

# Learning networks matter: challenges to developing learning-based competence in mango production and post-harvest in Andhra Pradesh, India

Citation for published version (APA):

Pant, L. P., Odame, H. H., Hall, A., & Sulaiman, R. V. (2008). *Learning networks matter: challenges to developing learning-based competence in mango production and post-harvest in Andhra Pradesh, India*. UNU-MERIT, Maastricht Economic and Social Research and Training Centre on Innovation and Technology. UNU-MERIT Working Papers No. 069

## Document status and date:

Published: 01/01/2008

## Document Version:

Publisher's PDF, also known as Version of record

## Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

## General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

[www.umlib.nl/taverne-license](http://www.umlib.nl/taverne-license)

## Take down policy

If you believe that this document breaches copyright please contact us at:

[repository@maastrichtuniversity.nl](mailto:repository@maastrichtuniversity.nl)

providing details and we will investigate your claim.

Download date: 10 Jun. 2023



**UNITED NATIONS  
UNIVERSITY**

**UNU-MERIT**

## **Working Paper Series**

**#2008-069**

### **Learning Networks Matter: Challenges to Developing Learning-Based Competence in Mango Production and Post-Harvest in Andhra Pradesh, India**

**Laxmi Prasad Pant, Helen Hambly Odame, Andy Hall and Rasheed Sulaiman V.**



# LEARNING NETWORKS MATTER: CHALLENGES TO DEVELOPING LEARNING-BASED COMPETENCE IN MANGO PRODUCTION AND POST-HARVEST IN ANDHRA PRADESH, INDIA

Laxmi Prasad Pant<sup>1</sup>, Helen Hambly Odame<sup>2</sup>, Andy Hall<sup>3</sup>, and Rasheed Sulaiman<sup>4</sup>

## Abstract

This discussion paper explores aspects of innovation systems ideas in the analysis of mango production and export by smallscale farmers in the South Indian state of Andhra Pradesh. The paper shows how despite favourable agro-ecological conditions and being the largest international mango producer, India still struggles to build momentum in rapidly emerging export markets. An analysis of the sector's recent history combined with an empirical account of inter-sectoral and intra-sectoral linkage patterns among stakeholder groups appears to provide the basis for remedial policy suggestions. Most of these relate to aspects of integrated technology development and innovation management.

**Key words:** systems, innovation, mango, high-value, national competence, learning networks, South Asia, India

**JEL codes:** O31, N55, Q13

UNU-MERIT Working Papers  
ISSN 1871-9872

Maastricht Economic and social Research and training centre on Innovation and Technology,  
UNU-MERIT

*UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at the Centre to stimulate discussion on the issues raised.*

---

<sup>1</sup> PhD candidate, School of Environmental Design and Rural Development, University of Guelph, Canada, [lpant@uoguelph.ca](mailto:lpant@uoguelph.ca)

<sup>2</sup> Associate Professor, School of Environmental Design and Rural Development, University of Guelph, Canada, [hhambly@uoguelph.ca](mailto:hhambly@uoguelph.ca)

<sup>3</sup> Joint Coordinator, Learning, INnovation and Knowledge Network (LINK), United Nations University, MERIT, Maastricht, The Netherlands, [hall@merit.unu.edu](mailto:hall@merit.unu.edu)

<sup>4</sup> Regional Director, LINK South Asia and Director, Centre for Research on Innovation and Science Policy (CRISP), Hyderabad, India, [rasheed.sulaiman@gmail.com](mailto:rasheed.sulaiman@gmail.com)

**Acknowledgements:** This research was funded by the International Development Research Centre (IDRC) of Canada, and implemented by the Rural Studies PhD Program at the School of Environmental Design and Rural Development, University of Guelph, Canada in collaboration with LINK (Learning, Innovation and Knowledge), an Initiative of the UNU-MERIT in the Netherlands, and its local partner CRISP (Centre for Research on Innovation and Science Policy) in India. The authors are grateful to Norman Clark for critically reviewing this paper. The authors also benefited from the participants' comments at the World Bank's workshop on "Enhancing Agricultural Innovation" held on March 22 and 23, 2007, where an earlier version of this paper was presented. Respondents from various organisations and rural farming communities in India also deserve due acknowledgements. This paper represents views of the contributing authors, and the authors kindly acknowledge that the usual disclaimer applies.

# TABLE OF CONTENTS

<b>1. INTRODUCTION.....</b>	<b>4</b>
<b>2. INNOVATION SYSTEMS.....</b>	<b>5</b>
FIGURE 1: CAPACITY TO INNOVATE.....	7
TABLE 1: INTERSECTING CODIFIED AND TACIT MODES OF LEARNING WITH THE SOURCES OF KNOWLEDGE.....	8
<b>3. STAKEHOLDER COLLABORATION FOR MANGO EXPORT PROMOTION IN KRISHNA DISTRICT.....</b>	<b>9</b>
BOX 1: TIMELINE OF MAJOR EVENTS RELATED TO MANGO EXPORT PROMOTION IN KRISHNA DISTRICT.....	10
<b>4. PATTERNS OF INTERACTION IN LEARNING NETWORKS.....</b>	<b>14</b>
4.1. INTRA-SECTORAL STAKEHOLDER INTERACTION.....	15
BOX 2: ILLUSTRATIONS OF THE IMPORTANCE OF MANGOES TO RURAL LIVELIHOODS .....	17
4.2. INTER-SECTORAL STAKEHOLDER INTERACTION.....	18
FIGURE 2: LEARNING NETWORKS ALONG AND OUTSIDE THE MANGO SUPPLY CHAIN....	21
<b>5. CONCLUSIONS AND POLICY SUGGESTIONS.....</b>	<b>22</b>
<b>REFERENCES.....</b>	<b>26</b>

## 1. INTRODUCTION

This discussion paper explores aspects of innovation systems ideas in the analysis of mango production and export by poor farmers in India, a part of the world where agro-ecological conditions are highly favourable for this type of crop (Zeven and Zhukosky, 1975). In fact India has maintained over 650 mango variety accessions, exceeding 500 varieties in a single research farm in Andhra Pradesh, and is ahead of most middle and low income countries in terms of technological innovations in horticulture and related disciplines (Vijaya et al., 2003). Nevertheless, despite being the largest producer of mangoes and accounting about 43 per cent of the world's production, India still struggles to build momentum in rapidly-emerging export markets. This paper argues that very probably the root of the problem lies in a dysfunctional innovation system where the patterns of interaction needed to stimulate innovation and growth are either absent or much more poorly developed than is required. In this way weak *capacity to innovate* has severely undermined the comparative advantages provided by otherwise favourable agro-ecological conditions.

The paper's empirical material has been derived from interviews with key stakeholder groups and direct observation in Andhra Pradesh supplemented by reviews of secondary material published over the past decade or so. Its focus is on an investigation of learning networks around the Vijaya Fruit and Vegetable Growers Association (hereafter referred to as Vijaya), a farmers' organisation that went through two successive restructuring periods since its establishment in 1992. For ease of exposition we call the grouping of smallholder farmers and other actors surrounding this network of mango producers in Krishna district the "sector". Section 2 reviews and summarises the relevant innovation systems literature paying particular attention to those properties felt to be central to technology development in small scale agricultural production in poor countries. Section 3 provides a short historical account of the sector's development from a relatively low point in the 1980s and setting out institutional changes that it was hoped would allow the sector to capitalise on growing international markets. Unfortunately despite a number of organisational and institutional changes export performance has continued to remain poor. Section 4 focuses the analysis on systemic issues of interactivity that seem to have affected the

sector's innovative performance adversely. The paper concludes in Section 5 by setting out a series of policy principles that are needed to inform recommendations for positive changes in the mango sector.

