practice. According to PARIHS, the use of research knowledge in practice is a function of the interplay of three core elements: (1) the level and nature of the research evidence to be used; (2) the context or environment in which the research is to be placed; and (3) the method by which the research use is to be facilitated. PARIHS argues that these three interacting bases positively influence KT: strong research evidence, supportive organizational context, and appropriate facilitation (Rycroft-Malone et al. 2002). The status of each of these elements can be assessed for having a weak or strong effect on KT.

The Tehran University of Medical Sciences model conceptualizes KT as the exchange efforts between decision makers and researchers repeatedly transferring questions and knowledge to each other within the context of an organization (Majdzadeh et al., 2008), while the Use of Research model (Cooper, Levin, and Campbell 2009) describes knowledge use as the intersection of research evidence with context and time. The KT process in the Knowledge to Action (KTA) model as put forward by Graham and colleagues (2006) is made up of a knowledge creation component and an action component. Each component contains several phases, and there are no definite boundaries between the two components and among their phases (Graham et al. 2006).

The Lavis knowledge transfer framework is often cited in reference to KT strategies (Lavis et al. 2003). It examines knowledge transfer processes outlined based on five questions designed to guide KT:

- What should be transferred to decision makers (the message)?
- To whom should research knowledge be transferred (the target audience)?
- By whom should research knowledge be transferred (the messenger)?
- How should research knowledge be transferred (the KT process and support system)?
- With what effect should research knowledge be transferred (evaluation)?

Many studies have adopted the Lavis knowledge transfer framework (in whole and in parts) in investigating the KT practices of researchers and research organizations (see Cameron et al. 2010; Couturier et al. 2014; El-Jardali et al. 2012; Guindon et al. 2010; Lavis et al. 2010; Moat, Lavis, and Abelson 2013; Opsahl 2012). The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) in Canada also adopted and incorporated these five steps proposed by Lavis' framework as its KT guidelines—template and checklist—for agriculture researchers in the province of Ontario.¹ The Lavis framework is used as a guide to write this review because it is straightforward in its conceptualization of the knowledge transfer process.

Agriculture is the world's largest industry and a key driver for many economies (Asselin, MacLeod, and Dosman 2009). According to Townsend et al. (2013), agriculture can help reduce poverty for 75 percent of the people in the world, raise incomes, improve food security, and benefit the entire world. Research knowledge is increasingly recognized in the agriculture sector (Klerkx et al. 2012); nonetheless, KT practices for agriculture knowledge is a line of research that has received less attention in recent years. This review presents the scope and summary of KT-related studies that have focused on agriculture knowledge.

Methods

The main phases of this review were: (1) searching for studies; (2) selecting studies based on relevance to a subject area by scrutinizing titles and reading abstracts; (3) extracting data by reading the full text of selected studies; and (4) collating, summarizing, and reporting the findings. According to Grant and Booth (2009, 94), literature reviews are published materials that provide examination of recent or current literature; can cover wide range of subjects at various levels of completeness and comprehensiveness; may include research findings; the search may or may not include comprehensive searching; appraisal may or may not include quality assessment; synthesis is typically narrative; and analysis may be chronological, conceptual or thematic.

The following databases were used to establish and identify the literature: Annual Review of Information Science and Technology (ARIST); Emerald Full-text; Library, Information Science and Technology Abstracts (LISTA); Library Literature and Information Science Full Text (H. W. Wilson); Scopus; and Web of Science (WOS) databases. They were searched for research studies pertaining to KT in agriculture, using a permutation and combination of search term strategies.

Scopus was used because it is reportedly the largest abstract and citation database of peer-reviewed literature: scientific journals, books, and conference

proceedings. Scopus delivers a very comprehensive overview of the world's research output across all research fields—science, mathematics, engineering, technology, health and medicine, social sciences, and arts and humanities.² WOS gives access to multiple databases that reference cross-disciplinary research, which allows for in-depth exploration of specialized sub-fields within an academic or scientific discipline (Burnham 2006). Kulkarni et al. (2009) noted that an advantage of WOS over Scopus is the depth of coverage; the WOS database goes back to 1945, and Scopus goes back to 1966. However, Scopus and WOS complement each other as neither resource is all-inclusive. ARIST, LISTA, and Library Literature and Information Science Full Text (H. W. Wilson) were included because they are key library and information science (LIS) databases, and this review was carried out from an LIS perspective. While, Scopus and WOS cover all fields, the LIS databases were included so as not to miss any KT in agriculture studies that might have been carried out from an LIS perspective, which might not be indexed in the WOS and Scopus, or if they did not appear in an agriculture journal.

Search strategy, study selection, and data extraction

Using ARIST, a search strategy of “KT” and “agriculture” searched *anywhere* produced eighty-six hits. “Knowledge translation” in *abstract* and agriculture *anywhere* produced zero hits, “knowledge translation” in title AND agriculture *anywhere* produced two results; “knowledge translation” searched in *keywords* AND agriculture *anywhere* produced six results. In addition to “knowledge translation,” other synonymous terms/phrases were used to search for relevant literature, such as “knowledge transfer” AND agriculture; “knowledge transfer and exchange” AND agriculture; “knowledge utilization” AND agriculture, “research policy gap” AND agriculture. In ARIST, these terms were all searched as *keywords* and agriculture was searched in *anywhere* in all cases. An Emerald Fulltext search produced seventy-six results using “knowledge translation.” LISTA produced zero results for “knowledge translation” AND agriculture and eight results for “knowledge transfer” AND agriculture. Scopus produced two results for “knowledge translation” AND agriculture and thirty results for “knowledge transfer” and agriculture searched for in *title*, *abstract*, and *keywords*. “Knowledge utilization” AND agriculture gave three hits, while “knowledge transfer and exchange” AND agriculture produced one result using Scopus. Using WOS, “knowledge translation” AND agriculture searched in *topic* gave two hits, “knowledge transfer” in *topic* AND agriculture in title gave ten hits, and “knowledge transfer” AND agriculture in *topic* produced 102 results. Table 1 presents the combination and permutation of search strategies that were used and the results that were obtained from each attempt. No language and geographical or date limitations were included in the search strategies.

