Diffusion of innovation in agriculture: the case of improved irrigation technologies for sugarcane in Reunion Island

Richefort L, Ph.D. Candidate, CERESUR, University of Reunion Island and UMR G-EAU, CIRAD, France

Farolfi S. Researcher, UMR G-EAU, CIRAD, France and University of Pretoria, South Africa

Fusillier J-L, Researcher, UMR G-EAU, CIRAD, France

In the irrigated agricultural sector of Reunion Island (France), technological change is an important process supported by public fundings for economic and environmental reasons such as improving productivity of sugarcane farmers and saving water resource. But the dynamics of improved technologies' adoption is complex and private individual cost-benefit analysis does not seem to be able to explain satisfactorily farmers' behaviour. Farmers delay the adoption of improved irrigation technologies whereas that has been proven to be more profitable and favour only two types of irrigation systems (sprinkler and drip irrigation) whilst other techniques are available (e.g. center-pivot systems) (Fusillier, 2006). Both environmental and agricultural policies aim at improving the cost-benefit ratio of farmer's technological adoption by subsidizing investments. These subsidies, though, do not seem to stimulate sufficiently technological innovation in the irrigation sector. Institutional factors might be the reason of this technological inertia: the quasi monopoly structure of the irrigation technology market might capture farmers' surplus and extension services may influence farmers' choices.

In economics, two main theoretical frameworks to analyse the diffusion of improved irrigation technologies can be identified: the neoclassical theory (also called the diffusion of innovation theory) and the evolutionary theory. Two well-developped models relate to the first one: the epidemic diffusion model, which tries to determine S-shaped patterns (origin, speed and ceiling) of aggregate diffusion through the population of (homogeneous) potential adopters over time (Griliches, 1957) and the rational choice model of diffusion, which tries to determine micro-parameters of technology adoption by profit (or utility) maximising individuals (Domencich & McFadden, 1975). However, both models assume that the diffusion process is exogenous and can be driven by price factors thanks to market mechnisms.

On the other hand, within the evolutionary theory of economic change pioneered by Nelson & Winter (1982), the analysis of technological diffusion took a different direction. This paradigm has been concerned with the impact of endogenous changes that can occur during the diffusion process by assuming that technologies are economically and technically linked to other technologies, user practices and institutions. More precisely, the evolutionary economics approach tries to recognize the way in which a sector is locked-in to particular unsustainable technologies (Dosi, 1988). Thus, this framework seems to be well-fitted to the context of Reunion Island where the reasons for the low adoption of improved irrigation technologies by sugarcane farmers need to be determined. This work refers to this theory by analysing in depth the interactive learning process between farmers and institutions to explain this phenomenon. We will adopt the evolutionary economics toolbox to depict the technological trajectories of irrigation systems in the irrigated sugarcane sector of Reunion Island over the 1985-2005 period. A sample of 103 sugarcane farmers will be surveyed to this purpose.

The proposed analysis should provide insights to discuss the dynamic efficiency of the Reunion Island water policy based on economic instruments such as water pricing or investment subsidies. This should lead us to suggest cost-effective strategies to policy makers in order to induce and sustain shifts towards more water-saving technological trajectories.

References

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