DESIGNING CORPORATE TRAINING IN DEVELOPING ECONOMIES USING OPEN EDUCATIONAL RESOURCES

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ABSTRACT

The Food Safety Knowledge Network (FSKN) is a collaboration between Michigan State University, the Global Food Safety Initiative of the Consumer Goods Forum, and other food industry and public sector partners. FSKN's goal is to help strengthen the food industry's response to the complex food safety knowledge and training challenges that affect emerging markets by providing free access to high-quality, standardized learning resources. The resources were designed to be available on demand and as a structured learning experience which can support face-to-face training and fully online training. The pilots thus far have shown that participants in FSKN training demonstrate a significant increase in knowledge. The paper will share the processes used to set up an efficient open educational resources initiative including understanding licensing, using open software, establishing competencies and working with corporate and other international partners.

KEYWORDS

Online Learning, Open Educational Resources, OER, creating partnerships, sustainable business models, innovation, international development, competencies

I. INTRODUCTION

The purpose of this ongoing initiative generously funded by the William and Flora Hewlett Foundation and the United States Agency for International Development (USAID; funding from both the Washington DC office and the USAID India Mission) was to create an international network of people and resources within the food industry to enable and support the development of industry-led Open Educational Resources (OER) to improve basic food safety practices in developing countries. Led by a collaboration between Michigan State University (MSU) and the Global Food Safety Initiative (GFSI) of the Consumer Goods Forum (CGF), an international association of global consumer product (particularly food and beverage) manufacturers and retailers. The resulting Food Safety Knowledge Network (FSKN) is the basis for the creation and provision of high-quality, low-cost training and education around food safety competencies associated for developing countries.

The collaboration between university and industry, development of OER materials, development of a competency-based OER delivery platform, and the piloting of the OER in trainings with pre-and post-training assessment were the major tasks of the ongoing project. Developing materials to support FSKN is similar to other curriculum efforts, but making OER policies, procedures, and licensing understandable to corporate partners required new approaches. The OER technology platform uses open source software including work from Creative Commons in the form of their DiscoverEd search tool to provide content resources organized by topic and competency. The findings and the resulting software code and documentation from this project can serve as a model for other endeavors focused on creating and searching topic-specific OER.

II. BACKGROUND

The history of the term "Open Educational Resources" (OER) is brief, but its foundations reach farther back in innovations including open access journals, learning objects, open source software and open licenses [1]. The term itself was adopted by UNESCO in 2002 [2]. OER refers to the "open provision of educational resources enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes. It includes open content, as well as software tools and standards" [3]. The term includes free (no charge) and open (for modification) resources such as digital content, open source software, and intellectual property licenses. OER takes many forms, including formal courses; course-related materials such as syllabi, lectures, lesson plans, and assignments; textbooks; or collections of digital media such as libraries of images and videos. The principles of OER are founded on the academic traditions of freely and openly sharing and extending knowledge [4]. In this way, OER extends the concept of the public commons, as well as the principles of open source software, into education [5].

Ahrash Bissell, former director of the ccLearn initiative of Creative Commons describes the effort this way: "Open Educational Resources (OER) represents the efforts of a worldwide community, empowered by the Internet, to help equalize the access to knowledge and educational opportunities throughout the world. They are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual-property license that permits their free use or customization by others. It is the granting of freedoms to share, reprint, translate, combine, or adapt that makes them educationally different from those that can merely be read online for free" [6]. The OER leaders at the William and Flora Hewlett Foundation sum it up by stating, "At the heart of the open educational resources movement is the simple and powerful idea that the world's knowledge is a public good" [7].

On a separate front, the global food system has changed dramatically as European and North American supermarkets and their procurement channels have rapidly expanded into emerging markets. Food procurement is now global with over 2/3 of suppliers in developing countries [8]. Due to food scares, consumers

are demanding safe, high-quality food [9]. In response, governments and industry are collaborating to assure quality and food safety consistently around the world [10; 11]. The FSKN came about as a solution to support the GFSI technical working group that is developing systematic protocols for use by potential suppliers in emerging markets to meet the more stringent buyer requirements of CGF member companies. The GFSI working group desired not only to provide the protocols to define and improve supplier competence, but also wished to facilitate training of persons responsible for food safety compliance in support of these supplier protocols.