## **2. INNOVATION SYSTEMS**

The idea of an innovation system is now widely used to explore the innovation process and capacities at both national and sectoral levels (Lundvall, 1992; Freeman, 1995; Malerba, 2002) in both developed (OECD) and increasingly developing economies (Hall et al, 2002; World Bank, 2007). At its simplest, the concept departs from earlier notions of innovation as a research-driven process of technology transfer and, instead, views it as a social process where different sources of knowledge and ideas are put into use. The concept gives centrestage to two interconnected dimensions of innovation. *First* is the interaction among different players in economic systems, the roles they play and the way their interaction facilitates the transmission, adaptation and use of ideas, and thus enables learning and innovation.

The *second* dimension is the way the process is located in, shaped by and responds to various contexts. These include: the habits and practices — institutions — of the various actors involved in innovation; the historical, cultural and political setting that gives shapes to habits, practice and styles of innovation; and the enabling environment that includes some of these other contextual elements, but also includes policies and infrastructure as well as the market itself as a mechanism for providing incentives for entrepreneurial activity. Two other important considerations that the innovation systems framework allows one to reveal are the dynamics of the processes involved and the capacity that emerges at a systems level. So while the concept recognises the importance of certain types of relationships and linkages that mediate information flows, it also recognises that in ever-changing biophysical and social environments (climate, weather, markets, policy, technology), patterns of linkages need to change to meet new conditions and demands.

The recognition of this as a systems phenomenon, however, is arguably the critical point of departure for contemporary thinking on innovation. Not only does it recognise the interaction of many individual parts, and the non-linearity of the outcomes of these interactions, but it also recognises that these networks of interacting elements have emergent properties. In other words

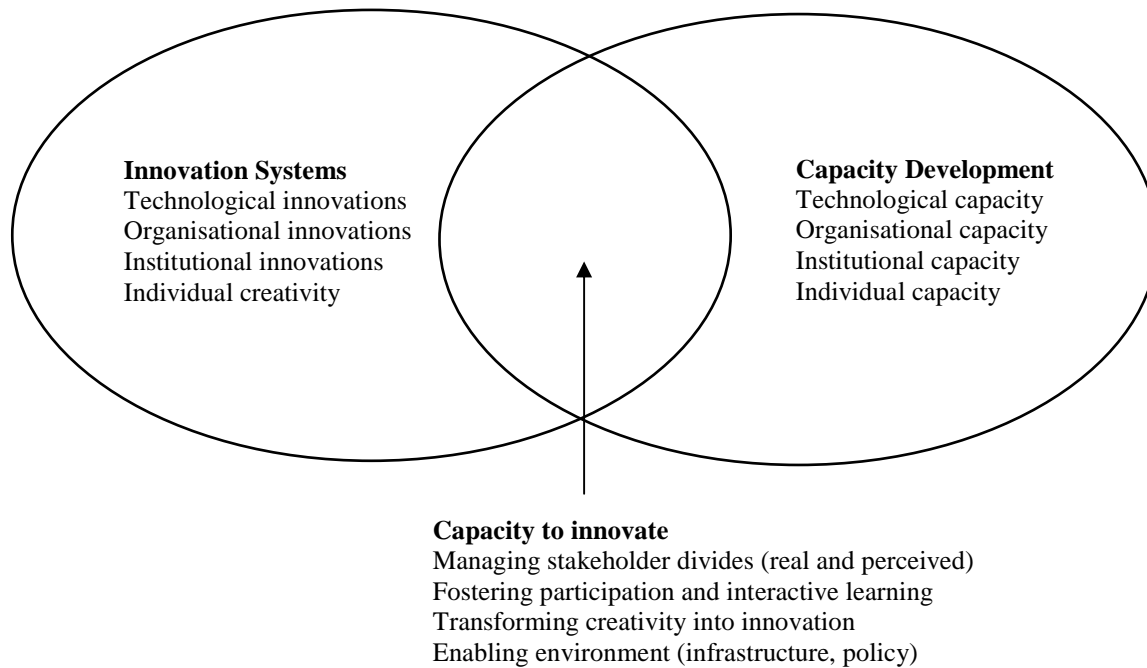


these systems have properties that are more than the sum of the constituent parts and which cannot be accounted for by analysis of individual elements of the system. It is for this reason that institutional settings of actors — ways of working — assume such significance since this is in a sense the “hidden hand” that determines how the system operates. By the same reasoning it is why science, technology and innovation policy focus is shifting towards considering capacity development in terms of the behaviour of systems rather than in terms of quantum of research or the nature of technology transfer elements.

This is not the same as the way technological capabilities have usually been specified in the literature (e.g., Lall, 1992, 2004). Nor does it really accord with how innovation capabilities have often been portrayed — that is, through major changes in the design and core features of products and production processes (Ernst, Ganiatsos and Mytelka, 1998). It is more akin to the concept of dynamic capabilities (Teece et al., 1997) as the firm’s ability to integrate, build, and reconfigure internal and external competencies to address a rapidly-changing environment. It accords also with Eisenhardt and Martin (2000)’s definition of dynamic capability as “the firm’s processes that use resources, especially the processes to integrate, reconfigure, gain and release resources to match and even create market change”.

In other words operational capacity development alone is less effective if it not integrated with learning-based adaptive capacities to experiment, to learn interactively and to develop capacity to innovate persistently (Hambly Odame et al., 2007). Capacity is an emergent property of a system that comes about through the interrelationships and interactions among various elements of the system of which it is a part (Hall, 2005; Morgan, 2005). In practice, the intersection of capacity development and systems of innovation focuses on two critical points — *managing divides* between key public and private stakeholders, and *enabling processes* of interactive learning and innovation (Hambly Odame et al., 2007; Pant and Hambly Odame, 2006) (See Figure 1 overleaf).

**Figure 1. Capacity to Innovate**



*Source: Adapted from Hambly Odame et al. (2007)*

Learning networks can be tacit and codified; and knowledge sources can be formal organisations or informal practices in rural communities. While tacit knowledge cannot be formally expressed as it is embedded in habits and practices of knowledge practitioners, codified knowledge can be expressed and recorded in external media, such as paper or electronic media, and is transmitted over time and space. Intersecting learning types and knowledge sources, four basic types of learning networks are possible (See Table 1 on the next page). The adaptive learning capacity through an integration of codified and tacit learning networks determines the success of knowledge management activities pertaining to a particular sector, such as in renewable natural resource and agriculture (Seufert, von Krogh and Bach, 1999).

