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Modelling the faddish, fashionable and efficient diffusion of agricultural technologies: A case study of the diffusion of wool testing technology in Australia

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ABSTRACT

This study investigates the nature of innovation diffusion in an agricultural context. The dominant agricultural diffusion models assume that an economically rational choice is made to adopt or reject agricultural technologies. However, recent studies of agricultural innovation highlight the 'irrational' and potentially 'inefficient' nature of the diffusion in this context. To investigate how and why agricultural technologies are adopted or rejected, we examine the diffusion of wool testing technologies in the Australian wool industry using the Bass diffusion model and Abrahamson's diffusion and rejection typology. The results show that diffusion of agricultural innovation is not simply an efficient choice made to close observable performance gaps. The findings suggest that the adoption of inefficient innovations and the rejection of efficient innovations can be driven by an adopter's social context, powerful external influences and imitation within an adopter group and that these drivers change over time, suggesting an evolutionary social process underlies the diffusion of agricultural technologies.

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1. Introduction

Technological innovation has long been considered a key driver of the agricultural sector's profitability, productivity and sustainability [1]. This process is generally considered to be the result of economically rational behaviour [2,4], which has an inherent pro-innovation bias [5–7]. People are thought to make efficient choices to adopt technologies that maximise their expected utility and reject those that do not [8–10]. However, there is growing evidence that new agricultural technologies that seem to be 'rational' choices are rejected and 'unsuitable' technologies are adopted. Examples include:

- The abandonment of seemingly profitable and heavily incentivised non-traditional agro-export crops by small family farms in Guatemala [11].
- The abandonment of a new System of Rice Intensification by Madagascan farmers despite higher yields [12].
- Evidence that pasture utilisation has not increased substantially in the last two decades despite the adoption of new pasture management techniques by Australian farmers [13].

These examples highlight the dynamic, uneven, 'irrational' and potentially 'inefficient' nature of the diffusion of agricultural technologies and suggest the efficient-choice perspective of innovation diffusion may obscure agricultural innovation's real drivers.

Abrahamson [14] suggested three alternative diffusion perspectives to the dominant efficient-choice perspective, which he termed:

1. The fad perspective, in which members of an adopter group imitate each other in terms of technology adoption or rejection.

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2. The fashion perspective, in which influential organisations or individuals outside an adopter group ('fashion-setters') are imitated by members of the adopter group.
3. The forced-selection perspective which suggests the diffusion process occurs in situations in which a number of organisations or individuals outside an adopter group have the power to determine which technologies will be adopted and rejected.

These alternative perspectives emerged in the management and organisational literature to help explain how concepts are diffused in uncertain or ambiguous environments [14]. However, little research has examined whether these perspectives can predict or explain the diffusion of technological innovations, despite evidence there are often technological and adopter uncertainties in such situations [15–17].

A central theme of agricultural innovation research has been the mathematical modelling of the diffusion of different types of technologies under different assumptions [18] which has its roots in diffusion models developed in the 1950s and 1960s [3,19,20]. The present study built on existing innovation diffusion research by using the Bass diffusion model [19] to examine fads, fashions, efficient choice and forced selection in the diffusion and rejection of agricultural innovation. The Bass diffusion model is robust, simple and parsimonious and can be used to compare diffusion patterns across a range of technologies and products [21,22]. Its use in the prediction and explanation of different innovation diffusion perspectives is appropriate because it is based on the imitation and innovation effects that underpin faddish, fashion-following and efficient-choice behaviours [14]. In the next section, the relevant literature that led to the present study is reviewed, while, in subsequent sections, the agricultural innovations that were examined in the study are described, the Bass diffusion model is reviewed, the results obtained are outlined and their implications are discussed.

2. A theoretical background

There has been considerable research into the diffusion of technological innovations over the last five decades [6]. In the agricultural sector, researchers have studied the adoption of a wide range of new agricultural technologies, including high yielding crop varieties [3], new varieties of legumes [23] and, more recently, the adoption and rejection of conservation practices and technologies [24–27]. The majority of these studies examined diffusion from an economic perspective [18] and assumed the decision to adopt or reject a new technology is based on an efficient choice made to maximise potential adopters' expected utility.

2.1. Efficient choice

The efficient-choice perspective is based on rational-efficiency theories that assume people or organisations can make an independent and rational choice to adopt or reject an innovation based on their assessment of its efficiency and ability to close a clearly defined gap in their performance [14]. The efficient-choice perspective is also based on the assumption that there is unbiased and unambiguous information about the efficiency of the innovation and that there are effective dissemination channels [28]. In most rational-efficiency approaches it is assumed early adopters disseminate information about the innovation to non-adopters, who then make a rational decision to adopt or reject it [6,28]. Such approaches reinforce a pro-innovation bias and do not explain the diffusion of inefficient innovations or the rejection of efficient innovations [14,28].

Abrahamson [14] argued potential adopters are often unable to assess the technical efficiency of an innovation or do not have sufficient goal clarity to determine the gaps that exist in their performance or the efficiencies that may be required to close such gaps. In situations where potential adopters have insufficient knowledge about the technology or their own performance and goals to make an 'efficient choice' to adopt or reject an innovation, they make ambiguous assessments of the technology based on the opinions of actors inside and outside the adopter group [29–31]. A decision to adopt or reject an innovation is based on external cues and the imitation of other actors can result in the adoption of inefficient technologies or the rejection of efficient technologies [14].

Theories of innovation fads and fashions have emerged to explain patterns of diffusion and rejection when the opinions of actors inside adopter group (fad) or outside the adopter group (fashion) drive decisions to adopt or reject an innovation under conditions of uncertainty or ambiguity [14,28,29]. Newell, Robertson and Swan [32] argued that "theorizing about fads and fashions has emerged at least partly in response to the limitations of normative-rational approaches to innovation diffusion" (p. 6). However, innovation fads and fashions theory is in its infancy and empirical studies of such patterns of diffusion and rejection are rare [32]. Theorizing and the empirical study of innovation fads and fashions have focused on management innovations, such as quality circles [29,33], business process reengineering [34] or greening [35]. Although fad and fashion research has emerged in the technical innovation field [36,37], little is known about such patterns of diffusion in an agricultural innovation context.

2.2. Fads

A 'fad' describes a diffusion pattern in which members of a group of potential technology adopters imitate the behaviour of other adopters [14,28,30]. The fad pattern is based on the concept of imitation that is found in innovation diffusion theories [6,20] and bandwagon behaviour theories that are found in management innovation contexts as potential adopters seek legitimisation through imitation in order to conform to social norms [28]. According to Abrahamson and Rosenkopf [28], the diffusion process occurs "not because of (people's) individual assessments of the innovation's efficiency or returns, but because of a bandwagon pressure caused by the sheer number of organisations that have already adopted the innovation" (p. 488) and can result in the adoption of technically inefficient innovations or the rejection of technically efficient innovations.

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