The Food Safety Knowledge Network was created to meet this need. It needed to support online, face-to-face, and blended training formats in a multitude of languages and contexts. It needed to support group training as well as individual self-paced instruction. It needed to enable new and existing trainers and training organizations to align their training with the supplier protocols as defined by the GFSI working group while enabling localization and maximum flexibility in delivery. At the same time, the solution needed to be as low-cost as possible to enable rapid deployment in developing countries.

The Food Safety Knowledge Network is a private-public partnership initiative to meet these needs. It is focused on enabling local training aligned with the GFSI protocols for suppliers in emerging markets using OER as an enabler. In its current pilot phase it is funded by foundation and federal government grants, in-kind corporate support and in-kind support from an international government organization.

III. PROJECT DESCRIPTION

A. Development of Corporate Requirements and Competencies of Individuals

Prior to the start of Phase I, MSU met with the GFSI Global Markets Working Group and created a subgroup called the FSKN Working Group. The purpose of the FSKN Working Group was to further the goals of the GFSI Global Markets Working Group by guiding the development of training processes, curriculum, and assessment directed at the food safety managers of suppliers in countries whose food safety systems are less developed than those typically in place in North American, Western European, and other developed markets. The GFSI Global Markets Working Group and FSKN effort focused initially on Basic Level Requirements for the Food Manufacturing sector. Ongoing work will focus on Intermediate Level requirements for the food manufacturing sector, as well as Basic and Intermediate Level requirements for primary production of fruit and vegetable products. This manuscript deals with the initial work conducted on Basic Level for food manufacture. To enable a robust and flexible solution for enabling training in developing countries, the components of the FSKN were determined to be competencies (statements of skills, knowledge and behavior), assessments of those competencies and training materials designed to be OER.

Members of the FSKN Working Group were identified by MSU and GFSI and drawn from the corporate members of GFSI as well as international food safety consultants, and representatives from public sector organizations (e.g. universities, UN agencies). The GFSI Global Markets Working Group developed the "Basic Level Requirements for Food Manufacture" document that defines the protocols required of companies preparing to supply CGF member companies who require more stringent food safety compliance in emerging markets. The ultimate goal of the GFSI Global Markets protocols and FSKN is continuous improvement of food suppliers in emerging markets so they can ultimately achieve formal certification against internationally-recognized food safety schemes. Building from the GFSI Global Markets protocols, the FSKN Working Group created competency statements, training modules and assessment instruments for individual employees. Working with its stakeholders at meetings held from December 2008 to March 2009, these two separate working groups co-developed the corporate and individual competencies. Subsequently, the FSKN group also met separately to refine and finalize the initial list of competencies.

The Basic Level for Food Manufacturing protocol finalized by the GFSI Global Markets Working Group encompasses fourteen key areas of company requirements (Figure 1). The Basic Level Requirements represent the first 30 percent of the total company requirements that the GFSI Global Markets Working Group is defining. The remaining requirements are being addressed in the Intermediate Level Requirements (currently under development) and the GFSI Guidance Document. Working from the Basic Level requirements for companies, the FSKN Working Group defined 89 competencies that articulate the knowledge and skill sets an individual food safety manager should have upon completion of training at the Basic Level.