**Table 1. Intersecting codified and tacit modes of learning with the sources of knowledge**

	<b>Codified learning</b>	<b>Tacit learning</b>
<b>Formal knowledge source</b>	Codified learning networks of the public, non-profit private and for-profit private sectors; example: policy briefs, manuals, journal papers	Tacit learning networks of the public, non-profit private and for-profit private sectors; example: social events, tea time chat
<b>Informal knowledge source</b>	Codified learning networks of rural communities; example: rural bulletin boards	Tacit learning networks of rural communities; example: social events, labour exchanges

*Source: Authors*

Within each type of learning network, knowledge conversion takes place from tacit-to-tacit, tacit-to-codified, codified-to-codified, codified-to-tacit (Nonaka, 1991; Nonaka and Takeuchi, 1995). Tacit-to-tacit conversion takes place through socialisation; tacit-to-codified conversion takes place through codification or externalisation of tacit knowledge embedded with people's habits and practices; codified-to-codified conversion takes place through systematisation or combination into a higher scale; and codified-to-tacit conversion takes place through decodification or internalisation to put codified knowledge into use. One or the other type of knowledge conversion takes place in a system, but an efficient system integrates all of these conversions to produce an upward spiral of learning networks. Here an upward spiral means that all four types of knowledge conversion begin at an individual, then at a group, organisational, network and system levels.

The higher the level, the more challenges collective action faces as the number of knowledge actors increase exponentially, which in turn increases the diversity and differences among actors. Inefficiency in any type of knowledge conversion will trap a system into a downward spiral that reduces learning networks to the tacit learning networks of a group or small number of individuals (e.g., families and friends). Therefore, knowledge networking is an important aspect of developing organisational and institutional capacities to innovate in the natural resource and agriculture sector because it represents the collective action of organisations and individuals in response to unpredictable economic, social, climatic and environmental changes. The next section examines the case of Vijaya Fruit and Vegetable Growers Association (Vijaya) to illustrate how an increasingly stringent export market demand for Indian mangoes combined

with weaker capacities to innovate led to a downward spiral of knowledge networks that serve lower value regional markets.

### **3. STAKEHOLDER COLLABORATION FOR MANGO EXPORT PROMOTION IN KRISHNA DISTRICT**

The Vijaya Fruit and Vegetable Growers Association (Vijaya) was established in 1992 in Vijayawada in Krishna District, in the southern state of Andhra Pradesh, India. At that time the association was made up of 16 fruit and vegetable cooperatives (primary societies) spread over three districts around Vijayawada. The primary society membership consisted of approximately 500 small and medium-scale farmers (1-10 acres) who, between them, cultivated almost 3,000 acres of mangoes (Hall et al., 1998; 2001a; 2001b). Vijaya acted as an apex organisation to undertake and coordinate the marketing of mangoes in export and high value domestic markets. Legally it was a non-profit private enterprise established with a specific goal of finding a better price for farmer members' produce through direct marketing without the produce being handled by middlemen, wholesalers and traders. Farmers received a premium price for fruit of export quality. In turn, a key function of Vijaya was to act as a source of technical advice and inputs to assist farmers in increasing the proportion of fruit which reaches export quality criteria. Initially only 10% of fruit were attaining this level of quality.

The initial efforts of Vijaya involved marketing its farmers' mangoes in the high value domestic market and subsequently to the Far Eastern export market relying on airfreight arrangements. In 1995 Vijaya began exploring the potential of European markets. Assistance was sought from the Agricultural Processed Products Export Development Authority (APEDA) in the Ministry of Commerce, Government of India. APEDA provided considerable assistance to Vijaya in its efforts to link farmers to this new export market. Subsidies were provided for collecting market intelligence; cost of samples and trial shipments; cost of producing promotional literature; and underwriting commercial shipments. APEDA also supported the technical capacity of Vijaya and its farmers, not only by providing 50 per cent of the costs of engaging national scientists but also in forming linkages between Vijaya and relevant sources of technical expertise both nationally and internationally.

Again in 1992, the Andhra Pradesh Department of Marketing (DoM), with financial support from APEDA, established a pilot facility in Gollapudi, near Vijayawada to process table mangoes for export (See Box 1). The facility was managed by an Agricultural Market

Committee (AMC). Exporters were able to use this facility for a nominal fee with Vijaya being one of the first exporters to utilise it. APEDA, DoM and Vijaya had been involved in developing a protocol for sea freight of mangoes to the Middle East and Europe. At the same time, the Natural Resources Institute (NRI), a specialised Institute at the University of Greenwich at Medway, United Kingdom, came to APEDA with a proposal to implement a component of the DFID’s Crop Post Harvest Program (CPHP) in India, and APEDA was more than happy to collaborate.

**Box 1. Timeline of major events related to mango export promotion in Krishna district**

- 1992:** Construction of the pilot facility in Gollapudi, Vijayawada to facilitate mango export
- 1992:** Establishment of the Vijaya Fruit and Vegetable Growers Cooperative Federation (Vijaya)
- 1993:** The first sea shipment of mangoes to London; testing of sea shipment protocol
- 1995 to 1996:** NRI project (R6306) on “Field trials for quality assurance for horticulture exports...”
- 1996 to 1999:** NRI project (R6641) on “Developing integrated post-harvest techniques to enhance small-holder livelihoods in India...”
- 1999:** The Vijaya Cooperative Federation renamed as the Sun Gold Agri Farms and Exports Ltd.
- 1999:** The Kedareswarapeta Fruit & Vegetable Market moved to the Nunna Market to avoid traffic congestion in the Vijayawada city
- 1999 to 2001:** NRI project (R7494) on “Optimisation of Horticulture Research and Uptake in India...” (terminated one year in advance)
- 1999 to 2003:** NRI project (R7502) on “Optimising institutional arrangements for demand driven post-harvest research... through public and private sector partnerships”
- 2000:** The Sun Gold Agri Farms and Exports Ltd. was renamed as the Vijaya Fruit and Vegetable Growers Association
- 2001:** Vijaya Laxmi Agro Service Centre, an input retailer established in 1975 entered into fruit and vegetable marketing
- 2002:** The APEDA declared Krishna district as an Agriculture Export Zone (AEZ) for mangoes
- 2006:** In Nuzvid 30 acres of land has been acquired for the proposed Horticultural Hub and 24 acres of land for the Mango Research Station
- 2006:** Japan lifted 20 years ban on imports of India mangoes, which has encouraged the mango growers in Krishna district as well.
- 2007:** The APEDA procured 1.4 tons of mangoes from the farmers in Krishna district, and sent to the USA for export promotion

*Source: Review of the recent history, fieldwork 2006/2007*

The first phase of the CPHP project was implemented in 1995 for one year. As per its stated objectives, the project identified constraints to implementing quality assurance (QA) systems for horticultural exports from India, defined legislative requirements to export fresh horticultural produce to Middle East, identified changes in European legislation affecting horticultural exports and gathered information on quality assurance for Francophone countries. However, although this project developed QA manuals, as well as awareness among relevant Indian stakeholders about QA for the export of horticultural produce, it failed to facilitate real-time learning networks for QA because legislation varies from nation to nation, and over time in a given nation.

A second phase of the project was implemented for three years in 1996-1999, during which Vijaya was even more actively involved. This phase aimed at developing an integrated package of treatments for successful mango export. Pilot scale equipment for hot water treatment was designed and established in the Gollapudi market yard. Several sea shipments of mangoes were sent to London and South East Asian markets without, however, any encouraging success. The problems identified were basically technical in nature and included recommendations for the regulation of temperature and carbon dioxide in the refrigerated containers. In fact, constraints were more institutional than technological *per se* (Hall et al., 2001a; 2001b; Hall et al., 2002). Indeed Hall and his colleagues concluded that the main problem was a complete disconnect between organisations involved in technology development (public sector R&D bodies who themselves operated in “silos”) on the one hand and private sector producers and their affiliates on the other. As a result, the project ended its second phase with a revised focus on institutional issues.

