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Brazilian university technology transfer to rural areas

Transferência de tecnologia de universidades brasileiras na área rural

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- REVIEW -

ABSTRACT

In agriculture, there is a difference between average yield obtained by farmers and crop potential. There is technology available to increase yields, but not all farmers have access to it and/or use this information. This clearly characterizes an extension and technology transference problem. There are several technology transfer systems, but there is no system to fit all conditions. Therefore, it is necessary to create extension solutions according to local conditions. Another rural extension challenge is efficiency, despite continuous funding reductions. One proposal that has resulted from extension reform worldwide has suggested integration between the public and private sectors. The public universities could play the role of training and updating technical assistance of human resources, which is the one of the main aspects that has limited technology transfer. The objective of this study was to identify approaches to promote technology transfer generated in Brazilian public universities to rural areas through literature review. An experimental approach of technology transfer is presented here where a Brazilian university extension Vice-chancellor incorporates professionals from consolidated research groups according to demand. In this way, public universities take part of their social functions, by integrating teaching, research, and extension.

Key words: *technology diffusion, information transfer, rural extension, universities extension, extension approach.*

RESUMO

Em agricultura, há diferenças entre a produtividade média obtida pelos produtores e o potencial produtivo dos cultivos. Há informação tecnológica disponível para aumentar a produtividade, mas nem todos os produtores têm acesso e/ou usam a informação. Isso caracteriza claramente um problema de extensão e transferência de tecnologia. Há vários sistemas de transferência de tecnologia, mas, como não há sistema que se ajuste a todas as condições, é necessário criar alternativas adequadas às condições de cada local. Outro desafio da extensão rural é ser eficiente, apesar da contínua redução de recursos. Uma proposta advinda das constantes reformas na extensão verificada ao redor do mundo é o trabalho integrado entre a iniciativa privada e o poder público. A universidade pública contribuiria para o treinamento e a atualização dos recursos humanos envolvidos com assistência técnica, apontado como um dos aspectos limitantes na transferência de tecnologia. O objetivo deste estudo foi identificar, por meio de revisão bibliográfica, alternativas de promover a transferência de tecnologias geradas nas universidades públicas brasileiras para a área rural. Assim, é apresentada uma proposta de transferência de tecnologia a ser gerenciada pelas Pró-reitorias de extensão das universidades brasileiras, tendo como base os grupos consolidados de pesquisa, nos quais poderiam ser incorporados outros profissionais de acordo com a necessidade. Dessa forma, a universidade pública recuperaria parte da sua função social, integrando ensino, pesquisa e extensão.

Palavras-chave: *difusão de tecnologia, transferência de informação, extensão rural, extensão em universidades, abordagem de extensão.*

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INTRODUCTION

In agriculture, there is a difference between average yield obtained by farmers and crops potential. According to FAO (2001) improving the management practices would reduce this gap in many countries. In Brazil, PINHEIRO et al. (2001), reported that the available technology permits to achieve rice yield approximately 12tons ha^{-1}, while the average in Rio Grande do Sul in the end of the 1980's and at the 1990's remained around 5tons ha^{-1} (IRGA, 2007). According to PINHEIRO et al. (2001), there is technological information available to help increase rice yield. However few farmers have access to it and/or use this information. This clearly characterizes an extension and technology transference problem. This paper is a literature review; the first part presents rural extension models around the world and the second part presents an alternative approach to rural extension in pubic Brazilian universities.

The information generated by Brazilian research activities takes place through official research institutions that establish their individual priorities. There are few areas that carry out research cooperatively among institutes, universities and private companies. The universities have their research priorities linked to graduate programs that involve more academic pursuits. On the other hand, rapid investment return is a high priority to private companies. As a result, there is a lack of cooperative work which often results in loss of market opportunities. SOUSA et al. (1993) concluded that the lack of communication between researchers of institutions and various users of technology limited the usefulness of research done to initially develop the technology. The interactions between the various users allow for anticipation of future potential needs, identifying new agribusiness opportunities.

However, technology validation is fundamental, not only to producers and technicians, but also to researchers. In some cases, technology adaptations are necessary due differences in climate conditions, soil characteristics, field management methods, farm culture. This is important to feedback into the research system.