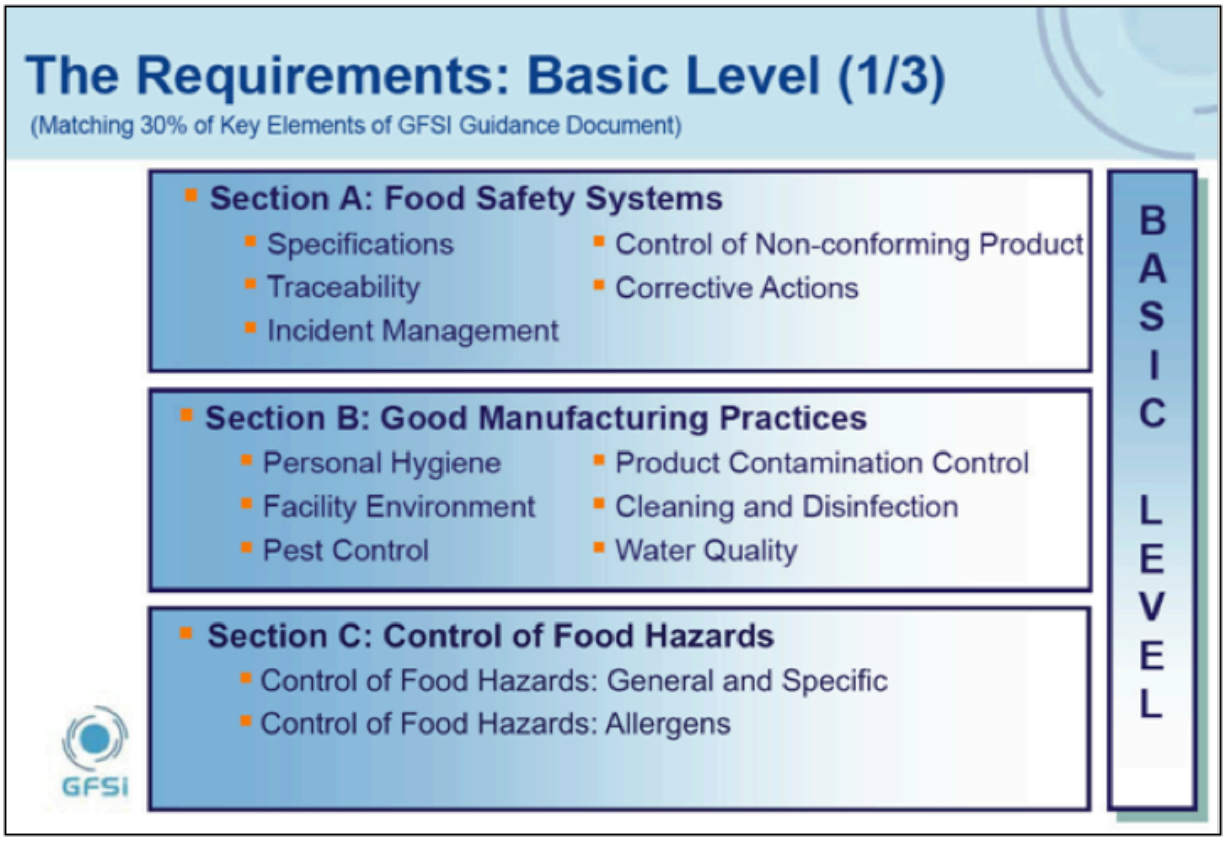

Figure 1. GFSI Basic Level Requirements (Food Manufacturing Scope) for Less Developed Businesses and Small Suppliers

B. Creating Processes for OER Development: The benefits of resources, not course packages

While the FSKN Working Group began creating competencies, MSU began creating instructional documentation and materials to support the development of OER aligned with the competencies. To accomplish the goals of publishing OER, the MSU team designed OER processes and procedures for collecting and creating content. For creating content, it was integral to think strategically about instructional use of materials. This meant moving beyond the concept of a whole course and into the level of individual learning resources. The goal was to enable learning resources to be combined to create a full course for Basic Level for Food Manufacture, or to be used separately if a learner, or trainer, desired to work on only a certain sub-set of competencies.

To create the individual resources at low cost, the MSU team determined that capturing existing trainings would provide the basis for the individual OER. Proprietary capture software Camtasia and Relay were

used to record presenters during training programs. The capture process allowed for four immediate file output types—PowerPoint, Flash video, mp4 and audio mp3. The audio files were immediately transcribed to produce text transcripts. In addition, the PowerPoint slide presentations were made available as PDFs and Open Office documents. Providing a wide variety of file formats, particularly those that are editable using common as well as open non-proprietary software, is an important enabler of OER remixing [12].

The learning resources were first produced in English. Training manuals were also produced. All formats of these resources (except, so far, for the transcripts and training manuals) were translated into Chinese and Arabic by pilot partners. These translated resources were also openly licensed and shared back to the FSKN as OER. In addition, ten stand-alone online learning modules are in review and seven modules have been created from their storyboards in the Connexions OER Repository (http://cnx.org).

C. Identifying existing resources

While capturing presentations was important for providing a base of OER aligned with the competencies, the MSU team also identified existing resources from training providers, universities, and non-governmental organizations. The FSKN pilot team reviewed the potential resources for alignment with the competency framework and agreed on content that could be added to the website. The MSU team prepared a policy document to explain OER and also an FSKN Toolkit document to explain how to contribute content.

