Is Investment in Rice Research in Nepal Adequate and Balanced Across Production Environments? Some Empirical Evidence

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Abstract

This study analyzes the patterns of public resource allocation in rice research in Nepal. The resource allocation for rice research was approximated based on the full-time equivalent (FTE) of researcher time spent on rice research. A simple congruence model modified by expected rate of research progress and equity criteria was used to investigate the gap between the actual and normative investment patterns across different types of rice production environments. The results show a substantial underinvestment in rice research in general but more so in rainfed areas and in the Terai agroecological zone. The use of modifiers amplified the extent of underinvestment in rainfed environments. The options for addressing these imbalances and the overall implications for resource allocation for rice research in Nepal are discussed.

Keywords: congruence analysis, public investment, resource allocation, rice research
JEL: Q 160, Q 190

1 Introduction

Public investment in agriculture is essential to generate productivity growth and reduce poverty in developing countries (PARDEY et al., 2006; FAN et al., 2007; BEZEMER and HEADEY, 2008). A strong link exists between public investments in research and agricultural productivity growth (THIRTLE et al., 2003; FAN et al., 2007; HAZELL, 2008; WORLD BANK, 2008). However, in recent years, public-sector investment in agricultural research in the developing world has been slowing down as a result of public policies and priorities being diverted toward structural reforms, environmental concerns, and human health (ALSTON and PARDEY, 2006; PARDEY et al., 2006). In spite of the well-known documented evidence of a higher rate of return from investment in agricultural research and development (ALSTON et al., 2000), underinvestment in agricultural research is a pervasive problem, particularly in low-income developing countries (PARDEY et al., 2006; OPM, 2007; WORLD BANK, 2008).

Underinvestment is also a pervasive problem in agricultural research in Nepal. Estimates show that current agricultural research investment intensity[1] in the country is very low, about 0.20% of the agricultural gross domestic product (AGDP). Rice research intensity is even lower, with about 0.021% of the value of rice output being invested in research. Both agricultural research and rice research investment intensities have further declined in recent years. For instance, the share of agricultural research in total agricultural investment in Nepal decreased from 7.5% in the year 2001-02 to 3.9% in 2008-09. Similarly, the share of rice research in total agricultural research investment decreased from 5.7 % in 2001-02 to 2.21% in 2008-09 (NARC, 2009). Decisions on investments in agricultural research and allocation across commodities are based on past spending patterns, without much analysis of the potential impact of research. Given this scenario, there is a need for scientific, more explicit, and evidence-based processes for empirical analysis of research investment patterns to inform and influence policy decisions on research investments in Nepal. The purpose of this study, therefore, is to contribute toward a more informed decision-making process in agricultural research through an analysis of the allocation of resources to rice research across production environments. Rice is chosen for this study because it is the principal food crop and a major source of livelihood for two-thirds of the rural households in Nepal.

The paper is organized as follows. Following the background information in section one, the paper provides an overview of the importance of rice, the production environments and description of rice research organizations in the second section. This is followed by a discussion of the current resource allocation patterns for overall agriculture and for rice research in Nepal. The methodology for assessing resource allocations is then outlined in the fourth section. The results of the congruence analysis are then presented in the fifth section. Finally, the conclusions and implications of the findings are discussed.

2 Rice Research and Production Environment

2.1 The Importance of Rice in Nepal

Agriculture is the main source of the national economy and the livelihood of the Nepalese people, accounting for 32% of the GDP and employing 70% of the population in the country (MOF, 2009). Rice is the most important food crop in terms of area,

[1] Research intensity of investment is defined as the ratio of research investment to the value of agricultural production. This measure is preferred to absolute levels of expenditure to make the country's agricultural R&D efforts easily comparable within international contexts (BEINTEMA and STADS, 2008).

production, and livelihood. It is currently grown on half of the total cropped area and accounts for more than half of the total food grain production in the country (MOAC, 2008). It is also the main source of livelihood for more than two-thirds of the farm households (70%) and accounts for one-fifth (20%) of the agricultural GDP in the country (MOF, 2009). Rice also supplies about 40% of the food calorie intake, with an annual per capita consumption of about 100 kg of milled rice (FAOSTAT, 2008).