In the third phase, two projects were implemented for three years (1999 to 2002) and four years (1999 to 2003), respectively. The first project aimed to produce technical and management systems for horticultural export by fostering suitable public-private partnerships (PPP). The main output of this project was a manual called “Decision Tools for Supply Chain Management”. Although this project recognised the interdependence of technical and institutional issues, the approach was not much different from the very first project where QA manuals were developed. The second project specifically focused on optimising institutional arrangements for ensuring

that in future public sector R&D would benefit resource-poor mango producers. Although this project catalysed some discussion on innovation systems thinking in agriculture — as well as its relevance to the mango export sector — it did not persuade Indian stakeholders to deviate from the ‘business-as-usual’ habits and practices of working within their own silos.

In an effort to create an upward spiral of learning networks, exploit stringent export market demands, and meet expectations of fellow mango growers, Vijaya then began to experiment with its organisational structures and processes. In 1999 Vijaya was renamed as the Vijaya Sun Gold Agri Farms and Exports Ltd., a public limited company. In fact, ‘Vijaya Sun Gold’ was already the brand name for its mangoes, but this had been used thus far without legal protection. In 2002 Vijaya was again restructured as an Association of Fruit and Vegetable Growers representing 217 individual members in order to revitalise collective action in mango export. One of Vijaya’s subsidiaries, Vijaya Laxmi Agro Service Centre (hereafter Vijaya Laxmi), recently diversified its activities to include marketing of agricultural produce in response to its unsuccessful institutional experiment with Vijaya. However, what was significant was that the mango export sector, including Vijaya Laxmi, managed most of this by using the tacit and informal learning networks of families and friends.

Another significant milestone in 2002 occurred when APEDA declared Krishna District as an Agricultural Export Zone (AEZ) for mangoes. Additional land was acquired to develop an integrated packing house in Nuzvid, a town that is relatively closer to mango-growing areas than Gollapudi. Another piece of land was also acquired to strengthen the activities of the Mango Research Station in Nuzvid, as a subsidiary of the Acharya NG Ranga Agricultural University (ANGRAU). This shift in location for infrastructure development, while existing infrastructure in Gollapudi remained underutilised, was largely due, it is claimed, to political interests.

Despite all these interventions, however, the mango sector in Andhra Pradesh has failed to succeed in high-value export markets. Clearly, part of the challenge has been the failure to meet different types of market demands at play. First, in countries like the United Kingdom, United States and Japan consumer demand for quality is stringent. Importers are concerned with QA issues, such as shelf-life, pesticide residue and insect pest and disease infestation. For example, the US has made it obligatory for imported Indian mangoes to be irradiated (exposing mangoes to a kind of radiation that kills insects and pathogens). In 2007, APEDA acquired 1.4 tons of



mangoes from Krishna District and sent them to the US as a promotional scheme. Before shipping them off, they were subjected to post-harvest processing in the Gollapudi market yard and then to an irradiation facility in Maharashtra, a neighbouring Indian state where cobalt ray irradiation facility for mangoes is currently available. ANGRAU conducts research on irradiation dosages for a few selected mango varieties.

Likewise, vapour heat treatment (VHT) of mangoes to eliminate fruit flies is mandatory on mangoes being exported to Japan. In 2006, Japan lifted its 20 year-ban on imports of Indian mangoes under an agreement that the fruit would be subjected to VHT before shipping.

These requirements by the US and Japan signify the types of stringent demands, requiring high technology interventions, to which the Indian public sector has to respond. The second type of export market demand is in other South Asian countries, the Middle East and South East Asia. The requirements here are less stringent than in the US and Japan — specifically in terms of non-tariff barriers, such as SPS measures. Indian mangos are exported to these regional markets by air freight, often through the involvement of commission agents. Sea shipment protocol has never been tested again since the end of various project interventions. Collective action for mango export through Vijaya has also been discontinued. As a result commission agents and their merchants (*mandi* operators) have remained the main form of collective action relevant to this sector but have failed to stimulate exports. In short the sectoral story is one of institutional failure that, although acknowledged by stakeholders, has failed to stimulate effective remedial policies.

#### **4. PATTERNS OF INTERACTION IN LEARNING NETWORKS**

The question then becomes: what has been missing? Given that successful export performance depends upon relevant technology development, which in turn depends on effective information flows among actors what kinds of intervention are likely to improve matters? From an innovation systems perspective the answer must lie in improving relevant patterns of interaction. This, in turn, led the authors to specifically investigate what these patterns are and how they need improving.

The empirical material for the investigation was derived from interviews with key stakeholder groups and direct observation of their habits and practices. Key informant and focus group interviews were conducted with primary stakeholders in Krishna District, and in Hyderabad, Bangalore and New Delhi, to investigate the patterns of interaction. The interviews were also instrumental in complementing the findings in the previous section, which primarily emerged from the review of the literature published over a decade or so. Key informant interviews were initiated with APEDA's officer in Hyderabad, who was a key public sector actor in the sector. The APEDA officer was asked to provide names of other persons who would be appropriate to interview, and the snowballing continued with other key informants. This method of snowballing was successful because stakeholders knew each through networks built over a decade or so.

On the recommendation of APEDA and subsequent stakeholders, interviews were held with mango farmers, exporters, executives of Vijaya and the AMC, district horticulture extension officers, officers of the DOM, and the director of the mango AEZ in Vijayawada. Scientists at ICAR in New Delhi and at the IIHR in Bangalore were also interviewed. The key informant interviews were facilitated using a check-list and the interviewees were specifically asked to draw a stakeholder map to illustrate and discuss the patterns of interaction among the public, non-profit private, for-profit private and informal sector actors.

Given the large numbers of mango farmers recommended for inclusion as key informants, mango growers were interviewed in groups employing a focus group interview technique and an interpreter as they spoke only Telugu and did not understand English. Farmers were also asked to

draw a stakeholder map representing tripartite relationships among the public, non-profit private and for-profit private sectors, putting themselves at the centre of the triangle. Since two field visits were subsequently organised — the first during the mango flowering season and the second during harvesting — direct observation of the habits and practices of stakeholders engaged in the sector served as a strong method of data triangulation.

Patterns of interaction are described in terms of relations among public and private sector bodies subdivided also according to whether they are *for-profit* or *not-for-profit*. Informal sector producers are also treated as a separate category. The linkages can be within scientific research and technology development and/or go beyond this, and include business innovation and entrepreneurship.

#### **4.1 Intra-sectoral stakeholder interaction**

##### *(i) The public sector*

Most public sector linkages concern R&D. The state agricultural university research stations and specialised fruit research centres of the Indian Council for Agricultural Research (ICAR) conduct mango research activities. The Indian Institute of Horticulture Research (IIHR) in Bangalore, and the Central Institute for Subtropical Horticulture (CISH), Lucknow, are the major ICAR institutes with mango research activities. The Central Food Technology Research Institute (CFTRI), Mysore, which is under the Council for Scientific and Industrial Research (CSIR), conducts research on post-harvest technology of various commodities including mango. Bhabha Atomic Research Centre (BARC) of the Ministry of Science and Technology in Mumbai funds research on nuclear science, including its application in horticultural export promotion. For example, ANGRAU conducts research on irradiation of selected mango varieties to determine appropriate dosages of irradiation with funding from BARC.