D. Platform Development

At MSU, MSUglobal and its internal partner, Virtual University Design and Technology (vuDAT), used open source technology for all aspects of the initiative. This included creating the FSKN web site (http://foodsafetyknowledgenetwork.org), creating an open source tool to map the OER to the competency frameworks, and integrating the open source Creative Commons DiscoverEd search tool to improve the discoverability of FSKN resources. Open source platforms were immediately investigated because we anticipated that solutions we would develop for FSKN would be useful to a much broader audience and we wanted to encourage its use in developing countries.

For content management, many potential options existed. Drupal was chosen because of its large community of developers and extensive list of modules developed for various website features and functionalities. Drupal served as the base to build from for accomplishing the tasks described in the planning phase. Drupal, however, did not provide a competencies database module nor did it provide a method for searching and pulling content to the website.

vuDAT programmers created an open source module that provides a way of creating a competency database and correlating resources to individual competencies. The current website demonstrates only the top level of competencies, but the module was built so that it could go five layers into a hierarchy (Figure 2). This allows for much deeper detail within competencies and eventually a learner could choose only a sub category of a competency to learn. While this level of sophistication is not necessary at this early phase of FSKN development, this will be a useful tool as FSKN grows in volume and complexity.

To improve the discoverability of the resources in the FSKN as it grows, we decided to integrate the Creative Commons' DiscoverEd open source search tool into the competency database. DiscoverEd provides an enhanced search experience for users looking for educational resources by looking for materials from selected curators and displaying valuable metadata on the resources. The competency database only includes competencies while learning resources are culled to match a competency. This required writing code to customize DiscoverEd so it would work with Drupal. It also required that both an RSS feed and Open Architecture Index (OAI) be incorporated. These tools pull with an RSS or OAI standard from our own and

other websites materials to support learning of the competencies. In addition, by adding OAI especially for MSU materials, we have begun an education process which demonstrates the use of OAI for content repositories. If a provider does not want to or cannot implement the OAI standard, they have the option of uploading to a website that does use OAI.

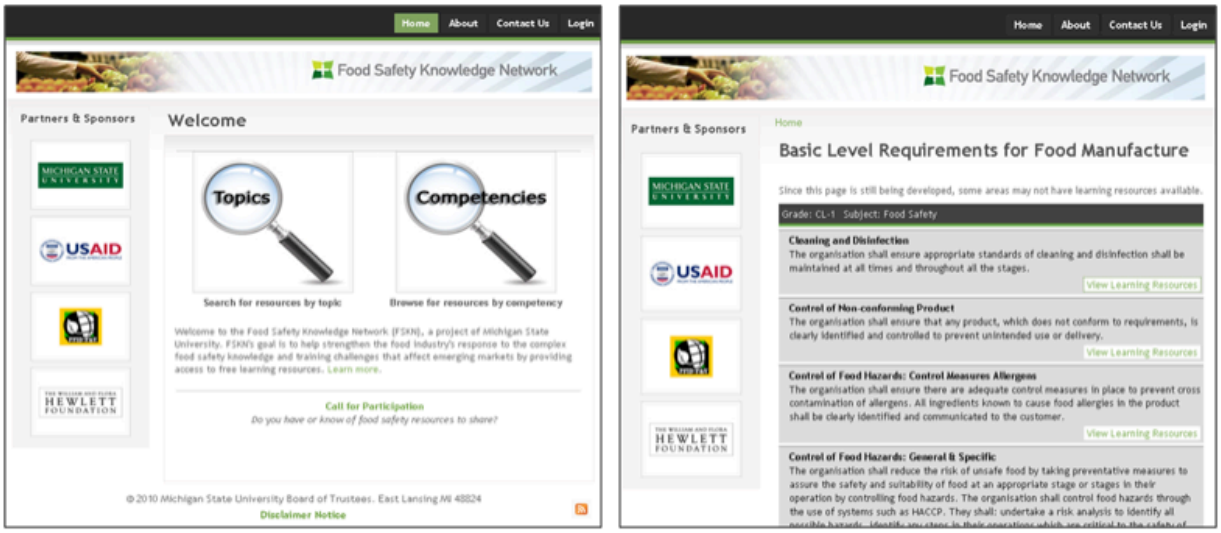

Figure 2. FSKN Home Page and Competency Correlation Page

IV. FINDINGS

From September 2009 to January 2010, the Food Safety Knowledge Network initiative conducted four pilot training programs for the purposes of testing the competency assessment instruments, creating initial OER teaching and learning resources aligned with the competencies, and testing the initial OER platform. Three pilots using face-to-face education were offered in India, Egypt and China in conjunction with industry partners, and a fourth pilot program using eLearning exclusively was conducted with industry partners in India. The pilot programs were the means for creating and capturing resources as OER, using them in different contexts and translating the materials into multiple languages by local partners and contributing them back into the FSKN as OER.