After eliminating duplicating titles from the 268 search results retrieved using all search strategies, the abstracts of eighty-one studies were read to determine whether the studies were concerning agricultural knowledge transfer by mentioning agriculture and information / knowledge dissemination. Of these,

Table 1: Search strategies and the results obtained for each attempt

Name of database	First search term / phrase	Search field for first search term	*Second search term	Search field for second search term	Number of hits produced
ARIST	"Knowledge translation"	Abstract	Agriculture	Anywhere	0
ARIST	"Knowledge translation"	Title	Agriculture	Anywhere	2
ARIST	Knowledge translation	Keyword	Agriculture	Anywhere	6
ARIST	"Knowledge translation"	Anywhere	Agriculture	Anywhere	86
ARIST	Knowledge transfer	Keyword	Agriculture	Abstract	0
ARIST	Knowledge transfer	Keyword	Agriculture	Keyword	1
ARIST	Knowledge transfer	Keyword	Agriculture	Title	1
ARIST	Knowledge transfer	Keyword	Agriculture	Journal Title	2
ARIST	Knowledge transfer	Keyword	Agriculture	Anywhere	50
ARIST	Knowledge transfer and exchange	Keyword	Agriculture	Anywhere	2
ARIST	Knowledge utilization	Keyword	Agriculture	Anywhere	5
ARIST	research policy gap	Keyword	Agriculture	Anywhere	1
Emerald Fulltext (advanced search)	Knowledge translation	Keyword	Agriculture	Anywhere	0
Emerald Fulltext (advanced search)	"Knowledge translation"	Abstract	Agriculture	Anywhere	0
Emerald Fulltext (advanced search)	"Knowledge translation"	Anywhere	Agriculture	Anywhere	3
LISTA (advanced search)	"Knowledge translation"	All Text	Agriculture	All Text	0
LISTA (advanced search)	knowledge transfer	Subject Terms	Agriculture	All Text	3
LISTA (advanced search)	"Knowledge transfer"	Title	Agriculture	All Text	3
LISTA (advanced search)	"Knowledge transfer"	All Text	Agriculture	All Text	8
Scopus (document search)	"Knowledge translation"	Article Title, Abstract, Keywords	Agriculture	Article Title, Abstract, Keywords	2
Scopus (document search)	"Knowledge transfer and exchange"	Article Title, Abstract, Keywords	Agriculture	Article Title, Abstract, Keywords	1
Scopus (document search)	"Knowledge utilization"	Article Title, Abstract, Keywords	Agriculture	Article Title, Abstract, Keywords	3
Scopus (document search)	"Knowledge transfer"	Article Title, Abstract, Keywords	Agriculture	Article Title, Abstract, Keywords	30
Web of Science (basic search)	"Knowledge translation"	Topic	Agriculture	Topic	2
Web of Science (basic search)	"Knowledge transfer"	Topic	Agriculture	Title	10
Web of Science (basic search)	"Knowledge transfer and exchange"	Topic	Agriculture	Topic	0
Web of Science (basic search)	"Knowledge transfer"	Topic	Agriculture	Title	0
Web of Science (basic search)	"Knowledge transfer"	Topic	Agriculture	Topic	102

*Note that in all search attempts, the first and second search terms were always conjugated using the Boolean operator AND.

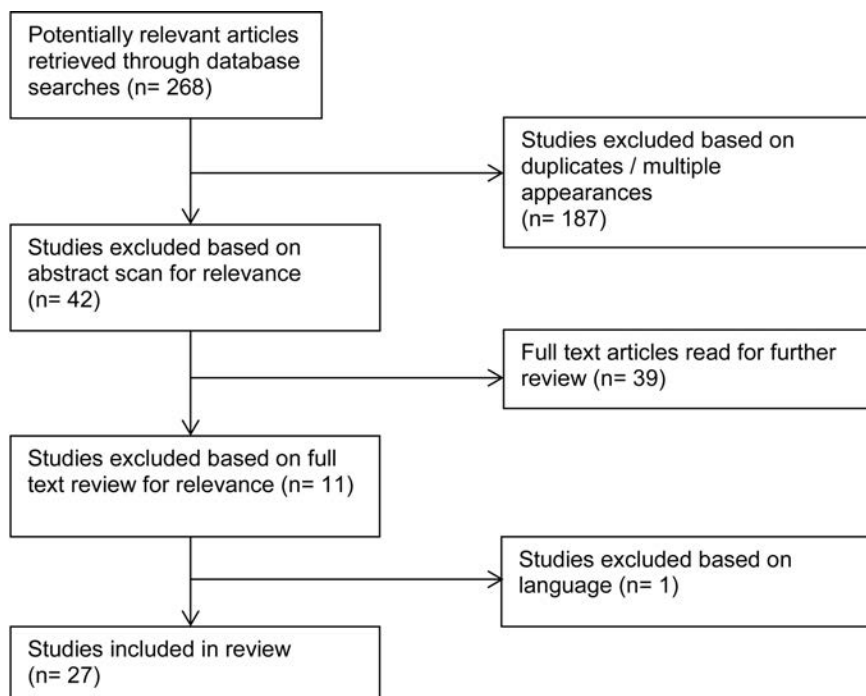


Figure 1: PRISMA flow diagram of the results of the search strategy and process of selecting KT in agriculture-related research articles

forty-two studies were excluded. Thirty-nine full-text studies were read and adjudicated on whether the authors made reference to any one or more of the variables in Lavis' knowledge transfer framework: the message, the target audience, the messenger; the transfer process and support system, and the evaluation. Of these, twelve were eliminated; eleven were deemed not relevant, while the full text of one study was not in English. Information on the message, the target audience, the messenger, the KT process and support system, and the evaluation were extracted for inclusion in the findings for the literature review. Figure 1 is a flow diagram describing the process of searching and selecting articles related to KT in agriculture that are to be included in the review.

Findings: descriptive summary of research on KT in agriculture presented using Lavis' framework for knowledge transfer

The message

Different types of agriculture knowledge have been transferred to potential users. While Malhan and Rao (2007) and Koka (2013) were not specific about the message or the type of agricultural knowledge, Butler, Le Grice, and Reed (2006), Feng and colleagues (2009), Isoe and Nakatani (2011a), Floriańczyk,

Janc, and Czapiewski (2012), Muscio and Nardone (2012), and Hočevár and Istenič (2014) made reference to the message in a very general sense to be “agricultural knowledge” or “scientific knowledge.” Young and colleagues (2014), however, discussed the translation of scientific evidence on agri-food public health. Similarly, Asselin, MacLeod, and Dosman (2009) studied the translation of agriculture health and safety knowledge on chemical exposure, stress, air and water quality, machinery safety, contaminants, synergy, farm safety issues, building sanitation and ventilation, and knowledge about impact of climate change on farming. In addition to knowledge regarding three livestock diseases that was the message for KT in Nielson and colleagues (2010), Feng and colleagues (2010) described the translation of agriculture knowledge on crop and livestock production, agriculture machinery and technology, agriculture programs and services, and farm business management. Likewise, Alcon and colleagues (2014) presented KT of research on deficit irrigation to help achieve water savings in water scarce areas. The message was knowledge about modern water-saving techniques to increase water use efficiency while maintaining production levels and reducing irrigation input requirements. Similarly, Reichardt and colleagues (2009) considered KT related to precision farming, while the translation of research on more suitable vegetable intercropping systems was the message for KT in the study by Feike and colleagues (2010) and water management knowledge in Wellens and colleagues (2013). The message for KT was on grassland nitrogen use efficiency in Oenema, van Ittersum, and van Keulen (2012) and improved agricultural technologies in Ibrahim, Mustapha, and Mamza (2014).