Scientists from the ANGRAU and ICAR institutes, along with extension staff from the state Department of Horticulture (DoH), meet in biannual workshops to determine long-term research priorities. The major research-extension linkage activities include publications, the hiring of researchers as consultants for extension programs, meetings and conferences, inviting scientists for farmers training and informal information exchange.

Some public agencies have attempted to help extend linkages beyond R&D. The state Ministry of Food Processing Industries (MFPI) and the state Department of Marketing (DoM), along with its network of Agricultural Marketing Committees (AMCs), are the state-level agencies that facilitate linkages for marketing of agricultural produce. The national agencies in this category include the National Cooperative Development Corporation (NCDC) and APEDA. As mentioned in the previous section, UK-based agency NR Institute worked with Indian mango stakeholders on a series of projects on supply chain management during the 1990s. In collaboration with APEDA and DoM, NR Institute helped stimulate linkages beyond R&D by identifying legislative requirements for importing countries and facilitating trial sea shipments of mangoes to London and Singapore. However, these initiatives were less effective in establishing sideward linkages with the informally operating but dominant supply chain actors, specifically the powerful wholesalers and their commission agents.

*(ii) Non-profit private sector*

Vijaya is the only non-profit private organisation working on mangoes in Krishna District. Although stakeholders in Vijaya claim they have an intermediary role as advisors to mango growers, they were neither involved in facilitating inputs and information access nor in the marketing of mangoes. Outside of an annual general meeting, Vijaya rarely functioned. As described in the previous section, the institutional experiments of Vijaya, although intended to create an upward spiral knowledge spiral, unfortunately trapped them in a downward spiral.

*(iii) For-profit private sector*

The family-run company Vijaya Laxmi trades mangoes to domestic and regional markets using the facility at Gollapudi market yard. In rare instances this entrepreneur reaches as far as South East Asian and Middle Eastern markets. In addition, there are several commission agents who work on behalf of merchants from northern India. These merchants run fruit and vegetable *mandis* (market places) in cities like New Delhi and Mumbai, from where they supply mangoes to various domestic, regional and international markets. The other groups of private actors are pulp and juice processors and the pickle industry, such as Priya Pickles. Family-run nurseries also come under this category as they constantly experiment with new ways of producing and

marketing mango saplings. Indeed, most mango entrepreneurs surveyed operate informally without any significant sideward linkages to formal R&D systems.

Mango stakeholders rely on information about legislation and certification requirements of importing countries only through tacit learning networks of friends and families. Moreover, the mango growers and exporters were unaware of the SPS Inquiry Point for plant protection that has been established at the Department of Agriculture and Cooperation to handle queries or comments on SPS notifications and regulations issued by other member countries of the WTO. Nevertheless, the APEDA website provides general information about export regulation and approved certifying agencies/laboratories in India. It would appear that this effort to promote codified learning networks through electronic media needs to be integrated with the tacit learning networks of the supply chain actors.

*(iv) Informal sector*

The resource-poor mango growers in Krishna District have struggled for food and livelihood security through income from sale of mangoes. For many farmers mango production is a traditional source of employment throughout the supply chain — production, post-harvest and marketing. Some farmers are self-employed while others work for relatively bigger farmers (See Box 2 below).

---

**Box 2. Illustrations of the importance of mangoes to rural livelihoods**

A 42-year-old woman farmer called Sunita owns 10 acres of land and grows mangoes on 3 acres. She rents a stall in the local market and sells her produce on her own. She also buys mangoes from her neighbours. In 2007 the mango crop was good and she made a good profit.

A 45-year-old-man called Krishna of Agrapalli village owns 1.5 acres of land where he grows mangoes and vegetables. He regularly rents a stall in the local market and sells his produce. To adapt to the seasonality of the mango business, Krishna integrates it with vegetables. Profits from the business are the sole support for his family.

A 16-year-old boy called Bala from a landless family buys mangoes from his neighbours and sells them in the local market. He has done this business for the last two consecutive years. When the mango season is over, he runs other businesses.

A smallholder farmer aged 60, called Nareshnan, works as a commission agent for merchants in northern India. He buys mangoes from his neighbours, often contract mango orchards before flowering, and supply good quality mangoes to the merchants. Once farmers contract out their orchards, the management responsibility goes to the contractor. Nareshnan sells inferior quality mangoes in local market. He has plans to use processing facilities in Gollapudi market yard to export mangos on his own. He, however, was not sure about the sources of information to involve in export market.

Note: All real names have been changed in the anecdotes.

Source: *Fieldwork 2006/2007*

All in all, while the formal sector stakeholders as usual engaged in mango related R&D interventions, the poorer section of the rural communities find it hard to extend their tacit learning networks to access information from codified learning networks through sideward linkages. Specifically, the failure to develop sideward linkages created exclusive learning networks, not only between formal and informal sectors but also between influential and less influential actors in rural communities.

#### **4.2 Inter-sectoral stakeholder interaction**

##### *(i) Between the public sector and non-profit private sector*

This is one of the weakest linkages in the system. If the capacity of the non-profit sector were to be developed, it would serve as a strong intermediary to promote sideward linkages between the public sector, exporters, commission agents and mango growers.

##### *(ii) Between the public and for-profit sector*

Vijaya Laxmi rents the facilities at Gollapudi market yard to process mangoes before sending them to regional export markets. Since the 2006 mango season Vijaya Laxmi has used the facilities to supply mangoes to Indian supermarket chains and South East Asian markets but has failed to export the fruit to high-value overseas markets. This observation leads to two, seemingly opposite, interpretations. On the one hand, the entrepreneur fails to successfully access international markets, in spite of the fact that APEDA provides subsidies for exports, and the state government commits to exempt all duties and taxes on inputs for production and processing of mangoes for export from the AEZ. On the other hand, the entrepreneur was successful in utilising the facilities, specifically subsidised for export promotion, to supply mangoes to domestic markets — clearly deviating from the public policy provisions. Such deviant behaviour would serve as a strong case against policy processes that favour export promotion, as smallholder mango growers are unable to prove that they grow mangoes for export markets.

*(iii) Between the non-profit private and for-profit private sector*

This type of learning network appears to have failed in Krishna District, more so due to the lack of interactive learning rather than high-profile ideological differences. The proprietor of Vijaya Laxmi is the president of Vijaya, an association of mango growers. Some Vijaya members claim that the profits made by Vijaya Laxmi should be shared among Vijaya members, while others claim that Vijaya was never involved in the marketing of mangoes. This was one of the reasons for the collapse of the original federation of 16 primary cooperatives with 500 members and its replacement by an (equally dysfunctional) association of 217 members.

