



Factors affecting adoption of economic management practices in beef cattle production in Rio Grande do Sul state, Brazil



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ARTICLE INFO

Article history:

Received 9 February 2015

Received in revised form

7 September 2015

Accepted 13 September 2015

Available online xxx

Keywords:

Rural development

Administration

Diffusion

Innovation

Technology

Livestock

ABSTRACT

Beef cattle production in the Rio Grande do Sul State, Brazil, faces serious challenges due to low profitability and competition for alternative land uses. Despite this, many farmers have not yet adopted economic management practices as a support tool to enhance the competitiveness of their farms, due to differences related to lifestyle, values, customs, traditions and personal goals. We interviewed 73 farmers in order to understand the factors affecting the adoption of such practices. A probit model was estimated to identify farmers' characteristics, access to information, and production and economic characteristics that affect the adoption of economic management practices. Farmers with large landholdings and diversified production are less likely to adopt such practices. On the other hand, a number of factors, such as Internet access, participation in farmer associations, receiving technical assistance, number of cows bred annually, weaning rate greater than 70%, and utilization of the birth to slaughter system, positively affect the probability of adoption. Considering that few workshops and training programs on farm management are offered to farmers, the information presented in this study might be useful to motivate the development of extension programs, which take into account farmers' characteristics and, thus, achieve better results in terms of dissemination of economic management techniques.

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1. Introduction

Brazil is one of the world's largest beef-exporting countries and has the largest commercial cattle herd in the world, with 212.8 million head (IBGE, 2012). However, the offtake rate, defined as the proportion of animals sold or consumed in a year in Brazilian beef production, is approximately 20% lower than those of other competing countries, such as Australia (41%) and the United States (37%) (Meister and Moura, 2007; ABIEC, 2014). While Brazil has achieved a prominent position in the international beef trade (Dill et al., 2013), the situation of individual farmers seems to have followed an opposite trajectory, due to the transfer of income within the value chain. Farmers have little or no bargaining power and the price they receive for their product is more heavily influenced by links in the supply chain that are closer to the consumer (processing and retailing) (Dill et al., 2014). Therefore, the alternative

for farmers is to improve their technological capacity and management to maintain or increase their profit (Udo et al., 2011). The adoption of economic management practices has a crucial role to play in that respect when optimizing the production process from an economic perspective, for example, by monitoring the net benefits of keeping calves one extra week on the farm.

Given the climatic diversity through Brazil, different cattle production systems can be identified in different regions. For instance, in the southeast, west central, north and northeast regions the most important cattle breeds are originally from *Bos indicus*, especially the Nelore breed. On the other hand, in the south of Brazil, specifically in the state of Rio Grande do Sul (RS), the subtropical weather is favorable to British cattle breeds, grazed on natural grassland area and winter pasture.

The RS is the sixth largest producer of cattle among the 27 states in Brazil (IBGE, 2012) and Hereford and Braford are among the most widespread breeds in the state, due to their adaptability, rapid weight gain and meat quality. However, cattle production in RS has been losing acreage to other agricultural activities, such as forestry

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and crop production, especially soybeans. The low profitability of beef cattle production in RS (ANUALPEC, 2013) has led farmers to adopt new technologies, such as improving the herd's genetics in order to add value to their product and expand to new markets. However, many farmers have not yet adopted economic management practices on the farm, something that tends to reduce profitability or increase the risks involved in the production activity.

Increased expenditures and market requirements have made low-productivity and low-quality beef cattle farming economically unviable. Little is known about new strategies that can help farmers overcome the difficulties imposed by the current situation (Canellas et al., 2010) and there has been minimal research about technology adoption in beef cattle production (Ward et al., 2008), especially with regard to the adoption of economic management practices. Given the aforementioned challenges, economic management practices could help farmers become more efficient and profitable, reducing uncertainties in an increasingly competitive market (Oaigen et al., 2008; Lampert et al., 2012). Annual planning, cash flow statements and calculation of annual profitability are examples of economic management practices which can help farmers identify key production bottlenecks, allowing actions to improve the production system.

To encourage rational and methodical economic and financial management at the farm level, extension services should prioritize the diffusion of techniques for planning and controlling of financial assets (Lourenzani, 2006), while considering the factors that influence the decision making process of farmers (Feder et al., 1985; Rogers, 2003; Borges et al., 2014). These factors could stem from socioeconomic, production-related, institutional, or organizational characteristics (Abadi Ghadim and Pannell, 1999; Mafimisebi et al., 2006; Souza Filho et al., 2011).