2.2 Rice Production Environments

The rice production environment in Nepal is broadly categorized into ecosystems (irrigated, rainfed lowland, and rainfed upland) and broader ecology-related regions (Mountains, Hills, and Terai). There may be similarities within the same ecosystem in the Terai[2] or Hills, but because of climatic differences caused by altitudinal variations, the same ecosystem of the Hills and the Terai may have different production systems and technological implications (JMA/APPROSC, 1995; GILL, 1996). Therefore, rice production conditions and growing environments are influenced not only by ecosystem but also by broad ecology (climate, topography, altitude)-related factors. These two types of rice production environments are briefly discussed below.

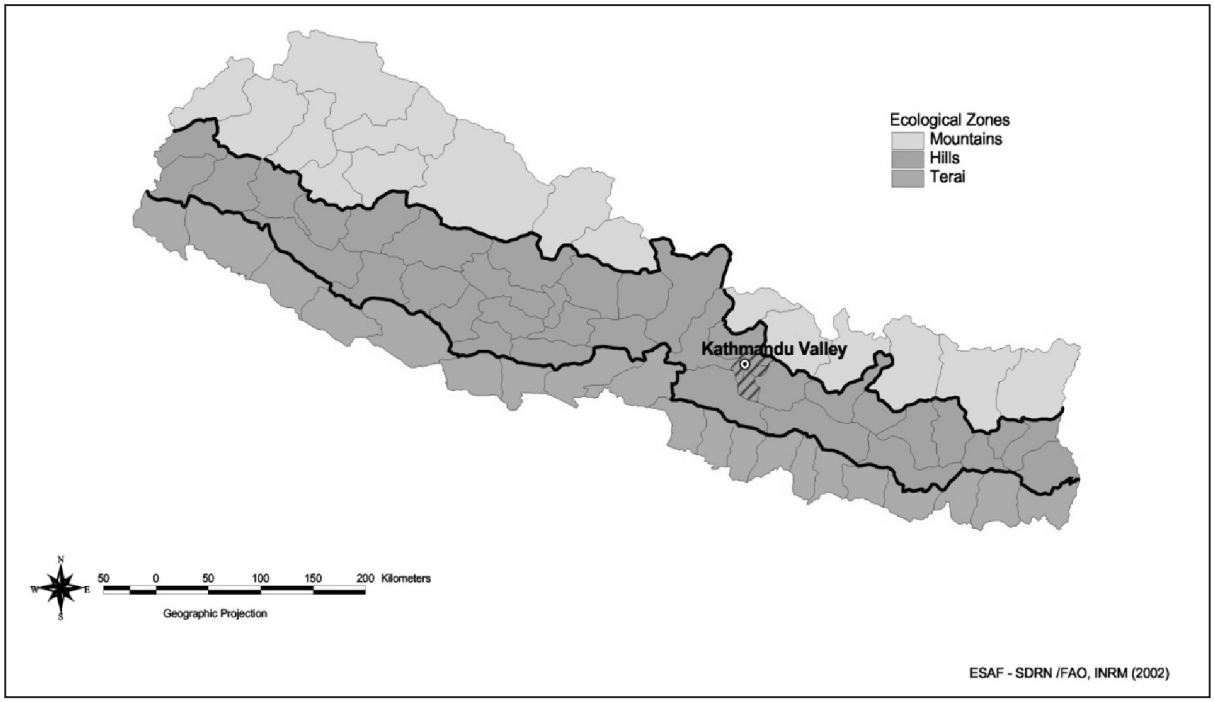
2.2.1 Agroecological Environments

Rice is grown in different ecological environments in Nepal (fig. 1), from the lowland in Terai (50-300 m asl) to the Hills (>300-1500 m asl) and Mountains (>1500-3000 m asl). The share of rice area, production, and yield varies by these ecological regions (table 1). Rice is largely produced in the Terai as it has a flat lowland topography and suitable climatic conditions. In the Hills and Mountains, rice is mainly grown in river valleys, foothills, hill terraces, and mountain slopes, up to as high as 3,000 m asl in Jumla valley of the mid-western mountain region (NARC, 1997).