*(iv) Between the public sector and informal sector*

The Zonal Research Extension Advisory Committee (ZREAC) sets research priorities at the local level. This committee comprises researchers from the state agricultural university, extensionists from the state Departments of Agriculture and Horticulture, and farmers. The committee meets twice a year, once in the *rabi* (winter crop) and again in the *kharif* (summer crop) season. The District Advisory for Agricultural Transfer of Technology (DAATT), also headed by the state agricultural university, works as a coordinating body among researchers, extensionists and farmers. The state university publishes *Babashaya Panchangam* (a compendium of research findings) in the local language (*Telugu*) on the occasion of the *Telugu* New Year. This compendium and other publications, as well as training, exchange visits and consulting services, are some of the important linkage mechanisms that exist between the public sector and rural communities. The emphasis on codified learning is again a ‘business-as-usual’ practice of client-patron relationships between the two sectors. Interactive learning through linkages between the public and informal sectors is still emerging, although it is not specifically apparent in mango. The state government recently emphasised social mobilisation programmes, including the *Rythy Palalou Sasthrya Betal* (scientists in the farmers’ fields), *Palaloum Bade* (farmers’ field schools), *Chetan Yatra* (farmers’ awareness campaign) that provide interpersonal interaction between scientists and farmers.

*(v) Between the non-profit private sector and informal sector*

Since Vijaya was the only non-profit private sector organisation working on mangoes in the area, it was expected to have close linkages with rural communities. However, its learning networks

are rather limited and exclude smallholder mango growers. In effect, smallholder mango growers are not served in a meaningful way.

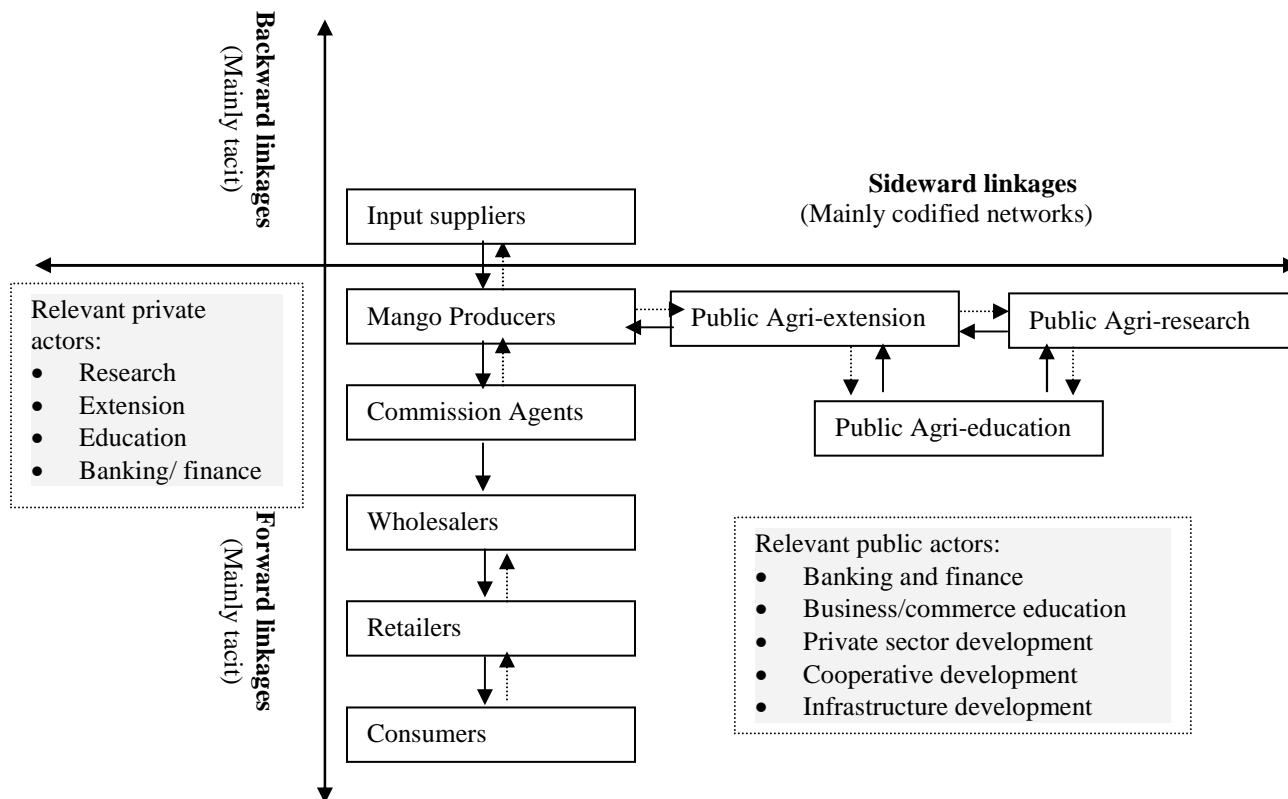
*(vi) Between the for-profit private and informal sectors*

Vijaya Laxmi and commission agents, who also belong to rural communities, could have strong linkages with individual farmers. However, mango growers are not satisfied with the prices they receive from Vijaya Laxmi and commission agents. Linkages are meant more for produce flows along the supply chain than information flows to improve the overall capacity of mango growers. Most farmers opt for pre-harvest contracts with commission agents. These usually-verbal contracts are made well before flowering, and farmers stop taking care of their mango orchards as soon as they have contracted it out. Management responsibility is transferred to commission agents once an agreement has been reached. The practice of handing over management responsibility to commission agents differs from the practice of contract farming, whereby private companies usually provide credit, inputs, technology and other extension services to grow a particular crop and secure a harvest.

The types of learning networks that Vijaya and Vijaya Laxmi are involved in prevent them from accessing increasingly stringent export markets. If the habits and practices around the issues of building innovation capacities, and specifically knowledge mobilisation, are not challenged and changed with strengthening sideward linkages between R&D organisations and informally-operating supply chain actors, Indian mangoes will not only fail to take off in the UK, US and Japanese markets but are also likely to be completely pushed out of the customary regional markets in South East Asia and the Middle East. Figure 2 (see overleaf) provides an image of this scenario; to visualise the challenge of strengthening sideward linkages towards formalising the mango supply chain, the vertical and horizontal axes of the figure should collapse and come into a single axis.



Figure 2. Learning networks along and outside the mango supply chain



Notes:

1. Within the networks of backward, forward and sideward linkages, solid arrows illustrate strong linkages and broken arrows illustrate weak linkages.
2. Shaded boxes on the left and right wing of the diagram respectively present private and public stakeholders that are relevant but currently weakly integrated in the learning networks.

Source: Authors

## 5. CONCLUSIONS AND POLICY SUGGESTIONS

Clearly the story of mango and export production in Krishna district, Andhra Pradesh, is a dismal one. Despite favourable agri-ecological conditions, extensive investment on the part of the state in R&D, technical overseas assistance and the existence of a co-operative organisation designed, *inter alia*, to stimulate technology development the past decade has seen little significant change. This paper has taken the view that an important part of the problem lies in the lack of the necessary learning-based innovation system that underlies integrated technology development. There is now ample evidence from the literature that knowledge networking and building capacities of relevant stakeholders is far more important in contemporary learning-based economies where knowledge is dispersed, fragmented and retained by a myriad of heterogeneous agents, such as public and private stakeholders from policy, research, extension and enterprise domains (Antonelli, 2006). The problem therefore often reduces to promoting collective learning at organisational, network and system levels, especially in how to coordinate context-specific skills, actors, practices, routines, institutions and policies, and integrate multiple streams of technologies and agro-ecological processes (Hall, 2005; Hall, 2007; Prahalad and Hamel, 1990).