In light of this, the objective of this study is to identify factors that influence the adoption of economic management practices by farmers in RS and in particular of farmers who use the most popular Hereford and Braford breeds. Extension services in Brazil, provided by the government, are important for the diffusion of new technologies to cattle farmers. Therefore, an understanding of the factors that influence farmers' decisions could help policy makers and extension agents to define policy initiatives to stimulate the adoption and diffusion of economic management practices. According to Rogers (2003) and Mafimisebi et al. (2006), the knowledge of these distinct factors can be used to direct communication strategies and formulate extension programs that aim to diffuse management techniques for specific groups of farmers, with the purpose of maximizing profitability and minimizing production risks.

This paper contributes to the existing literature on farmers' decisions by demonstrating how farmer characteristics, in particular access to information, technical and economic characteristics, influence the decision to adopt economic management practices. It also describes the experimental design and presents a framework for understanding the adoption of an innovation.

2. Theoretical framework and relevant drivers of adoption of innovation

2.1. Adoption of innovation and the importance of economic management practices in livestock

The expected utility theory (EUT) is the most widely used conceptual framework for analyzing the adoption of innovations (Feder et al., 1985). This framework presupposes that decision makers are risk-averse (von Neumann and Morgenstern, 1947) and that the farmer's objective is to increase the expected utility of profit (Marra et al., 2003). The individuals' set of the alternatives available to

them when considering the adoption of an innovation expresses their preferences in terms of utility associated with the possible outcomes and their probabilities of occurrence (Lazzarotto et al., 2010; Valvekar et al., 2011). If the utility function is convex, the decision involves trading-off expected returns and lower variability of returns.

In this context, it is evident that the individual is the starting point for analyzing technology adoption, as it is the entity that will decide on the actions to be performed at any given moment. According to Dziuk and Bellows (1983), the decisions in an animal production system can be understood as the sum of the actions made by a farmer, which then becomes the focal point for the success or failure of a farm. In beef cattle production, technologies are indispensable factors to increase income. Such a focus is applied to any purpose, particularly increasing profit (Barbosa et al., 2010).

An important tool for maximizing profitability or otherwise enhancing the competitiveness of a farm is the application of economic management practices, which involves summarizing, examining, and comparing data, with the objective of reaching conclusions about the current position and prospects of the business (projections). A range of economic indicators are currently available, which highlight the costs, revenues, cash flow statements, annual planning, and profitability. These indicators are particularly influenced by the effect of economies of scale: as production increases, fixed costs are being spread over a greater quantity of output, thus reducing total average costs (Lopes et al., 2007; Kay et al., 2008).

Economic management encompasses both short and long term planning. Analyzing past data and using the results to prepare a detailed annual plan ensures that the farm's long-term economic prospects are positive, or points to possible corrective actions. On the other hand, using cash-flow statements could indicate any liquidity problems the farm may face in the short run. Thus, economic management is understood as a set of practices that involves all three of the following activities: organizing economic data and calculating annual profitability, preparing annual plans, and using cash-flow statements.

The economic resources available and the availability of credit are important in the analysis of a beef cattle farm. Through economic analysis, the farmer comes to know in detail and rationally apply the factors of production, using information as a tool for monitoring, control, and support for future decisions (Kay et al., 2008). Thereafter, it is possible to locate the bottleneck points in order to concentrate technological efforts to succeed in the activity and achieve his/her goals (Lopes et al., 2007). In this manner, the adoption of economic management practices of the farm is assumed to be a way of maximizing the expected utility; that is, allocating resources more efficiently in the production system to maximize profitability and, ultimately, minimize expected risk (Fig. 1).

Channel information/communication, together with the social system in which the individual decision maker operates, the availability of resources, the time vector, and innovation (ideas, practices, or objects perceived as new), form some of the elements involved in the process of technological diffusion. Promptly, the technology adoption decision is characterized as a process that seeks the best alternative, through rules and models that aim to improve productivity.

However, limited resources, whether human or physical, prevent many farmers from using best management practices (Ward et al., 2008). Because of this, the low adoption rates of many agricultural practices are often a source of frustration for researchers and extension agents, arising from the differences between farmers (Llewellyn, 2007). To improve this situation, extensive research has been conducted to better understand the entire decision-making

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