The first pilot was held in September 2009 in Chennai, India as part of a USAID capacity-building effort for food safety managers in food manufacturing facilities and educators and trainers working with this target audience sector. The three day face-to-face workshop had 74 participants from 25 Indian companies and six public sector organizations. Participants completed pre- and post-tests to assess their knowledge of key food safety concepts associated with the competency framework. All workshop presentation materials were published as OER and the workshop itself was captured on video to create additional OER resources.

The second pilot was an online self-paced course using the FSKN platform, offered in India from August 2009 to January 2010. The online training program was conducted in partnership with METRO Cash and Carry for their suppliers to their new stores around the country. The online curriculum used the taped presentations, classroom materials and pre-and post-assessments from the Chennai training which were made available online in a linear format progressing from one competency to the next using a variety of resource formats (i.e., flash video, audio, video for iPod, PDF, etc.). There were 63 participants from 30 METRO Cash and Carry suppliers.

Pilot Three was a "train the trainer" face-to-face training program held in Cairo, Egypt in November 2009.

The training program was conducted in partnership with Macro (the Egyptian subsidiary of METRO Cash and Carry) and the United National Industrial Development Organization (UNIDO) for 36 participants. Macro conducted this pilot as part of its planning to identify suppliers as it opens several large retail operations in Egypt. Eight trainers completed a train-the-trainer session with one subject matter expert. These trainers then taught potential suppliers for Macro. Training materials and pre- and post-assessment instruments were the same as those used for the Chennai training, but were translated into Arabic by UNIDO personnel.

Pilot Four was held in Shanghai, China in December 2009. It was a face-to-face 4-day training program and conference conducted in partnership with the Coca-Cola Company. FSKN training modules and pre- and post-assessments were slightly adapted from those used in Chennai. All materials were translated into Mandarin. In addition to FSKN training materials, the program included topics dealing with pre-harvest food safety for fruits and vegetables, other prerequisite food safety programs, and the ISO 22000 food safety management system. The training program had 142 participants drawn from the Coca-Cola Company (both Chinese and global operations), suppliers to Coca-Cola in China, and sub-suppliers (suppliers of suppliers in China).

The findings of the Pilot phase included results of training, use and re-use of OER, refinement of the assessments, and testing the FSKN platform. The FSKN pilot activities in India, Egypt and China all demonstrated the effectiveness of the training programs to significantly improve participant knowledge regardless of previous educational attainment, previous training, or organization type. Assessment scores improved between the pre-and post-assessments by 6-16% across all pilots. Groups with lower performance on the pre-test tended to show the greatest improvement. Analysis of the results from the testing is continuing in order to learn more about how to improve the training, refine the learning materials and identify key determinants of participant performance. Participants also completed satisfaction surveys at the end of the online pilot experience. There was strong overall support for the value and effectiveness of the online training. Participants rated the PowerPoint and PDF files as most effective followed by an Mpeg4 file for iPods which included audio and video. The majority of participants ranked the quality of learning resources as excellent or good.

As part of the pilots, the original pre- and post-assessment instruments continued to be used in online environments. A total of 264 assessment questions were developed to evaluate knowledge against the 89 competencies in Basic Level for Food Manufacture. These 264 items were randomly allotted to two assessment forms, which then were randomly administered to participants in a manner such that each participant was exposed to all 264 items during the course of a single workshop. The online tools mimicked a similar assessment approach for the eLearning pilot participants. For face-to-face workshops, the questions were assigned by subject matter experts. Only in China, due to restrictions of time, the question set was refined to 140 items (70 per instrument) aligned with all of the competencies. In all cases, statistical analyses demonstrated that the two assessment forms were equivalent with regard to participant performance.

Nearly 90 resources were created as part of the pilots. The multiple file formats in which the OER were created played a significant role in the efficient reuse and remixing of the materials. The editable file formats allowed the resources to be translated and adapted for various audiences. Presentation slides were efficiently localized and translated for specific groups, and videos were bundled with audio to provide Flash videos in both English and Chinese.