Unfortunately our investigation of corresponding patterns of interaction show clearly that this has not happened in the case of mango production in this part of India. Neither the activities of the local cooperative body, nor the considerable activities of the public R&D sector have shown the slightest signs of interaction with economic production. The supply chain remains a purely private sector activity dominated by the commercial interests of *mandi* (large commercial house) operators that seem quite content to rely on traditional markets. Nor has any significant attempt been made to make the (mainly QA) technological efforts necessary to penetrate difficult but potentially lucrative export markets.

Hence if Indian mango stakeholders agree with this reality, what should they do to reform public policy towards achieving national comparative advantage in mangoes? Here we suggest six key principles that policy processes should embrace in one way or other. *Firstly*, neither the tacit learning networks associated with the mango supply chain nor codified learning networks of the public sector R&D organisations have been sufficient to stimulate continuous processes of

innovation needed to cope with ever-changing export market demands. The current preoccupation is mango quality, but this is just one of a series of evolving challenges. It is hard to anticipate what may come, say after another 10 years. It is important, therefore, to develop dynamic learning networks of the relevant stakeholders with their technological, organisational and institutional capacities to deal with unpredictably evolving challenges. *Such networks should be able to connect tacit and codified learning activities that are appropriate to mango stakeholders and at the same time fit with local conditions, such as the traditional norms and values of Indian society.*

*Secondly*, one element of the current problem is that well-conceived public policy to deal with quality issues is not suited to the institutional setting of the mango trade and this makes such a policy-based approach to quality inoperable. For example, the poor quality of mangoes arriving at destinations was mainly due to a short shelf-life, often determined by defective pre- and post-harvest practices, improper grading and intentional certification of lower quality fruits for export. The mango growers wish to sell all their mangos at once, regardless of quality, but exporters will buy only high quality mangoes. Interactive learning to improve the quality of mangoes to meet the export market requirements is lacking. *A key policy principle to deal with this is to foster effective sector coordination through broad-based stakeholder collaboration.*

*Thirdly*, although a sector coordinating body might serve as a facility to encourage integration of tacit and codified learning networks (both intra-sectoral) and inter-sectoral), it cannot be effective until functional linkage policies are developed for scientific research, technology development, technology use, access to information, inputs and credits, financing innovations, and marketing produce. Coordinating bodies, such as the Zonal Research Extension Advisory Committee (ZREAC) for research priority setting and the District Advisory for Agricultural Transfer of Technology (DAATT), which are discussed in the case study, are not enough for complex problems like the one faced by Indian mangoes. *A key policy principle to bring structural as well as functional changes to foster sector coordination is to focus directly on the mango sector.*

*Fourthly*, investment in infrastructure development and technological innovations alone is obviously insufficient to achieve national competitiveness in the mango export sector. The weak

or missing learning networks are undermining the capacity of the sector to innovate in response to changing circumstances. There is a need to integrate R&D organisations with a tacitly-operating mango supply chain, but it is not an easy task. It needs several pilot projects and institutional experiments. For example, a mango export challenge fund with specific rules about partnerships with R&D organisations could be tested to develop linkages between codified learning networks of the public sector organisations and the tacit learning networks of private stakeholders along the mango supply chain. *A key policy principle to establish linkages beyond R&D systems is providing a safe policy environment to experiment with new organisational structures and institutional set-ups so that stakeholders are willing to try new things and specifically new learning networks.*

*Fifthly*, investing in long-term collaborative research, development and innovation activities is essential, but such a collaboration that operates under classic R&D projects, such as the testing of sea shipment protocol, is obviously not enough. For example, farmers had a hard time internalising the technical recommendations of the scientists, such as temperature and carbon dioxide regulations in the shipping vessels. The later phases of the project tried to incorporate and highlight the institutional issues, but the policy debates were limited to the academic community and, to a small extent, with policymakers. While the formal sector did not adequately pursue the approach, the informal sector stakeholders often remained isolated from this debate. *A key policy principle to foster long-term interest in learning networks is to promote policy processes that are responsive to the prevailing production practice and shape emergent policies.*

*Finally*, mango exporters in India involved traditional practices of supply chain management deploying a cadre of commission agents in rural villages. Not only commission agents but also their merchants compete with each other while procuring mangoes from farmers and shipping to domestic and regional markets. In the increasingly globalised world, the main source of core national competence comes through cohesion and collaboration at the national level, but the size and diversity of India it is often blamed when this is not achieved. *A key policy principle to achieve national competence is to focus on ways to promoting collective action, collective intelligence and collective learning.*

To sum up, neither the codified learning networks of the public organisations nor the tacit learning networks of the mango supply chain actors have been sufficient in developing an upward spiral of learning networks, fostering interactive learning and collective intelligence and spurring continuous processes innovations. The tacit learning networks of supply chain actors in low-income countries that focus on produce flows are necessary but not sufficient to address basic quality issues of the importing countries. This, coupled with an excessive focus on codified learning networks exclusively within the public sector, contributes to a downward spiral of learning as the informal sector stakeholders find it difficult to engage with codified knowledge. To build capacity for an upward spiral of knowledge networks and spur continuous processes of innovation, it is imperative to integrate tacit and codified learning networks among relevant stakeholders. In other words, national competitiveness in high-value agricultural commodities like mango, aromatic rice, medicinal plants, spices and lac come from capacities to innovate, not from agro-ecological comparative advantage alone.

## REFERENCES

- Antonelli, C. 2006. "The Business Governance of Localized Knowledge: An Information Economics Approach for the Economics of Knowledge." *Industry and Innovation* 13:227-261.
- Eisenhardt, K.M. and J. A. Martin. 2000. "Dynamic capabilities: what are they?" *Strategic Management Journal* 21:1105–1121.
- Ernst, D., T. Ganiatsos, T. and L. Mytelka (eds.) 1998. *Technological Capabilities and Export Success in Asia*. Routledge, London and New York.
- Hall, A. J. 2005. "Capacity Development for Agricultural Biotechnology in Developing Countries: An Innovation Systems View of What it is and How to Develop it." *International Journal of Development* 17:611-630.
- Hall, A. J. 2007. "Challenges to Strengthening Agricultural Innovation Systems: Where Do We Go From Here?" *UNU-MERIT Working Papers* #2007-38.
- Hall, A. J., M.V.K. Sivamohan, N G Clark, G. Bockett, S. Taylor, and. 2001a. "Why Research Partnership Really Matter: Innovation Theory, Institutional Arrangements and Implications for Developing New Technology for the Poor." *World Development* 29:783-797.
- Hall, A. J., M. V. L. Sivamohan, N. G. Clark, S. Taylor and G. Bockett. 1998. Institutional developments in Indian agricultural R&D systems: emerging patterns of public and private sector activities. *Science, Technology and Development, Vol.16, No.3, pp. 51-76*
- Hall, A, N. G. Clark, R. V. Sulaiman, and S. Taylor. 2002. "Institutional learning through technical projects: Horticultural technology R&D systems in India." *The International Journal of Technology Management and Sustainable Development* 1:25-39.
- Hall, A. J., N. G. Clark, S. Taylor and R. V. Sulaiman. 2001b. "Institutional learning through technical projects: Horticultural technology R&D systems In India." *AgREN Network Paper* 111.
- Hambly Odame, H., J. Fitzsimons, L. P. Pant, and P. Sykanda. 2007. " Innovations in Farm Families and Rural Communities: Capacity Development for Broadband Use in Southern Ontario." in *Working Paper Spring 2007*. Toronto/Guelph: Ontario Ministry of Government Services/University of Guelph.
- Lall, S. 1992. "Technological capabilities and industrialization." *World Development*, 20 (2): 165–186.
- Lall, S. 2004. Stimulating industrial competitiveness in Sub-Saharan Africa: Lessons from East Asia on the role of FDI and technology acquisition. Paper prepared for the World Bank for the NEPAD/TICAD Conference on Asia-Africa Trade and Investment. Tokyo International Conference on African Development 31October–2 November 2004.
- Lundvall, B-A. 1992. *National systems of innovation: towards a theory of innovation and interactive learning*. London: Pinter Publishers.
- Malerba, F. 2004. "Sectoral Systems: How and Why Innovation Differs across Sectors", in *Oxford Handbook of Innovation*, pp. 380-407. Oxford: Oxford University Press
- Morgan P. 2005. "The Idea and Practice of Systems Thinking and Their Relevance for Capacity Development." Maastricht: European Centre for Development Policy Management.