In the university tripartite mission, extension has received less resources and attention than teaching and research. Because of this, extension activities need to be organized in order to accomplish the mission. One of the vital aspects of extension is to increase integration among teaching, research and extension inside the academic institutions and among institutions work with teaching, research and extension (LEITE & ROAHAKRISHNA, 2004). Brazilian universities do not have consolidated technology transference programs. It is very important to be conscious that research is not finished when a manuscript is published. In fact, its "life" is just beginning. So, the evidence shows that it is necessary to revise the process.

In this respect, the objective of this study was to identify approaches to promote technology transfer generated in Brazilian public universities to rural areas.

Rural extension systems and technology transfer

Land - Grant system

The Land - Grant system in the United States is a unique system because extension is linked to research and teaching within the same institution. In this system, the extension specialist is important in linking researchers to county agents.

So, the extension specialist is responsible for transferring new technologies to the county extension agents or directly to producers. In this work, new research areas and suitable technologies are identified and fed back into the system. The Land - Grant extension system has high costs and a large organization structure. However, the efficiency of technology transfer depends on the dynamics of the human resources involved in the process, producer motivation and commitment to research to solve the problem (MARCHESAN, 2007).

Farm Field School

The Farm Field School is an adult education program based on the concept of group practice learning. For example, the participants periodically examine the crop field from sowing to harvest and apply the management practices that the group concluded are best. The process is supervised by a trained facilitator and continues in future meetings, where the group evaluates the earlier decisions and makes further observations. It is a participatory method called "doing learning". ROLLA et al. (2002), described the methodological procedures, emphasizing that the technology generated restricted basically to conditions where it was developed and has little dissemination of informal knowledge because it is difficult to transfer decision skills, which is one of the main aspects developed when employing the Farm Field School System. According to DAVIS (2006), this system is being intensely adopted in African Countries but still has little data available referring to effectiveness or sustainability.

Training & Visiting system

Training & Visiting (T&V) was used in many developing countries from 1975 to 1998, especially in Africa and Asia with the objective of helping increase the adoption of Green Revolution technologies. It was a rigorous training program demanding discipline and leadership. According to ANDERSON et al. (2006), the system was called "top down" technologies, without interaction with the community where it was implemented.

However, when the subvention from the World Bank had run out of funds, communities did not have funding to continue. Consequently, the program was ended due to poor program evaluation and little evidence of gains that could accredited of the extension service. In Brazil, in the late 1990s, EMBRAPA (2007), started using the T&V System, adapted to the Brazilian conditions, and it has been used in some Brazilian states. This is a method that has been changed when related to its original concept, especially regarding working structure and costs. It is been used in cooperation between public and private institutions to train technicians for work in the extension service.

Farmer to Farmer

This program is used by the United States Agency of International Development (USAID) in many countries. The program provides voluntary technical assistance to farmers, farmer groups and agribusinesses that are involved in food processing, marketing, and other agricultural issues. The program relies on expertise volunteer work for three-four-week periods.

However, projects can extend for years with different volunteers. Even with the volunteers, the cost of the project was high because of logistics of getting people from one location to another (USAID, 2007).

The China rural extension system

The China rural extension system (also known as Village Leader) underwent several reforms (USDA, 2007) and presently operates through technical contracts between technicians and users. The villages consist of a group of families and the village leaders are people that have legal power to allocate land use within the village. Beginning in the 1980s, it was necessary to reform rural extension to incorporate research and extension technologies.

Later, farmers were charged to pay for extension services through technical contracts. In a third reform, the government incorporated other business sectors in the financing of extension activities that included farmer's associations and companies were termed an Extension Cooperative. According to MEI (2005), the Chinese system presents deficiencies in the financial system and excessive administrative interventions in the extension sector. Although having experienced continuous transformations, SHEN & JONES (2005) said that the ineffectiveness of the reforms of this system is linked to deficiencies in rural education. Seeking to adjust the economy to a global scale, China enacted the first law that protected private property on March 16, 2007, one problem that has limited agricultural development (NEW YORK TIMES, 2007).

Contract Production system

The Contract Production system has several variants of use. Contracts can be created among industries, suppliers, cooperatives, financial institutions and farmers or between assistant technicians and farmers. Actually, it is not a specific technology transfer system, but it is a way for farmers to use a certain technology level through contract. It is a system used between some private companies and farmers and has been proposed in the new extension vision involving partnership between private and public entities within several countries around the world.