V. DISCUSSION

This paper outlines the approach and key lessons learned from the initial development of an international

knowledge network, the Food Safety Knowledge Network. Early on in the project, the FSKN pilot team identified significant differences in the ways international food companies and academic institutions approach training and education, especially with regard to OER. OER is a nascent educational concept within academia as well as in US and international business and government agencies. The FSKN was uniquely placed to introduce the concept to the international community committed to food safety and to educate that community about its benefits and potential to inform and reform training practices and opportunities.

The collaboration between MSU, GFSI and other FSKN partners brought to light the differences in priorities, approach, and challenges such as communication that are unique to an international collaboration among academic institutions, retailers, manufacturers, food service companies, and service providers. While there was a common understanding around the company requirements and the competencies for food safety professionals, there was less agreement around how best to translate these expectations into curriculum resources. The creation of training and instruction is not a primary function of GFSI. Thus, partnership with MSU and other organizations in the FSKN project was beneficial as GFSI launched its Global Markets protocols for less developed businesses. Similarly, although several food industry and public sector organizations routinely conduct training of food professionals, few have the expertise in pedagogy, adult learning, instructional design and assessment that MSU and other academic partners could contribute to the effort. Overall, the FSKN effort represents an ideal collaboration between the private and public sectors to address a key problem – capacity development of food professionals in developing countries.

The corporations involved in the pilot projects (and CGF itself) are bound by certain legal restrictions that academic institutions do not experience and which call into question the nature of OER in this context. For example, the law in several European Union countries holds food companies strictly liable for any illness or injury caused by their products. They are also liable for the work performance of the food professionals they employ. These liability issues, once brought to light, have called into question whether these organizations can fully participate as partners in FSKN to make the curriculum they use 'open' in OER terms, the terms commonly understood by most institutions of higher education in the US that are protected from liability claims associated with the information they provide. The members of the collaboration have continued to work together to find a solution to this issue, since all agree on the need for high quality, effective training and training resources in this field. Currently, the curriculum resources are being made available on the MSU-maintained FSKN website. However, to alleviate concerns about potential legal liability, FSKN partners are able to self-select the extent to which they wish to co-brand FSKN training modules and other materials.

Regarding the OER, many content partners, including corporations, are willing to contribute resources. However, it is very time-consuming to explain OER, secure and create learning materials, and have them reviewed. The process is indeed quite doable but until the project has developed a viral pull, considerable effort is needed to proactively recruit partners and content and implement solutions using the OER.

VI. SUMMARY AND CONCLUSIONS

The FSKN initiative demonstrates the use of OERs within an industry-university-public sector partnership. It demonstrates the flexibility of creating and publishing OER as individual resources, instead of courses, to provide flexibility in learning configurations and re-use. The FSKN also provides a replicable platform using open source tools for content management, mapping to competencies and improved discoverability. This promising approach to OER provides a model for other contexts where collections of resources can be aggregated through content management systems, and search tools, in ways that enable rapid and flexible deployment in multiple contexts [13].

It is noteworthy that the FSKN project has generated a very high level of interest among donor agencies and others working in emerging markets. The immediate next steps for the FSKN project include 1) formal launch of the FSKN website, 2) expansion of FSKN training and localization activities to other regions, 3) in conjunction with the GFSI Global Markets Working Group, expansion of the program to Intermediate Level for Food Manufacturing, and Basic and Intermediate Levels for Primary Production, and 4) implementation of a long-term financial sustainability plan for the FSKN. Work on several of these steps is currently ongoing.

VII. ABOUT THE AUTHORS

Dr. Christine Geith is an Assistant Provost and Executive Director of Michigan State University's MSUglobal, the university's entrepreneurial business unit that works with academic partners across the campus and worldwide to develop online institutes, programs and services. She is responsible for developing strategic frameworks and business models and leading all activities that impact revenue growth. Dr. Geith's publications and research include costs, benchmarks and business models for online and blended learning. Dr. Geith has nearly 20 years of experience in online learning. Prior to joining MSU, Dr. Geith was Executive Director of e-learning and co-director of the Educational Technology Center at Rochester Institute of Technology. Dr. Geith holds an M.B.A. from Rochester Institute of Technology and a Ph.D. from the University of Nebraska-Lincoln.