The target audience

A variety of target audiences were reported in the literature pertaining to KT in agriculture. Many studies were concerned with knowledge translated to rural or local farmers (Alcon et al. 2014; Butler, Le Grice, and Reed 2006; Feike et al. 2010; Feng, Duan, and Fu 2007; Feng, Duan, Mathews, and Fu 2007; Feng et al. 2009; Heffernan, Thomson, and Nielsen 2008; Hočevár and Istenič 2014; Malhan and Rao 2007; Reichardt et al. 2009; Rivera-Huerta et al. 2011; Wellens et al. 2013), livestock keepers (Lin and Heffernan 2010; Nielsen et al. 2010), dairy farmers (Oenema, van Ittersum and van Keulen 2012), and farm businesses (Butler, Le Grice, and Reed 2006; Feng et al. 2009; Feng et al. 2010; Floriańczyk, Janc, and Czapiewski 2012). The second most important target audiences for the translation of agriculture knowledge reported in the literature were agricultural researchers or scientists (Alcon et al. 2014; Asselin, MacLeod, and Dosman 2009; Feng et al. 2010; Feike et al. 2010; Okocha 1995). Novice agricultural workers were noted as the target audience for the KT effort in Isoe and Nakatani (2011a, 2011b), students and agricultural entrepreneurs (Koka 2013), secondary schools (Ibrahim, Mustapha, and Mamza 2014), and extension service officers or extensionists (Alcon et al. 2014; Feike et al. 2010). More specific target audiences for agriculture knowledge were: irrigation community managers (Alcon et al. 2014), food industry (Muscio

and Nardone 2012), and water users association (Wellens et al. 2013). Public administrators, policy-makers and agricultural decision makers were also listed as target audiences in Alcon et al. (2014), Young et al. (2014), and Asselin, MacLeod, and Dosman (2009) respectively, while other more general stakeholders and relational ties and networks such as neighbours, relatives, friends, accountants, bank managers, suppliers, husbands, sisters, brother-in-laws, advisors, veterinarians, sales representatives, and abattoir employees were noted as target audiences in Butler, Le Grice, and Reed (2006) and Feike et al. (2010).

The messenger

Of the different categories of messengers for the translation of agriculture knowledge mentioned in the literature, the most popular were agriculture researchers or research scientists (Alcon et al. 2014; Asselin, MacLeod, and Dosman 2009; Feike et al. 2010; Feng et al. 2010; Hočevár and Istenič 2014; Rivera-Huerta et al. 2011; Okocha 1995). Still among studies that indicated researchers as messengers, Asselin, MacLeod, and Dosman (2009) were precise about the specialization of the researchers, which was noted to be agriculture health and safety researchers. Farmers were also popularly mentioned among messengers of agriculture knowledge (Alcon et al. 2014; Asselin, MacLeod, and Dosman 2009; Butler, Le Grice, and Reed 2006; Feike et al. 2010; Floriańczyk, Janc, and Czapiewski 2012; Heffernan, Thomson, and Nielsen 2008; Okocha 1995). Agriculture universities and academic and research institutes were listed as messengers in Alcon et al. (2014), Asselin, MacLeod, and Dosman (2009), Feng, Duan, Mathews, and Fu (2007), Feng et al. (2009), Feng et al. (2010), Gaitán-Jurado et al. (2013), Hočevár and Istenič 2014), Ibrahim, Mustapha, and Mamza (2014), Koka (2013), Malhan and Rao (2007), Muscio and Nardone (2012), and Reichardt et al. (2009). Other messengers were knowledge extensionists, extension service officers, extensionists, and agricultural extension personnel (Alcon et al. 2014; Feng et al. 2009; Feike et al. 2010; Floriańczyk, Janc, and Czapiewski 2012; Hočevár and Istenič 2014; Okocha 1995). Agriculture knowledge brokers were regarded as the messengers in Feng, Duan, and Fu (2007) and Feng, Duan, Mathews, and Fu (2007), experienced agricultural workers (Isoe and Nakatani 2011a, 2011b), technical colleges and local advisors (Feng et al. 2009; Hočevár and Istenič 2014; Reichardt et al. 2009), and agriculture suppliers and vendors (Alcon et al. 2014; Asselin, MacLeod, and Dosman 2009; Floriańczyk, Janc, and Czapiewski 2012). Other messengers included private external operators (Wellens et al. 2013), mass media (Floriańczyk, Janc, and Czapiewski 2012), non-governmental organizations, and private firms (Hočevár and Istenič 2014), agricultural or farmers associations and government agencies (Asselin, MacLeod, and Dosman 2009; Feng et al. 2009), irrigation industry and policy-makers (Alcon et al. 2014), farmers' social networks or professional contacts (Butler, Le Grice, and Reed 2006; Heffernan, Thomson, and Nielsen 2008), agricultural science parks, commercial organizations, farm service organizations, and rural internet bars (Feng, Duan, and Fu 2007; Feng, Duan, Fu, and Mathews 2009; Feng, Li, Duan, and Fu 2010).