Other extension systems

The extension systems Ricecheck, used in Australia (RICECHECK RECOMMENDATIONS, 2009), Project 10 used in Rio Grande do Sul, (RS) (IRGA, 2005), Farmer to Farmer-CFC, that just finished activities in RS, (PULVER & CARMONA, 2005), and Marca Project, proposed to use in RS also (EMBRAPA, 2004), are all related to rice cropping system. These systems are based on the use of key technologies presented in technical recommendations. Demonstration plots are installed in farmer properties so other farmers can see results of applied technologies. The Ricecheck system is characterized by rigorous mentorship, notes, remarks and evolution analysis of rice. After harvest, data are discussed in groups.

Technical recommendations are updated and communicated to farmers to use in the next cropping year. In this system, the cooperation between the extension agent and farmer is imperative. In RS, the Project 10 and the Farmer to Farmer-CFC, follow similar methodology used in the Ricecheck system in general. These systems are characterized by the use of key technology, plot demonstrations, farmer and technician training, and prominent farmers working with rice specialists.

In summary, extension systems or technology transfers that involve high costs without private entity participation and no rigorous evaluation system have little chance of success. According to RIVERA (2001), agricultural extension involves several approaches and there is no system that is best for all situations.

Extension reforms

Presently, extension has been globally challenged to be efficient with diminishing funds. According to RIVERA (2001), countries have tried to reduce their extension expenses through changing strategies that include decentralization or privatization. But RIVERA (2000) said there is a frontier not well delimited between decentralization and privatization, concluding that it is necessary that both, the public and private sectors participate and evaluate results of activities that are pursued.

According to CHAPMAN & TRIPP (2003), some reforms were motivated by cost reductions and the lack of technical training in public extension services. The demand for new areas such as trade, finance and marketing make it clear that reform is necessary. To integrate public and private sectors, it is necessary that professionals receive continuous training (RIVERA 2000). This could be one of the attributes of the public universities, similar to what occurs in the Land Grant system of the USA (MARCHESAN, 2007). Today, after transferring agricultural extension responsibility to the private sector, RIVERA (2000) and CHAPMAN & TRIP (2003) reaffirmed the importance of the public and private sectors working together, but that the challenge is to find the balance between their participation.

In public universities, however, it is necessary to create an extension system adapted to their reality. Among other aspects, we must consider that the researcher and staff are involved in teaching and research activities. Currently these other activities take priority and few experiences in agricultural technology transference are available.

MARCHESAN (2007) reported that an experimental approach needs to be validated and the research groups need to be relied upon for this validation. According to DAVIS (2006), there is no extension approach that can fit all situations and it is necessary to create specific solutions according to local problems.

Approach contextualization

Although in universities, extension cannot be considered separated from teaching and research, yet there are no mechanisms that permit extension to play a role by itself. To participate in graduate programs, it is necessary to have high levels of academic structure and scientific output, as well as to be successful in fundraising. There are institutions that support these activities that are well accepted by the scientific and academic community, while having an effective evaluation system for career progression. In this case, research and teaching complement each other, because the research qualifies the teaching and the student body is a fundamental part of the scientific output of the universities.

Extension does not have similar compliments, unless research is available for this supportive role supported at the financial level for transfer of the technology and information generated from such activities. Without incentives, many of the items detected in extension diagnostic in Brazilian universities (UFSM, 2007) will continue without any solution.

As result of this imbalance among teaching, research and extension, the social function of the universities in Brazil is losing opportunities to enhance teaching and research activities.

But, the question is how to implement an action plan for Brazilian agricultural systems. An approach is presented below (Figure 1), relying on consolidated research groups within the Brazilian university system.

Approach presentation

This is an experimental approach at the university level, just while there is no National extension plan in Brazil. It would be structured and financially supported by federal institutions.

The university, through the vice-chancellor, would be the manager, linking university and community organizations. The first task is to contact leaders in the university and external university, in order to present this approach and collect suggestions. After analyzing and making adaptations, the vice-chancellor staff would return to the potentially involved public sector. They would present the approach, make corrections if necessary, and start the motivational phase. Marketing is necessary to let the community know that it is starting this extension activity.