Karen Vignare currently serves as the Director of the Customer Experience for MSUglobal at Michigan State University. In that role, Karen is responsible for creating online entrepreneurial approaches for extending both non-credit and credit programs at MSU. Besides supervising content creation, she oversees all customer services. She has published research on online learning retention, models, business practices and blended learning. She is an adjunct professor teaching Customer Relationship Management and Marketing on Internet courses. Karen has served as a full-time faculty member at SUNY-Alfred State in the marketing, retail, and computer technology departments. She also served as a vice president and political economist for a Wall Street financial firm. She has an MBA from the University of Rochester's William Simon School of Business and a BS from Frostburg State University in political science and economics. She is doctoral candidate at Nova Southeastern University.

Dr. Deepa Thiagarajan is an Assistant Professor and Director of Global Food Standards and Value Chains in the Institute of International Agriculture and is Director of the USAID-MSU-Indian Horticulture Development Alliance (IHDA) project, which is based at MSU with in-country project staff based in New Delhi and Hyderabad. Currently, Dr. Thiagarajan's global agrifood systems development work focuses on applied research, education and capacity building on food safety issues and market development for agricultural commodities in developing countries. Dr. Thiagarajan also provides leadership to additional international development programs under the general oversight of the Institute of International Agriculture at Michigan State University. Dr. Thiagarajan has BS and MS degrees in Nutrition from the University of Madras and a PhD in Human Nutrition from Michigan State University.

Dr. Leslie Bourquin is a Professor and Food Safety Specialist in the Department of Food Science and Human Nutrition at Michigan State University. He also is a core faculty member in the Center for Advanced Studies in International Development and the Center for Integrative Toxicology at Michigan State University. Dr. Bourquin's research program focuses on the impacts of public and private food safety standards, barriers to their acceptance and effective implementation by the food industry, and the potential impacts of these standards on public health. Dr. Bourquin's outreach and development work focuses on applied research, education and capacity building, and risk communication on food safety issues. Dr. Bourquin com-

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VIII. REFERENCES

1. **Willinsky, J.** The access principle: the case for open access to research and scholarship. Cambridge: MIT Press, 2005.
2. **Albright, P.** Final forum report: Open Educational Resources. 2005. Available online http://www.unesco.org/iiep/eng/focus/opensrc/PDF/OERForumFinalReport.pdf.
3. UNESCO, January 2008. http://www.unesco.org/iiep/eng/focus/opensrc/opensrc_1.htm.
4. OECD. Giving knowledge for free: The emergence of open educational resources. 2007. Available online at http://213.253.134.43/oecd/pdfs/browseit/9607041E.PDF.
5. **Udas, K.** International Perspectives on the Impact of Open Educational Resources and Open Source Software on Education. In Proceedings of Open Education 2007: Localizing and Learning. Logan, UT.
6. **Bissell, A.** Some Guiding Principles for Legal and Technical Interoperability in OER. In Proceedings of Open Education 2007: Localizing and Learning. Logan, UT.
7. **Smith, M.S. & Casserly, C.M.** The Promise of Open Educational Resources. Change 38(5):8-17, 2006.
8. **Reardon, T.** The Supermarket Revolution in Emerging Markets: Implications for the Produce Industry, Produce Marketing Association, December 2007.
9. **Golan, E. & Roberts, T. & Ollinger, M.** Savvy Buyers Spur Food Safety Innovations in Meat Processing, AmberWaves, USDA, 2 (2) (April 2004).
10. **Buzby, J. C.** International Trade and Food Safety: Economic Theory and Case Studies, Agricultural Economic Report No. AER828, 2003, p. 145.
11. **Porter, S.A. & Lister, D. V.** Food Safety: Federal and State Response to the Spinach E. coli Outbreak, CRS Report for Congress (Nov. 2006).
12. OER stories/Open Learn,The Open University http://webcache.googleusercontent.com/search?q=cache:bh_Lvt33zoUJ:oerwiki.iiep-unesco.org/index.php%3Ftitle%3DOER_stories:OpenLearn%252C_The_Open_University+OpenLearn+units+can+be+downloaded+or+taken+away+in+several+formats&cd=6&hl=en&ct=clnk&gl=us&client=firefox-a.
13. **Geith, C. & Vignare, K.** Access to education with online learning and open educational resources: can they close the GAP? Journal of Asynchronous Learning Networks, 12 (1) (February 2008). http://www.distanceandaccesstoeducation.org/contents/JALN_v12n1_Geith.pdf.