The KT process and support system

A range of processes and support systems have been used to translate agriculture knowledge. The use of information and communication technologies, including computer applications, expert systems, multimedia learning programs, and websites, was prominent among the KT support systems reported (Feng, Duan, Matthews, and Fu 2007; Feng, Duan, Fu, and Mathews 2009; Feng, Li, Duan, and Fu 2010; Gaitán-Jurado et al. 2013; Isoe and Nakatani 2011a, 2011b; Lin and Heffernan 2010; Malhan and Rao 2007; Nielsen et al. 2010; Shaalan, Hendam, and Rafea 2012). Next in proximity were planned activities with farmers such as demonstrations (Alcon et al. 2014; Ibrahim, Mustapha, and Mamza 2014; Koka 2013; Reichardt et al. 2009), vocational training programs (Butler, Le Grice, and Reed 2006; Heffernan, Thomson, and Nielsen 2008; Koka 2013; Reichardt et al. 2009), face-to-face seminars, short courses, lectures, meetings, and workshops (Butler, Le Grice, and Reed 2006; Gaitán-Jurado et al. 2013; Hočevár and Istenič 2014; Ibrahim, Mustapha, and Mamza 2014; Koka 2013; Reichardt et al. 2009), experiential peer-to-peer learning and knowledge-sharing activities by farmers (Feng, Duan, and Fu 2007; Floriańczyk, Janc, and Czapiewski 2012; Isoe and Nakatani 2011a, 2011b), group membership (Heffernan, Thomson, and Nielsen 2008), business internships and on-farm research projects (Hočevár and Istenič 2014), counselling services (Koka 2013), radio, television, and teleconferencing (Malhan and Rao 2007), teaching modules (Gaitán-Jurado et al. 2013; Reichardt et al. 2009), information awareness sessions (Wellens et al. 2013), and conferences (Gaitán-Jurado et al. 2013). Only Malhan and Rao (2007) mentioned libraries as a support system for the KT process in agriculture in India. However, publications were another very common system used for translating agriculture knowledge (Gaitán-Jurado et al. 2013; Koka 2013; Malhan and Rao 2007; Okocha 1995; Reichardt et al. 2009; Rivera-Huerta et al. 2011). Types of publications listed as agricultural scientists' preferred media for KT were: brochures, journal articles, edited proceedings, conference papers, extension guides, extension/research bulletins, annual reports, books, monographs, newsletters, and abstracts.

Evaluation

In the study by Alcon et al. (2014), the KT effort led to the adoption of deficit irrigation by farmers to ensure the continuity of irrigation agriculture in the drought-prone Segura River Basin in southeastern Spain and to enhance the resilience of the agricultural sector. Similarly in Spain, Gaitán-Jurado et al. (2013) reported promotion in the modernization of the Andalusia agriculture fisheries and food sector through research, development, technological innovation, and training. The outcome of the KT process in Asselin, MacLeod, and Dosman (2009) bridged the gap between researchers, agricultural producers, and policy-makers, resulting in the uptake of knowledge consistent with the policy objectives of agri-food Canada. Butler, Le Grice, and Reed (2006) reported the improvement in farm business profitability through KT. This is consistent with Feike et al. (2010) who noted optimal use of limited land resources as a

consequence of the KT effort. It was noted that as a result of KT directed at farmers, farmers made full use of space and thus achieved a higher income from their limited land resources. In an experience described by Floriańczyk, Janc, and Czapiewski (2012) in Poland, the KT effort aided the provision of more satisfactory income for the agricultural population and thus the development of rural areas, while Isoe and Nakatani (2011a, 2011b) expressed the fact that novice agricultural workers in Japan learned from experienced agriculture workers and gained individual knowledge. In Albania, Koka (2013) reported the education of agricultural entrepreneurship through KT; likewise poor livestock keepers in Kenya demonstrated a significant increase in knowledge through KT (Nielsen et al. 2010).

Oenema, van Ittersum, and van Keulen (2012) discussed the improvement in nitrogen use efficiency and management on grassland by dairy farmers on milk production farms in Netherland through KT. Reichardt et al. (2009) reported the acceptance and adoption of precision farming into daily practice by farmers in Germany, while Rivera-Huerta et al. (2011) noted the increase in researchers' production of both scientific and technical products as a result of KT. Wellens et al. (2013) disclosed improvements in the land occupation situation, more equitable water distribution, and progress in the management of the Kou valley irrigation scheme in Burkina Faso. Through KT, farmers developed a good awareness of all aspects of the irrigation scheme. This is similar to the study by Ibrahim, Mustapha, and Mamza (2014), where the level of awareness of improved agricultural technologies was reported to be high after KT activities. In England, Smallshire, Robertson, and Thompson (2004) outlined significant progress in translating knowledge gained from farmland bird research into mechanisms that delivered sympathetic farm management, agri-environment schemes, and supported advisory materials and services. This was corroborated by Manning (2013) who noted that one of the main achievements of agricultural extension was effective behaviour change in the target audience. Popescu (2013) also reported that in Romania the consequence of the transfer of agriculture knowledge was an increase in the income and living standards for rural people.

Discussion

The objective of this article was to explore studies that have been carried out with respect to KT in agriculture to determine the focus of these studies, using the Lavis framework for knowledge transfer. Consistent with past studies, this article found that agriculture has wide-ranging global impacts, which extend from economic growth, poverty reduction, food security, livelihood, rural development, and the environment (Waddington et al. 2012). As presented by Floriańczyk, Janc, and Czapiewski (2012), in agriculture, like in many other sectors, knowledge is the most important factor of production, relevant to the creation and utilization of material capital, which stimulates growth in productivity through better utilization of resources.

In Mexico's agricultural sector, Rivera-Huerta et al. (2011) reported that agricultural research is conducted in three types of institutions in Mexico: general universities; sectoral universities; and other local organizations such as technological universities and institutes that also research non-agricultural topics or conduct other types of activities. The institutes were mandated to generate research results that could contribute to poverty alleviation in Mexico. And so it is not surprising that the most popular categories of messengers for the transfer of agriculture knowledge mentioned in the studies reviewed were agriculture researchers or research scientists. Communicating research findings to potential users is often conceived to be the researchers' responsibility, and the role of messenger is often abdicated to the producers of the research knowledge. In addition to the emphasis of researchers as the preferred messengers for the translation of agriculture research knowledge, some studies in this review showed no clear distinction between the messengers for KT and the target audience. This is also another common occurrence in KT studies, whereby the messengers and the target audience are one and the same—people translating knowledge within their professional or practice communities. This is so because persons are able to act in both capacities by virtue of their roles, relationships, and interactions in their communities, such as farmers to farmers or researchers to researchers.

There were a variety of target audiences for the transfer of agriculture knowledge and technologies, demonstrating that agriculture research has the potential to be beneficial to a lot of people. The review showed also that the transfer of agriculture research knowledge has had significant outcomes for farmers and farmer groups. However, very few studies were carried out with a focus on KT to policy-makers. This is noteworthy given the buzz on evidence-informed policy-making being discussed in many disciplines. In addition, it has been put forward that agriculture is the main source of income for many countries (Food and Agriculture Organization 2003), and research in agriculture is the most significant tool for the sustainability of agricultural productivity and economic development (Uganneya, Ape, and Ugbagir 2012). Thus, agriculture research knowledge can enhance policy-making and strengthen the agricultural sectors of countries where agriculture is a major economic activity. Virgona and Daniel (2011) even suggested that, as with health, there is a clear need in agriculture to ensure that research is central in the policy decision-making process.

