

Path-dependency in plant breeding: Challenges facing participatory reforms in the Ethiopian Sorghum Improvement Program

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Abstract

Participatory plant breeding (PPB) seeks to involve farmers more closely in crop improvement in order to improve breeding impact. While PPB aims to reform breeding practice, there has been little analysis of the current practice breeding institutions. Such an analysis is necessary, both to understand why a breeding programme works the way it does, and to assess the possibilities of for reforms. This paper develops theories of path-dependency, social construction of technology, and actor-networks to analyse the historical development of the Ethiopian Sorghum Improvement Program (ESIP), a long-running and sophisticated public-sector effort whose outputs have had limited adoption. This analysis explores choices in technology development, the social networks influencing them, and the possibility that established choices become stabilized in a pathway that resists changes to different lines of research and technology development. Applying this analysis to ESIP helps to understand the path-dependency of sorghum breeding, showing how early choices around agroecological classifications, germplasm use, and F₁ hybrid development became 'locked-in', consequently resisting change. Technical constraints, breeding routines, and actor networks all reinforce particular choices from the past, as does the centralized organization of the ESIP team. Most PPB efforts assume that poor breeder awareness of the traits farmers desire is the main reason for low impact, and thus concentrate on addressing this gap. This study points to more fundamental reasons for poor impact, and indicates that institutional change in breeding is unlikely to emerge from a PPB intervention focusing on selection criteria alone. In order to be lasting, reforms need to recognise technical pathways, strengthen the voice of farmers or other beneficiary groups, and engage with dominant policy narratives. This highlights the value of analysing breeding institutions before designing breeding reforms, and the utility of path-dependency for such an analysis.

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1. Introduction

Public-sector crop breeding often appears ineffective in developing countries. Adoption of the modern varieties (MVs) produced by breeding, an important (though not the only) measure of impact, is frequently low – particularly for poor farmers using few external inputs, or farming in highly stressed or variable conditions (e.g., Lipton and Longhurst, 1989; Ceccarelli, 1994). However, the value of breeding efforts has also been questioned for more favour-

able contexts (Sperling et al., 2001). These critiques resonate with more general criticisms of top-down development approaches, which argue that agricultural research that fails to engage with farmers' knowledge will be less useful (e.g., Chambers et al., 1989). Such critiques help explain the growing popularity of participatory plant breeding (PPB), which seeks to reform breeding through greater farmer involvement. While farmer participatory efforts sometimes do seek social development goals, such as farmer empowerment (Okali et al., 1994; Cornwall and Brock, 2005), the majority of PPB projects emphasise more practical goals around improving the effectiveness of crop breeding (McGuire et al., 1999). This analysis focuses on the challenges facing this latter goal.

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Many PPB reforms present farmer participation both as the solution to low impact and as the stimulus for institutional change. However, few projects critically analyse constraints to impact in a breeding programme, while even fewer examine how institutional change might occur in a programme. Well-designed reforms need first to understand why particular breeding practices were established, and why they are maintained. This paper demonstrates the utility of path-dependency theory for analysing the historical development of a breeding programme in the context of the wider institutional system. Opening the ‘black box’ of a programme in this way can reveal how norms in theories, institutions, and policies help make specific practices ‘valid’ within a breeding programme, and how such norms, combined with the costs of learning about or developing new practices, can inhibit change. Following summaries of gaps in PPB thinking and practice, and of path-dependency theory, this paper examines a specific case in the public sector, the Ethiopian Sorghum Improvement Program (ESIP). Analysing the development of practices in this programme, and their impact, I argue that path-dependency in ESIP will constrain the scope for simple reform interventions to arrive at institutional change. This highlights the importance for participatory reforms to develop a critical institutional analysis.

2. Background: breeding reform and path-dependency

2.1. Participatory breeding

Broadly, PPB includes any effort where breeders collaborate with other actors (farmers, merchants, food processors, and end users) in crop improvement. Scores of PPB projects have appeared in the past 15 years in international research institutes, non-governmental organizations, and especially national agricultural research systems (NARSs) (for lists of cases, see McGuire et al., 1999; Weltzien et al., 2000; PRGA Program, 2001a). Cited benefits include developing more acceptable MVs (Joshi and Witcombe, 1996; Mulatu and Belete, 2001), decentralising work to address localised environmental stresses (Ceccarelli et al., 2001), and increasing the diversity available to farmers (Witcombe et al., 2001).

Questions remain, however. PPB can take many forms – enhancing farmers’ own skills, or addressing seed policy, for instance – yet the majority of projects mainly focus on obtaining farmers’ input to MV selection in formal breeding systems. Two-thirds of cases in an extensive PPB review “focused on identifying, verifying, and testing specific selection criteria” (Weltzien et al., 2000, p. xiv), as did nearly every project attending a sub-Saharan Africa workshop (PRGA Program, 2001b). Learning more about farmers’ criteria is undoubtedly valuable, yet few projects critically question whether this knowledge is important, or the main constraint to impact. Rather, PPB is treated as “the method of recourse when classical breeding approaches have been tried and failed” (Weltzien et al.,

2000, pp. xvii–xviii). As Sumberg et al. (2003) noted for participatory research more generally, most theoretical energy focuses on methods for participation, or organisational issues, rather than analysing how farmer participation would relate to the existing research system. In a similar vein, technical methods receive detailed attention in PPB (e.g., Atlin et al., 2001), while the wider crop development system does not.

Focusing on methodological ‘toolboxes’ also avoids engaging with how the institutional history of a breeding programme shapes current practices, or with the implications of this history for any proposed reforms (Biggs and Gauchan, 2001). Treating research institutions as a black box is particularly ironic given that PPB projects often highlight changing institutional priorities as a key goal (Lilja and Ashby, 2000). Johnson et al. (2003) concede that institutional changes are not very apparent in NARS-based PPB projects. There may be many possible reasons for such inertia, though limited understanding and engagement with the institutional context of NARSs clearly cannot help. Analysing the history of a breeding institution can offer insights into the factors, both social and technical, that underpin and maintain its strategies, and into the scope for institutional change. Path-dependency, originally developed within economics (Magnusson and Ottosson, 1997) is particularly useful in this regard, as it considers wider system influences on innovation, and accounts for historical contingencies (Berkhout, 2002). Theories of actor networks and the social construction of technology enrich this perspective, by showing how social actors shape, and stabilize, choices in technology development. Breeding is a long-term undertaking, and this analytical approach can assist reforms to understand better the dynamics of continuity and change in a research system.

2.2. Path-dependency

Path-dependency emerged in the 1980s to counter neo-classical assumptions about the reversibility of economic decisions (Nelson and Winter, 1982; Magnusson and Ottosson, 1997). Frequently used to analyse trends in innovation (Patel and Pavitt, 1997; Coombes and Hull, 1998), the theory is best known for the notion of ‘lock-in’. A technology or technological regime may be quite flexible when it first develops, but over time steadily more fixed pathways become established. The theory assumes that different pathways could have been taken (i.e. there is no single equilibrium), thus highlighting the influence of (possibly minor) historical events on the emergence of a particular pathway (Ruttan, 1996; Hogg, 2001). Well-known examples of ‘lock-in’ include the dominance of the QWERTY keyboard (David, 1985) or VHS video format, over alternative options. In those examples, once one option gained advantage (i.e. market share), other factors provided positive feedback to reinforce its pathway. These factors can include: capital or learning investments sunk in one option, which inhibit change; increasing returns to scale or infor-

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