This approach represents a two-way communication, because proposals could be done by different entities of the universities or by different segments of the community. So, the colleges, departments, faculties and research groups may suggest extension and/or technology

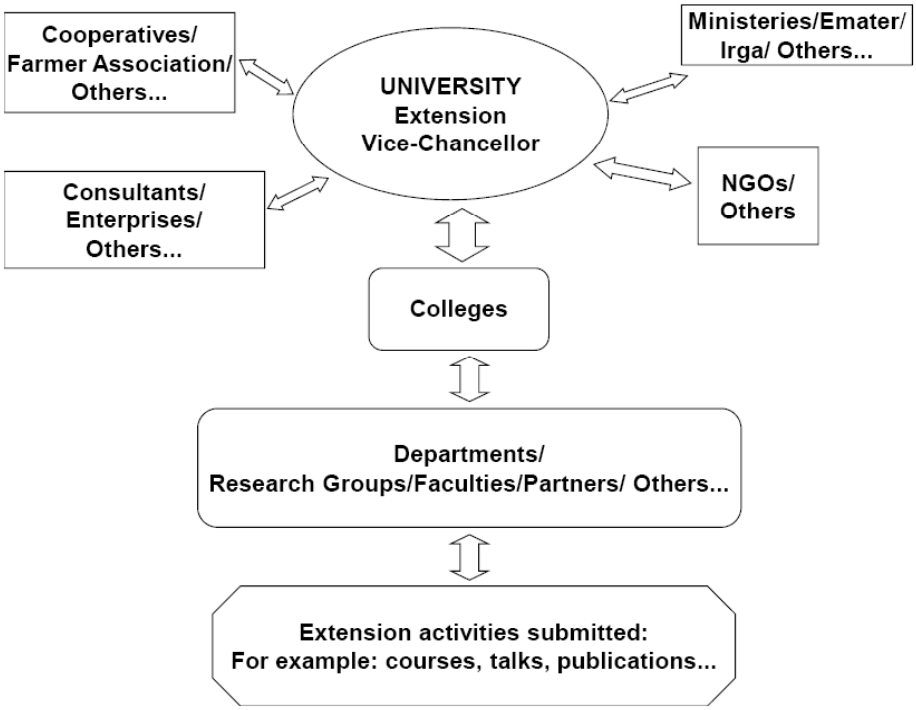

Figure 1 - Experimental approach to transfer research information in a Brazilian public university system.

transfer activities. On the other hand, different public or private enterprises such as farmers, farmer groups or consultants can ask for extension activities such as courses, presentations and published materials.

Afterwards, the vice-chancellor identifies and composes a qualified team to answer the questions, address problems and then negotiate financial payment of services. The university would provide assistance to faculty to prepare material in an adequate way to extension publications as well as webpage creation and maintenance.

Finally, the university could develop and use an efficient assessment method regarding the results and impact of extension activities.

A system of technology transfer adapted starting in a small research group of a public university is proposed to acquire experience and make adaptations. These groups constitute a fundamental part where other professionals could be invited according to specialization so as to include necessary diversity of ideas.

This suggestion is based in studies and observations carried out during a postdoctoral study program and present context of public Brazilian universities. It is a proposition focusing agricultural extension or technology transfer.

CONCLUSIONS

There is no a national extension plan in the Brazilian public universities, although they could play the role of training and updating technical assistance of human resources, which is one of the main aspects that have limited technology transfer.

The involvement of the universities in rural extension is important because it validates research information, qualifies teaching and gives feedback to research, but it is necessary to give incentives to the scientists in order to get them involved in this activity.

Therefore, an experimental extension approach for Brazilian universities is proposed as a conclusion to this study.

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REFERENCES

ANDERSON, J.R. et al. The rise and fall of training and visit extension: an Asian mini-drama with an African epilogue. **World Bank Policy Research Working Paper** n. 3928, 2006. Available from: <http://econ.worldbank.org/external/default/main?pagePK=64165259 &piPK=64165421&theSitePK=469372&menuPK=64216926&entityID=000016406_20060519144915>. Accessed: Jun. 10, 2007.