It was surprising also that only one study mentioned libraries (or librarians) as a support system for the KT process in agriculture. Considering that it has been suggested that librarianship has a long preoccupation with the research-practice gap (Booth 2003), KT is the business of information professionals (Booth 2008), and information professionals have a long history of linking information sources and information users (Booth 2011). Furthermore, Azimi, Fattahi and Asadi-Lari (2015) noted that information professionals play a critical role in organizing and operating major components of KT, such that successful KT requires the collaboration of researchers, practitioners, and information professionals.

Evident from the results of the literature search using the search terms, there were not very many studies indexed in the searched databases pertaining to KT from an agriculture perspective. It was observed, however, that most studies in the review were carried out in the last eight years, and similarities were found in KT studies carried out in particular geographical locations. For instance, many of the studies reported from Asia were trying to implement one expert system application as the KT process and support system for agriculture knowledge.

Conclusions

Studying KT is key to ensuring that the most appropriate strategies are used to communicate suitable research-based evidence to the right target audience through the most appropriate and effective means. In addition to contributing to the evidence base around KT, this review has attempted to re-establish the literature base on KT in agriculture and what has been reported so far concerning KT efforts in agriculture, outlining the findings based on the Lavis framework for knowledge transfer. The findings of this review will be beneficial to researchers in the area of KT as well as to agriculture researchers since it exposes them to various KT mechanisms that have been used in agriculture and the effect they have had in different contexts. It will help suggest areas for improvement. It will also be useful for potential users of agriculture knowledge to learn about strategies to improve opportunities for knowledge uptake to inform practice and policy. In addition, it may be useful for policy-makers in ministries of agriculture, multilateral and bilateral organizations, international donor agencies, and anyone interested in promoting the use of agriculture research knowledge for agriculture policy-making. Library and information professionals may also learn and/or proffer possible ways they can support KT in agriculture, especially for policy-making.

Limitations to the study

The analysis for this review covered the articles indexed using the chosen search terminologies in the databases. Studies indexed in agriculture journals were not missed using the chosen databases; however, academic outputs not included in these databases as well as “grey literature” were not considered. In addition, studies included in the databases, but not indexed with the selected search terms, would have been missed. These included related studies that used alternatives terms such as “extension” and “technology transfer” to describe the process of knowledge transfer. Nevertheless, the choice of search terminologies enabled the analysis to be focused on a manageable number of references. The study’s conclusions are made on the use of the applied terms in the literature concerned with agriculture.

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Notes

- 1 Ontario Ministry of Agriculture, Food and Rural Affairs, <http://www.omafra.gov.on.ca/english/research/ktt/indexktt.html> (accessed 17 February 2015).
- 2 Scopus, <https://www.elsevier.com/solutions/scopus> (accessed 19 February 2015).

References

- Alcon, F., S. Tapsuwan, J. M. Martínez-Paz, R. Brouwer, and M. D. de Miguel. 2014. "Forecasting Deficit Irrigation Adoption Using a Mixed Stakeholder Assessment Methodology." *Technological Forecasting and Social Change* 83:183–193. <http://dx.doi.org/10.1016/j.techfore.2013.07.003>.
- Asselin, J., M. L. P. MacLeod, and J. Dosman. 2009. "National Consultation Leads to Agrivita Research to Practice Plan for Canada." *Journal of Agromedicine* 14 (2): 179–84. <http://dx.doi.org/10.1080/10599240902779477>.
- Azimi, A., R. Fattahi, and M. Asadi-Lari. 2015. "Knowledge Translation Status and Barriers." *Journal of the Medical Library Association* 103 (2): 96–99. <http://dx.doi.org/10.3163/1536-5050.103.2.008>.
- Blake, S. C., and J. M. Ottoson. 2009. "Knowledge Utilization: Implications for Evaluation." *New Directions for Evaluation*, special issue In *Knowledge Utilization, Diffusion, Implementation, Transfer and Translation: Implications for Evaluation*, edited by J.M. Ottoson and P. Hawe 124: 21–34.
- Booth, A. 2003. "Bridging the Research-Practice Gap? The Role of Evidence Based Librarianship." *New Review of Information and Library Research* 9 (1): 3–23. <http://dx.doi.org/10.1080/13614550410001687909>.
- . 2008. "Using Evidence in Practice." *Health Information and Libraries Journal* 25 (3): 233–36. <http://dx.doi.org/10.1111/j.1471-1842.2008.00780.x>.
- . 2011. "Bridging the 'Know-Do Gap': A Role for Health Information Professionals?" *Health Information and Libraries Journal* 28 (4): 331–34. <http://dx.doi.org/10.1111/j.1471-1842.2011.00960.x>.
- Bowen, S. J., and I. D. Graham. 2013. "From Knowledge Translation to Engaged Scholarship: Promoting Research Relevance and Utilization." *Archives of Physical Medicine and Rehabilitation* 94 (1): S3–S8. <http://dx.doi.org/10.1016/j.apmr.2012.04.037>.
- Burnham, J. F. 2006. "Scopus Database: A Review." *Biomedical Digital Libraries* 3 (1). <http://dx.doi.org/10.1186/1742-5581-3-1>.
- Butler, A., P. Le Grice, and M. Reed. 2006. "Delimiting Knowledge Transfer from Training." *Education and Training* 48 (8/9): 627–641. <http://dx.doi.org/10.1108/00400910610710056>.
- Cameron, D., J. N. Lavis, G. E. Guindon, T. Akhtar, F. Becerra Posada, G. D. Ndossi, and the Research to Policy and Practice Study Team. 2010. "Bridging the Gaps among Research, Policy and Practice in Ten Low- and Middle-Income Countries: Development and Testing of a Questionnaire for Researchers." *Health Research Policy and Systems / BioMed Central* 8 (1).
- Canadian Institutes of Health Research. 2008. "Knowledge to Action: A Knowledge Translation Casebook." Ottawa: Canadian Institutes of Health Research.
- Cooper, A., B. Levin, and C. Campbell. 2009. "The Growing (But Still Limited) Importance of Evidence in Education Policy and Practice." *Journal of Educational Change* 10 (2–3): 159–171. <http://dx.doi.org/10.1007/s10833-009-9107-0>.
- Cordero, C., R. Delino, L. Jeyaseelan, M.A. Lansang, J.M. Lozano, S. Kumar, and P. Tugwell. 2008. "Funding Agencies in Low- and Middle-Income Countries: Support for Knowledge Translation." *Bulletin of the World Health Organization* 86 (7): 524–34. <http://dx.doi.org/10.2471/BLT.07.040386>.