The Terai has the largest area (71%) and production share (73%), followed by the Hills (24%). The Mountain region accounts for a small proportion of area (4%) and production (3%) in the country. Yield is also higher in the Terai (2.8 t/ha) than in the Hills (2.6 t/ha) and Mountains (2.0 t/ha). Considering the high production potential of the Terai, the national agricultural perspective plan (APP) of Nepal has given special priority to this region for enhancing food production and reducing poverty (JMA/ APROSC, 1995).

[2] Terai refers to the southern, flat low-lying region of the country bordering India, which is a part of the Indo-Gangetic fertile plains. This region stretches in parallel from east to west, covering more than 1,000 km of Nepal.

Figure 1. Map of Nepal showing three ecological regions



Source: ESAF-SDRN/FAO, NRM (2002)

Table 1. Triennium average of rice area, production and percent shares by ecological environment (2006-07 – 2008-09)

Ecological region	Rice area		Production		Yield
	(000 ha)	Percent	(000 Mt)	Percent	(t/ha)
Mountain	63.7	4.21	124.9	3.0	1.96
Hills	382.1	25.22	1,005.1	24.1	2.63
Terai	1,068.8	70.56	3037.8	72.9	2.83
Nepal	1,514.7	100.00	4,167.9	100.0	2.75

Source: MOAC (2008)

2.2.2 Rice Ecosystems

Rice in Nepal is cultivated in both irrigated and rainfed ecosystems. Rice ecosystems are categorized as rainfed and irrigated based on field hydrology. The rainfed ecosystem is further subdivided into rainfed lowland, rainfed upland, and deep water based on field hydrology and toposequence (HUKE and HUKE, 1997). Approximately

79% of the rice area in Nepal falls under the rainfed ecosystem, while the rest is in the irrigated ecosystem (table 2). Rice production data, presented by ecosystem, are estimated based on the share of the area of each ecosystem, and yield[3] in irrigated and rainfed ecosystems (MOAC, 2008; IRRI, 2010).

Table 2. Rice area, production, and percent share by ecosystem

Rice ecosystem	Area (%)	Area (000 ha)	Yield (t/ha)	Production (000 t)	Prod. (%)
Irrigated	21	325	3.65	1,188	27.6
Rainfed	79	1,225	2.55	3,122	72.5
Lowland	66	1,023	2.80	2,864	66.5
Upland	5	78	1.60	124	2.9
Deep water	8	124	1.10	136	3.2
Total	100	1,550		4,310	100.0

Source: IRRI (2009) (derived from FAO 2004-06, three years' database); MOAC (2008), and IRRI (2010)

2.3 Rice Research and Organizations

Agricultural research in Nepal has historically been a public-sector responsibility. Private-sector agriculture is nonexistent in Nepal (GAUCHAN et al., 2003; STADS and SHRESTHA, 2006). The Nepal Agricultural Research Council (NARC) is the sole public organization in Nepal that conducts rice research in the country. Rice research in Nepal dates back to the early 1950s with the collection and evaluation of 930 rice germplasm accessions on the agricultural research farms of Parwarnipur and Khumaltar in Bara and Lalitpur districts, respectively (MALLICK, 1981). However, a systematic coordinated rice research program began only in 1972 with the establishment of the National Rice Improvement Program (NRIP) in Parwanipur, Bara District. The NARC central disciplinary divisions located in Kathmandu and regional agricultural research stations located in different ecological and development regions are also mandated to implement their own rice research activities to assist in the national on-station and on-farm varietal testing process as well as to provide technological information to other clients.

[3] The yield of the irrigated and rainfed ecosystem is obtained from the cost of production data for the given years (MOAC, 2008). The yield of the rainfed sub-ecosystems is estimated from the yield data of recent in-country studies carried out by the International Rice Research Institute (IRRI, 2010).

