

**AFBI** *Alliance For Food &  
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Final Report

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**Innovation and Producer Decision Making: Why  
Farmers Appear to Underinvest in Agricultural R&D**

By

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February, 2015

# Innovation and Producer Decision Making: Why Farmers Appear to Underinvest in Agricultural R&D

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**Ph.D. Thesis Title:** Decisions of Producer-funded Agricultural Research and Development<sup>1</sup>

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## RESEARCH ABSTRACT

Agricultural research and development (R&D) investment is becoming an increasingly important policy issue as food prices push upwards and food security problems emerge (Alston et al., 2009). An important source of agricultural R&D funding is from producer check-offs, which are increasingly being used to fund applied agricultural research such as disease management, genetic improvement, and weed control. Existing studies of producer-funded agricultural R&D indicate that there are high private and social rates of return to agricultural R&D investment by farmers, and thus that farmers are under investing in R&D.

The focus of this AFBI project is at the producer level. Zhihua Xiao, a PhD student in the department of Bioresource Policy, Business and Economics at the University of Saskatchewan, has been carrying out the research on this project. Her supervisor is Professor Murray Fulton. Dr. Xiao finished this project and received her PhD degree in August 2014.

The objective of this study is to examine one of the factors -- the horizon problem -- behind the apparent disincentive for farmers to invest in producer-funded R&D activities. It has been argued that given the long period of time over which the benefits of R&D investment occur, the increasing age of the farm population implies that the horizon problem could be indeed an important factor in producer underinvestment. Contrary to this widely acknowledged argument, this study shows the horizon problem is likely not a factor affecting farmers R&D investment decisions.

Two models are developed to examine the horizon problem. The first model consists of a framework for determining the marginal internal rate of return of investing in R&D. Specifically, the analysis compares the internal rate of return  $IRR_h$  associated with the farmers' planning horizon with the internal rate of return  $IRR_{bar}$  associated with the benefit horizon of the R&D. The impact of the horizon problem is determined by examining the difference between  $IRR_h$  and  $IRR_{bar}$ . In this analysis the farmers are assumed to be located in a small country -- i.e., a country whose collective output has no impact on world price -- and produce a single product.

<sup>1</sup> Available at <http://ecommons.usask.ca/handle/10388/ETD-2014-08-1717>

The results of the horizon problem model show how that, contrary to what some authors have argued, the horizon problem is likely not a disincentive for R&D investment, unless the time horizon of farmers is very short. Given that the membership horizon for the average Canadian producer is 15 to 20 years, it is expected that the horizon problem is not an issue for Canadian producers. Furthermore, the analysis assumes farmers only are concerned with profit maximization. However, farmers may also consider other factors when making R&D investment decisions, such as future generations of agricultural producers and environment issues. The results of this study show that, even under the assumption of profit maximization, the horizon problem is not an issue for Canadian farmers, let alone in a more realistic model implemented by including factors other than profit. The results of the horizon problem model also show that the impact of the horizon problem is not affected by land tenure relationships.

In the second model, the assumption of a single-product small-country exporter is relaxed. The model consists of a multi-region, multi-product trade model that is used to examine the impact of Canadian pea R&D funding on consumers and producers in Canada and in various countries around the world that produce and consume pulses. To address the underinvestment issue, it is important to understand the question of who benefits from the research that is undertaken, and who bears the cost. Given that Canada is the largest pea exporter in the world an increase in R&D investment can be expected to have a significant impact on international trade and overseas producers and consumers. Given this impact, there is a need to develop a model of a large-country exporter. In addition, since R&D in the pulse industry affects the profitability of growing other crops such as canola and wheat, it is necessary to consider the multi-product case.

The model considers the lags that occur between R&D investment and increases in the research benefits. It explicitly specifies the linkage among the check-off ratio, the R&D investment, and the knowledge stock. This dynamic framework allows the calculation of the internal rate of return to Canadian producer-funded R&D and a re-examination of the horizon problem in the case of the multi-product large-country exporter. The model also fills a gap in our understanding of the manner in which the nature of the supply shifts affects R&D returns. This study examines the empirically relevant case where a pivotal supply shift generates the R&D cost and a parallel supply shift generates the R&D benefits. Contrary to what some authors find, the incentives to invest are not the same in the large country exporter case and in the small country exporter case, a situation that is particularly important for the Canadian pulse industry.

The simulation results from the second model illustrate that with increased pea R&D investment, Canadian producers, as well as consumers in all regions, are better off as a result of the R&D investment, while overseas producers are worse off.

The results of the sensitivity analysis indicate that the IRR to Canadian producers depends critically on how large an impact pea R&D has on the production of other crops (e.g., wheat and canola). The larger is this impact -- i.e., the more that wheat and canola production falls as a result of higher yields/lower costs of pea production -- the smaller is the IRR. The results also indicate that the elasticities of demand for peas and lentils in the importing countries do not have an impact on the IRR in the case where Canada is a large country exporter for peas only; however, they do have an impact on IRR in the case where Canada is a large exporter for both peas and lentils. In all cases, the more elastic is the demand, the higher is the IRR.

## RESEARCH OUTPUT

- Xiao, Z., (2014): Decisions of Producer-funded Agricultural Research and Development. PhD Thesis. University of Saskatchewan
- Xiao, Z., (2014): Measuring Economic Impacts of Canadian Producer-Funded R&D. **Third place** poster competition at the Fourth Annual Canadian Agri-Food Policy Conference, Canada; Ottawa; January 29 - 31, 2014.
- Xiao, Z., (2014): Welfare Allocation of Canadian Producer-Funded R&D. Paper Presented at the Department of Bioresource Policy, Business & Economics, University of Saskatchewan, Canada; Saskatoon; January 10, 2014.
- Xiao, Z., (2013): National and Global Impact of Canadian Producer-Funded Research and Development. Selected presentation at the Agricultural and Applied Economics Association (AAEA) and the Canadian Agricultural Economics Society (CAES) Joint Annual Meeting, United States; Washington DC; August 4-6, 2013.
- Xiao, Z., Fulton, M.E., (2012): Farmers Decisions on Agricultural R&D. Paper Presented at the Department of Bioresource Policy, Business & Economics, University of Saskatchewan, Canada; Saskatoon; November 2, 2012.
- Xiao, Z., Fulton, M.E., (2012): Why Do Farmers Under-Invest In Agricultural R&D? Selected paper presented at the Canadian Agricultural Economics Society (CAES) Annual Meeting, Canada; Niagara Falls; June 17-19, 2012.