- Couturier, J., M. Kimber, S. Jack, A. Niccols, S. van Blyderveen, and G. McVey. 2014. "Using a Knowledge Transfer Framework to Identify Factors Facilitating Implementation of Family-Based Treatment." *International Journal of Eating Disorders* 47 (4): 410–17. <http://dx.doi.org/10.1002/eat.22225>.
- Dobbins, M., S. E. Hanna, D. Ciliska, S. Manske, R. Cameron, S. L. Mercer, and P. Robeson. 2009. "A Randomized Controlled Trial Evaluating the Impact of Knowledge Translation and Exchange Strategies." *Implementation Science* 4 (1).
- El-Jardali, F., J. N. Lavis, N. Ataya, and D. Jamal. 2012. "Use of Health Systems and Policy Research Evidence in the Health Policymaking in Eastern Mediterranean Countries: Views and Practices of Researchers." *Implementation Science* 7 (2).
- Feike, T., Q. Chen, S. Graeff-Hönniger, J. Pfenning, and W. Claupein. 2010. "Farmer-Developed Vegetable Intercropping Systems in Southern Hebei, China." *Renewable Agriculture and Food Systems* 25 (4): 272–80. <http://dx.doi.org/10.1017/S1742170510000293>.
- Feng, W., Y. Duan, and Z. Fu. 2007. "A Case Study of the Role of Agricultural Knowledge Broker." International Conference on Wireless Communications, Networking and Mobile Computing, Shanghai, China, 21–25 September 2007, 5654–57. <http://dx.doi.org/10.1109/WICOM.2007.1387>.
- Feng, W. Z., Y. Q. Duan, B. Mathews, and Z. T. Fu. 2007. "Measuring ICT-Based Agricultural Knowledge Transfer under a Sender Advantage Asymmetric Information Structure." *New Zealand Journal of Agricultural Research* 50 (5): 1307–14. <http://dx.doi.org/10.1080/00288230709510417>.
- Feng, W., Y. Duan, Z. Fu, and B. Mathews. 2009. "Understanding Expert Systems Applications from a Knowledge Transfer Perspective." *Knowledge Management Research and Practice* 7 (2): 131–41. <http://dx.doi.org/10.1057/kmrp.2009.6>.
- Feng, W., D. Li, Y. Duan, and Z. Fu. 2010. "A Survey of Stickiness of Agriculture Knowledge Acquisition in China." *Sensor Letters* 8 (1): 198–202. <http://dx.doi.org/10.1166/sl.2010.1226>.
- Floriańczyk, Z., K. Janc, and K. Czapiewski. 2012. "The Importance and Diffusion of Knowledge in the Agricultural Sector: The Polish Experiences." *Geographia Polonica* 85 (1): 45–56. <http://dx.doi.org/10.7163/GPol.2012.1.4>.
- Food and Agriculture Organization. 2003. *The State of Food Insecurity in the World: Monitoring Progress towards the World Food Summit and Millennium Development Goals*. Rome: Food and Agriculture Organization.
- Gaitán-Jurado, A. J., A. Pedrera-León, K. Vanderlinden, F. J. Jiménez-Crespo, and L. Pérez-Náger. 2013. "The On-Line Agriculture and Fisheries Knowledge Transfer and Consulting Platform of Andalusia, Spain." Proceedings of INTED2013 Conference, 4–6 March 2013, Valencia Spain, 2414–23.
- Graham, I. D., J. Logan, M. B. Harrison, S. E. Straus, J. Tetroe, W. Caswell, and N. Robinson. 2006. "Lost in Knowledge Translation: Time for a Map?" *Journal of Continuing Education in the Health Professions* 26 (1): 13–24. <http://dx.doi.org/10.1002/chp.47>.
- Grant, Maria J., and A. Booth. 2009. "A Typology of Reviews: An Analysis of 14 Review Types and Associated Methodologies." *Health Information and Libraries Journal* 26 (2): 91–108. <http://dx.doi.org/10.1111/j.1471-1842.2009.00848.x>.
- Genuis, S. K. 2007. "Evolving Information in an 'Evidence-Based' World: Theoretical Considerations." *Canadian Journal of Information and Library Science* 31 (3–4): 209–31.
- Gibb, H. 2013. "An Environmental Scan of an Aged Care Workplace Using the PARiHS Model: Assessing Preparedness for Change." *Journal of Nursing Management* 21 (2): 293–303.