3 Resource Allocation Pattern

3.1 Agricultural Research Expenditures

The current funding method for agricultural research in Nepal is in the form of block grants provided by the government through the MoAC to the public research institute (e.g. NARC). The amount of grant allocated to research depends mainly on the past resource allocation, spending pattern, and total public allocation to agriculture but there is no explicit consideration of research priorities, research productivity, or research planning in general (ITAD, 2005). Estimates show that public allocation to agriculture[4] as a whole currently accounts for less than 3% of the national budget and 4% of the value of agricultural output in spite of its importance in the national economy (SHARMA, 2009; NARC, 2009).

Since agricultural research has a long gestation period and its impact is not immediately observable to policymakers, the resource allocation pattern for agricultural research has historically been low, despite the government's declaration of priority given to the agricultural sector in various plans and policies (YADAV, 1987; THAPA, 1994; UPADHYAY, 1996; ITAD, 2005; SHARMA, 2009). The trend of investment in agricultural research has declined in recent years both as a percentage of agricultural gross domestic products (AGDP) and also in real value terms (table 3).

Table 3. Trend in public agriculture R&D budget (nominal) as a percent of AGDP

Year	AGDP (US$ billion)	Budget for agriculture (US$ million)	Agriculture budget as % of AGDP	Budget for agriculture research (US$ million)	Research share in agriculture budget (%)	Research budget in AGDP (%)
2001-02	2.24	104	4.60	7.81	7.53	0.35
2002-03	2.34	82	3.50	4.23	5.18	0.18
2003-04	2.51	86	3.40	4.06	4.72	0.16
2004-05	2.69	92	3.40	4.21	4.58	0.16
2005-06	2.86	102	3.60	3.98	3.92	0.14
2006-07	3.06	124	4.10	4.79	3.86	0.16
2007-08	3.50	143	4.10	5.61	3.91	0.16

Source: compiled from MoF (2009) and NARC (2009)

[4] Agriculture expenditures in Nepal reflect those allocated for agriculture, irrigation, and forestry. Agriculture specifically covers agricultural research and development (crops, horticulture, livestock, and fisheries), agricultural cooperatives and inputs (seeds and fertilizers).

In 2000-01, the government allocated about 8% of its agricultural expenditures in research, which then declined to around 4% in 2007-08. Similarly, the share of public research expenditures in AGDP allocated to NARC declined from 0.35% in 2001-02 to 0.16% in 2007-08. This current share of public research expenditures is very low relative to the investment of 0.6% on average in developing countries and 2.35% in developed countries (BEINTEMA and STADS, 2008). Over the last eight years, one of the principal reasons for the drop in agricultural research spending was the lack of major donor support for agricultural research after the termination of the World Bank-funded Agricultural Research and Extension Project in 2002.

3.2 Rice Research Expenditures

The budget for rice research depends on the total amount of the block grant that NARC receives annually from the government and the number and quality of the research proposals submitted by researchers within the organization. At present, there is no clear scientific process for allocation of core research funds to rice research in the country. The proposals and budget proposed for rice research have to compete with other commodities and sectors. These are screened internally through the annual program review. The current budget allocated to rice research is extremely low, which has also declined in real value terms in recent years (table 4).

Table 4. Allocation of rice research budget (real price*) to total agri-research budget (US$)

Year	Budget for agricultural research (US$ 000)	Operational agricultural research budget (US$ 000)	Operational food crop research budget (US$ 000)	Operational rice research budget (US$ 000)	Rice research to operational agri-research budget (%)
2001-02	7,808	2,541	739	146	5.7
2002-03	4,073	1,222	306	50	4.1
2003-04	3,792	1,253	463	47	3.8
2004-05	3,769	1,273	498	66	5.21
2005-06	3,355	947	373	41	4.27
2006-07	3,773	1,182	417	51	4.34
2007-08	4,095	1,318	453	49	3.69
2008-09	4,668	1,200	334	27	2.21

* Note: Real price is obtained by using GDP deflator for 2001 as a base year (IMF, 2009). The local currency NRs is converted to US$ using the prevailing exchange rate of US$1=NRs 74.

Source:compiled from NARAC (2009)