CHAPMAN, R.; TRIPP, R. Changing incentives for agricultural extension - A review of privatized extension in practice. **Agren**, n.132, 16p, 2003. Available from: <http://www.odi.org.uk/resources/details.asp?id=4266&title=advantages-privatised-extension>. Accessed: May, 5, 2007.

DAVIS, K. Farmer field schools: A boom or bust for extension in Africa. **Journal of International Agricultural and Extension Education**. v.13, n.1, p 91-97. 2006. Available from: <http://www.aiaee.org/attachments/151_Davis-Vol-13.1-10.pdf>. Accessed: Jul. 12, 2007.

EMBRAPA. **Manejo racional da cultura do arroz irrigado, "Programa Marca".** Pelotas, 2004. 203p.

EMBRAPA. **Manual de implantação do treino e visita (T&V).** Londrina: Embrapa Soja. Available from: <http://www.cnpso.embrapa.br/tev/mostra_tv.php?pagina=1>. Accessed: Oct. 01, 2007.

FAO. Yield gap and productivity decline in rice production. International Rice Commission. **Proceedings...** Rome, 2001. 465p.

IRGA. **Dados de safra,** Porto Alegre. Available from: http://www.irga.rs.gov.br/arquivos/20060626143337.pdf. Accessed: Oct. 03, 2007.

IRGA. **Projeto 10-RS.** Manual de Procedimentos, Porto Alegre. Available from: <www.irga.**rs**.gov.br/arquivos/**manualprojeto**alta.pdf>. Accessed: Dec. 15, 2006.

LEITE, F.C.T.; RADHAKRISHNA, R.B. Profile of agriculture education and extension: challenges from a changing Brazilian rural milieu. **Journal of International Agricultural and Extension Education**, v.11, n.3, p.13-21, 2004. Available from: <http://www.aiaee.org/vol-113-fall-04.html>. Accessed: May. 15, 2007.

MARCHESAN, E. **Caracterização de sistemas de transferência de tecnologia em arroz, visando melhorar o sistema de extensão em Universidades Brasileiras.** 2007. 160f. Relatório de Pós Doutorado na Universidade da Texas A & M.

MEI, L. A case study of Chinese agro-technical extension system. **Acta Agriculture Slovenica**, v.85, n.2, p.429-44, 2005. Available from: http://aas.bf.uni-lj.si/oktober2005/25linhai.pdf. Accessed: Jun. 17, 2007.

NEW YORK TIMES. **China backs property law, buoying middle class.** New York Times Digital, New York, on March 16th, 2007. Available from: <http://www.nytimes.com/2007/03/16/world/asia/16china.html?ex=1331697600&en=6284ab99568d916f&ei=5088.Online>. Accessed: Oct. 11, 2007.

PINHEIRO, B. da S. et al. Yield gap in irrigated rice production in Brazil. In: **Yield gap and productivity decline in rice production**. International Rice Commission, Proceedings... Rome: FAO, 2001. p.227-246.

PULVER, E.; CARMONA, L. Technology transfer of high yield production technologies for irrigated rice. Results of the farmer to farmer extension system in Rio Grande do Sul, Brazil. **Annual Report,** July 2004-July 2005. October 2005.

RICECHECK. **Rice check recommendations**. Australia. Available from: <http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/178171/Ricecheck-recommendations-2009.pdf>. Accessed: Ago. 10, 2010.

RIVERA, W.M. **Agricultural and rural extension worldwide: options for institutional reform in the developing countries**. Extension, Education and Communication Service. FAO, Rome, 51p. Available from: <ftp://ftp.fao.org/docrep/fao/004/y2709e/y2709e.pdf>. Accessed: Mar. 20, 2007.

RIVERA, W.M. **The invisible frontier: the current limits of decentralization and privatization in developing countries**. Available from: <http://ifsa.boku.ac.at/cms/fileadmin/Proceeding2002/2002_WS05_17_rivera.pdf>. Accessed: Mar. 12, 2007.

ROLA, A.C. et al. Do farmer field school graduates retain and share what they learn? An investigation in iloilo, Phillipines. **Journal of International Agricultural and Extension Education,** v.9, n.1, p.65-76, 2002. Available from: http://<www.aiaee.org/vol-91-spring-02/256-do-farmer-field-school-graduates-retain-and-share-what-they-learn-an-investigation-in-iloilo-philippines.html>. Accessed: Jun. 13, 2007.