- Gozdzik, A. 2013. "Applying the PARiHS Framework in a Knowledge Dissemination Initiative." *CANNT Journal* 23 (2): 48–50.
- Greenhalgh, T., and S. Wieringa. 2011. "Is It Time to Drop the "Knowledge Translation" Metaphor? A Critical Literature Review." *Journal of the Royal Society of Medicine* 104 (12): 501–09. <http://dx.doi.org/10.1258/jrsm.2011.110285>.
- Grimshaw, J. M., M. P. Eccles, J. N. Lavis, S. J. Hill, and J. E. Squires. 2012. "Knowledge Translation of Research Findings." *Implementation Science* 7 (50). <http://dx.doi.org/10.1186/1748-5908-7-50>.
- Guindon, G. E., J. N. Lavis, B. Boupha, G. Shi, M. F. Sidibe, and B. Turdaliyeva, and the Research to Policy and Practice Study Team. 2010. "Bridging the Gaps among Research, Policy and Practice in Ten Low- and Middle-Income Countries: Development and Test of Questionnaire for Health-Care Providers." *Health Research Policy and Systems* 8 (3).
- Heffernan, C., K. Thomson, and L. Nielsen. 2008. "Livestock Vaccine Adoption among Poor Farmers in Bolivia: Remembering Innovation Diffusion Theory." *Vaccine* 26 (19): 2433–42. <http://dx.doi.org/10.1016/j.vaccine.2008.02.045>.
- Helfrich, C. D., L. J. Damschroder, H. J. Hagedorn, G. S. Daggett, A. Sahay, M. Ritchie, T. Damush, M. Guilan, P. M. Ullrich, and C. B. Stetler. 2010. "A Critical Synthesis of Literature on the Promoting Action on Research Implementation in Health Services (PARiHS) Framework." *Implementation Science* 5 (82). doi:10.1186/1748-5908-5-82
- Hočvar, D. K., and M. C. Istenič. 2014. "In Pursuit Of Knowledge-Based Slovenia: Is Knowledge Transfer to Agriculture Stuck in Faculties?" *Anthropological Notebooks* 20 (3): 103–20.
- Huzair, F., A. Borda-Rodriguez, M. Upton, and J. T. Mugwagwa. 2013. "An Interdisciplinary and Development Lens on Knowledge Translation." *Science and Public Policy* 40 (1): 43–50. <http://dx.doi.org/10.1093/scipol/scs119>.
- Ibrahim, A. A., S. B. Mustapha, and B. T. Mamza. 2014. "Assessment of Lake Chad Research Institute "Adopted Schools Scheme" for Dissemination of Improved Agricultural Technologies in Borno State, Nigeria." *International Journal of Research in Agriculture and Food Sciences* 2 (5): 2311–2476
- Isoe, Y., and Y. Nakatani. 2011a. "Agricultural Knowledge Transfer via Talking Planter." SOTICS 2011: The First International Conference on Social Eco-Informatics, Barcelona, Spain, 23–29 October 2011, 14–18.
- . 2011b. "Agricultural Knowledge Transfer Based on Experience from Failures." IADIS International Conference ICT, Society and Human Beings, Rome, Italy, 24–26 July 2011, 263–66.
- Jacobson, Nora. 2007. "Social Epistemology: Theory for the "Fourth Wave" of Knowledge Transfer and Exchange Research." *Science Communication* 29 (1): 116–27. <http://dx.doi.org/10.1177/1075547007305166>.
- Kastner, M., and S. E. Straus. 2012. "Application of the Knowledge-to-Action and Medical Research Council Frameworks in the Development of an Osteoporosis Clinical Decision Support Tool." *Journal of Clinical Epidemiology* 65 (11): 1163–70.
- Kitson, A., G. Harvey, and B. McCormack. 1998. "Enabling the Implementation of Evidence Based Practice: A Conceptual Framework." *Quality in Health Care* 7 (3): 149–58.
- Klerkx, L., M. Schut, C. Leeuwis, and C. Kilelu. 2012. "Advances in Knowledge Brokering in the Agricultural Sector: Towards Innovation System Facilitation." *Institute of Development Studies Bulletin* 43 (5): 53–60. <http://dx.doi.org/10.1111/j.1759-5436.2012.00363.x>.

- Koka, M. 2013. "The Role of Agricultural Education Institutions in Knowledge Transfer on Agriculture Entrepreneurship." *Albanian Journal of Agricultural Sciences* 12 (2): 237–241.
- Kulkarni, A. V., B. Aziz, I. Shams, and J. W. Busse. 2009. "Comparisons of Citations in Web of Science, Scopus, and Google Scholar for Articles Published in General Medical Journals." *Journal of the American Medical Association* 302 (10): 1092–96.
- Lavis, J. N., D. Robertson, J. M. Woodside, C. B. McLeod, and J. Abelson. 2003. "How Can Research Organizations More Effectively Transfer Research Knowledge to Decision Makers?" *Milbank Quarterly* 81 (2): 221–48. <http://dx.doi.org/10.1111/1468-0009.t011-1-00052>.
- Lavis, J. N., G. E. Guindon, D. Cameron, B. Boupha, D. Dejman, E. J. A. Osei, and R. Sadana, and the Research to Policy and Practice Study Team. 2010. "Bridging the Gaps Between Research, Policy and Practice in Low- and Middle-Income Countries: A Survey of Researchers." *Canadian Medical Association Journal* 182 (9): 350–61. <http://dx.doi.org/10.1503/cmaj.081164>.
- Levin, B. 2011. "Mobilising Research Knowledge in Education." *London Review of Education* 9 (1): 15–26. <http://dx.doi.org/10.1080/14748460.2011.550431>.
- Lin, Y., and C. Heffernan. 2010. "Creating the Livestock Guru: ICTs to Enhance Livestock-Related Knowledge among Poor Households in Orissa, India." *Tropical Animal Health and Production* 42 (7): 1353–61. <http://dx.doi.org/10.1007/s11250-010-9592-4>.
- Malhan, I. V., and S. Rao. 2007. "Agricultural Knowledge Transfer in India: A Study of Prevailing Communication Channels." *Library Philosophy and Practice (e-journal)*. Paper 110. <http://digitalcommons.unl.edu/libphilprac/110> (accessed 17 February 2015).
- Manning, L. 2013. "A Knowledge Exchange and Diffusion of Innovation (KEDI) Model for Primary Production." *British Food Journal* 115 (4): 614–31. <http://dx.doi.org/10.1108/00070701311317883>.
- McKibbin, K. A., C. Lokker, N. L. Wilczynski, D. Ciliska, M. Dobbins, D. A. Davis, R. Brian Haynes, and Sharon E. Straus. 2010. "A Cross-Sectional Study of the Number and Frequency of Terms Used to Refer to Knowledge Translation in a Body of Health Literature in 2006: A Tower of Babel?" *Implementation Science* 5 (1): 16. <http://dx.doi.org/10.1186/1748-5908-5-16>.
- Moat, K. A., J. N. Lavis, and J. Abelson. 2013. "How Contexts and Issues Influence the Use of Policy-Relevant Research Syntheses: A Critical Interpretive Synthesis." *Milbank Quarterly* 91 (3): 604–48. <http://dx.doi.org/10.1111/1468-0009.12026>.
- Majdzadeh, R., J. Sadighi, S. Nejat, A. S. Mahani, and J. Gholami. 2008. "Knowledge Translation for Research Utilization: Design of a Knowledge Translation Model at Tehran University of Medical Sciences." *Journal of Continuing Education in the Health Professions* 28 (4): 270–77. <http://dx.doi.org/10.1002/chp.193>.
- Muscio, A., and G. Nardone. 2012. "The Determinants of University-Industry Collaboration in Food Science in Italy." *Food Policy* 37 (6): 710–18. <http://dx.doi.org/10.1016/j.foodpol.2012.07.003>.
- Nielsen, L., C. Heffernan, Y. Lin, and J. Yu. 2010. "The Daktari: An Interactive, Multi-Media Tool for Knowledge Transfer among Poor Livestock Keepers in Kenya." *Computers and Education* 54 (4): 1241–47. <http://dx.doi.org/10.1016/j.compedu.2009.11.010>.
- Nutley, S. M., I. Walter, and H. T. O. Davies. 2007. *Using Evidence: How Research Can Inform Public Services*. Bristol: Policy Press.

- Oborn, E., M. Barrett, and G. Racko. 2010. *Knowledge Translation in Healthcare: A Review of the Literature*, Working Paper Series 5/2010. Cambridge: Cambridge Judge Business School, University of Cambridge.
- Oborn, E., M. Barrett, and G. Racko. 2013. "Knowledge Translation in Healthcare: Incorporating Theories of Learning and Knowledge from the Management Literature." *Journal of Health Organization and Management* 27 (4): 412–431. <http://dx.doi.org/10.1108/JHOM-01-2012-0004>.
- Oenema, J., M. van Ittersum, and H. van Keulen. 2012. "Improving Nitrogen Management on Grassland on Commercial Pilot Dairy Farms in The Netherlands." *Agriculture, Ecosystems and Environment* 162: 116–26. <http://dx.doi.org/10.1016/j.agee.2012.08.012>.
- Okocha, K.F. 1995. "Socio-Cultural Determinants of the Use and Transfer of Scientific Information by Agricultural Scientists in South Eastern Nigeria." *International Information and Library Review* 27 (4): 301–16. <http://dx.doi.org/10.1080/10572317.1995.10762377>.
- Opsahl, Wendy. 2012. "Knowledge Translation Practices of Health Services Research Organizations in the United States." PhD dissertation, Educational Leadership, University of North Dakota.
- Ottoson, J. M. 2009. "Knowledge-for-Action Theories in Evaluation: Knowledge Utilization, Diffusion, Implementation, Transfer, and Translation." *New Directions for Evaluation* 124: 7–20.
- Popescu, G. 2013. "The Market of Knowledge Transfer in Agriculture." *Quality Access to Success* 14 (S3): 125–36.
- Powrie, S. L., D. Danly, C. F. Corbett, J. Purath, and A. Dupler. 2014. "Using Implementation Science to Facilitate Evidence-Based Practice Changes to Promote Optimal Outcomes for Orthopaedic Patients." *Orthopedic Nursing* 33 (2): 109–14. doi:10.1097/NOR.0000000000000036
- Reichardt, M., C. Jürgens, U. Klöble, J. Hüter, and K. Moser. 2009. "Dissemination of Precision Farming in Germany: Acceptance, Adoption, Obstacles, Knowledge Transfer and Training Activities." *Precision Agriculture* 10 (6): 525–45. <http://dx.doi.org/10.1007/s11119-009-9112-6>.
- Rivera-Huerta, R., G. Dutrénit, J. M. Ekboir, J. L. Sampedro, and A. O. Vera-Cruz. 2011. "Do Linkages Between Farmers and Academic Researchers Influence Researcher Productivity? The Mexican Case." *Research Policy* 40 (7): 932–42. <http://dx.doi.org/10.1016/j.respol.2011.05.001>.
- Rogers, E. M. 2003. *Diffusion of Innovations*. 5th edition. New York: Free Press.
- Rycroft-Malone, J. 2004. "The PARIHS Framework—a Framework for Guiding the Implementation of Evidence-Based Practice." *Journal of Nursing Care Quality* 19 (4): 297–304.
- Rycroft-Malone, J., A. Kitson, G. Harvey, B. McCormack, K. Seers, A. Titchen, and C. Estabrooks. 2002. "Ingredients for Change: Revisiting a Conceptual Framework." *Quality and Safety in Health Care* 11 (2): 174–80.
- Shalan, K., A. Hendam, and A. Rafea. 2012. "Rapid Development and Deployment of Bi-Directional Expert Systems Using Machine Translation Technology." *Expert Systems with Applications* 39 (1): 1375–80. <http://dx.doi.org/10.1016/j.eswa.2011.08.019>.
- Smallshire, D., P. Robertson, and P. Thompson. 2004. "Policy into Practice: The Development and Delivery of Agri-Environment Schemes and Supporting Advice in England." *Ibis* 146: 250–58. <http://dx.doi.org/10.1111/j.1474-919X.2004.00367.x>.

- Sudsawad, P. 2007. *Knowledge Translation: Introduction to Models, Strategies, and Measures*. Austin, TX: Southwest Educational Development Laboratory, National Center for the Dissemination of Disability Research. http://ktdrr.org/ktlibrary/articles_pubs/ktmodels/ktintro.pdf (accessed 17 February 2015)
- Townsend, R. F., I. Ceccacci, S. Cooke, M. Constantine, and G. Moses. 2013. *Implementing Agriculture for Development: World Bank Group Agriculture Action Plan (2013–2015)*. World Bank, <http://documents.worldbank.org/curated/en/331761468152719470/Implementing-agriculture-for-development-World-Bank-Group-agriculture-action-plan-2013-2015> (accessed 17 February 2015).
- Uganneya, S., R. Ape, and N. Ugbagir. 2012. "Information Services Provision and User Satisfaction in Agricultural Research Libraries in Nigeria." *International Journal of Library and Information Science* 3 (6): 88–93.
- Virgona, J., and G. Daniel. 2011. "Evidence-based Agriculture: Can We Get There?" *Agricultural Science* 23 (1): 19–25.
- Waddington, H., B. Snilstveit, J. G. Hombrados, M. Vojtkova, J. Anderson, and H. White. 2012. *Farmer Field Schools for Improving Farming Practices and Farmer Outcomes in Low- and Middle-Income Countries: A Systematic Review*. Campbell Collaboration, Oslo, Norway.
- Ward, V., A. House, and S. Hamer. 2009. "Developing a Framework for Transferring Knowledge into Action: A Thematic Analysis of the Literature." *Journal of Health Services Research and Policy* 14 (3): 156–64.
- Wellens, J., M. Nitchou, F. Traore, and B. Tychon. 2013. "A Public-Private Partnership Experience in the Management of an Irrigation Scheme Using Decision-Support Tools in Burkina Faso." *Agricultural Water Management* 116: 1–11. <http://dx.doi.org/10.1016/j.agwat.2012.09.013>.
- World Health Organization 2012. *Knowledge Translation Framework for Ageing and Health*. Geneva: World Health Organization.
- Young, I., K. Gropp, K. Pintar, L. Waddell, B. Marshall, K. Thomas, S. A. McEwen, and A. Rajic. 2014. "Experiences and Attitudes towards Evidence-Informed Policy-Making among Research and Policy Stakeholders in the Canadian Agri-Food Public Health Sector." *Zoonoses and Public Health* 61 (8): 581–89.