- Nonaka, I. 1991. "The knowledge-creating company." *Harvard Business Review* November-December 1991:96-104.
- Nonaka, I, and H Takeuchi. 1995. *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford: Oxford University Press.
- Pant, L. P., and H Hambly Odame. 2006. "Multi-stakeholder deliberation on dialectical divides: an operational principle of the Systems of Innovation." *Knowledge Management for Development* 2:60-74.
- Prahalad, C. K., and G. Hamel. 1990. "The Core Competence of the Corporation." *Harvard Business Review* May-June 1990.
- Seufert, A, G von Krogh, and A Bach. 1999. "Towards knowledge networking." *Journal of Knowledge Management* 3:180-190.
- Teece, D.J., G. Pisano and A. Shuen. 1997. "Dynamic capabilities and strategic management." *Strategic Management Journal* 18(7):509-533.
- Vijaya, N, A. Bhagwan, V. Anitha, and A. Girwani. 2003. *Advances of Mango Research*. Andhra Pradesh, India: Fruit Research Station, Acharya N.G. Ranga Agricultural University.
- World Bank. 2007. *Enhancing Agricultural Innovation: How to Go Beyond the Strengthening of Research Systems*. Washington, D. C.: The World Bank.
- Zeven, A. C, and P. M. Zhukosky. 1975. *Dictionary of cultivated plants and their centres of diversity*. Wageningen, The Netherlands: Centre for Agricultural Publishing and Documentation.

## The UNU-MERIT WORKING Paper Series

- 2008-01 *Science, Technology and Development: Emerging concepts and visions* by Luc Soete
- 2008-02 *Reframing technical change: Livestock Fodder Scarcity Revisited as Innovation Capacity Scarcity. Part 1. A Review of Historical and Recent Experiences* by Andy Hall, Rasheed Sulaiman V., Mona Dhamankar, Peter Bezkorowajnyj & Leela Prasad
- 2008-03 *Reframing technical change: Livestock Fodder Scarcity Revisited as Innovation Capacity Scarcity. Part 2. A Framework for Analysis* by Andy Hall, Rasheed Sulaiman, V. and Peter Bezkorowajnyj
- 2008-04 *Reframing technical change: Livestock Fodder Scarcity Revisited as Innovation Capacity Scarcity. Part 3. Tools for Diagnosis and Institutional Change in Innovation Systems* by Andy Hall, Rasheed Sulaiman and Peter Bezkorowajnyj
- 2008-05 *Is Inter-Firm Labor Mobility a Channel of Knowledge Spillovers? Evidence from a Linked Employer-Employee Panel* by Mika Maliranta, Pierre Mohnen & Petri Rouvinen
- 2008-06 *Financial Constraints and Other Obstacles: Are they a Threat to Innovation Activity?* By P. Mohnen, F.C. Palm, S. Schim van der Loeff and A. Tiwari
- 2008-07 *Knowledge-based productivity in 'low-tech' industries: evidence from firms in developing countries* by Micheline Goedhuys, Norbert Janz and Pierre Mohnen
- 2008-08 *The Voyage of the Beagle in Innovation Systems Land. Explorations on Sectors, Innovation, Heterogeneity and Selection* by Martin Srholec & Bart Verspagen
- 2008-09 *Crafting Firm Competencies to Improve Innovative Performance* by Boris Lokshin, Anita van Gils & Eva Bauer
- 2008-10 *The Economics and Psychology of Personality Traits* by Lex Borghans, Angela Lee Duckworth, James J. Heckman & Bas ter Weel
- 2008-11 *Embedding Research in Society: Development Assistance Options for Supporting Agricultural Innovation in a Global Knowledge Economy* by Andy Hall
- 2008-12 *Playing in Invisible Markets: Innovations in the Market for Toilets to Harness the Economic Power of the Poor* by Shyama V. Ramani
- 2008-13 *Explaining Success and Failure in Development* by Adam Szirmai
- 2008-14 *Running The Marathon* by William Cowan, Robin Cowan and Patrick Llerena
- 2008-15 *Productivity effects of innovation, stress and social relations* by Rifka Weehuizen, Bulat Sanditov and Robin Cowan
- 2008-16 *Entrepreneurship and Innovation Strategies in ICT SMEs in Enlarged Europe (EU25)* by Kaushalesh Lal and Theo Dunnewijk



- 2008-17 *Knowledge Transfers between Canadian Business Enterprises and Universities: Does Distance Matter?* By Julio M. Rosa & Pierre Mohnen
- 2008-18 *Multinationals are Multicultural Units: Some Indications from a Cross-Cultural Study* by Nantawan Noi Kwanjai & J. Friso den Hertog
- 2008-19 *The Innovativeness of Foreign Firms in China* by Branka Urem, Ludovico Alcorta and Tongliang An
- 2008-20 *Beyond the emission market: Kyoto and the international expansion of waste management firms* by Ionara Costa, Asel Doranova and Geert-Jan Eenhoorn
- 2008-21 *The 'making of' national giants: technology and governments shaping the international expansion of oil companies from Brazil and China* by Flavia Carvalho and Andrea Goldstein
- 2008-22 *If the Alliance Fits . . . : Innovation and Network Dynamics* by Robin Cowan & Nicolas Jonard
- 2008-23 *Facing the Trial of Internationalizing Clinical Trials to Developing Countries: With Some Evidence from Mexico* by Fernando Santiago-Rodriguez
- 2008-24 *Serving low-income markets: Rethinking Multinational Corporations' Strategies* by Shuan SadreGhazi and Geert Duysters
- 2008-25 *A percolation model of eco-innovation diffusion: the relationship between diffusion, learning economies and subsidies* by Simona Cantono and Gerald Silverberg
- 2008-26 *New Europe's Promise for Life Sciences* by Sergey Filippov and Kálmán Kalotay
- 2008-27 *A closer look at the relationship between life expectancy and economic growth* by Théophile T. Azomahou, Raouf Boucekkine, Bity Diene
- 2008-28 *Regional Capital Inputs in Chinese Industry and Manufacturing, 1978-2003* by Lili Wang & Adam Szirmai
- 2008-29 *Worker remittances and government behaviour in the receiving countries* by Thomas Ziesemer
- 2008-30 *Strategic motivations for Sino-Western alliances: a comparative analysis of Chinese and Western alliance formation drivers* by Tina Saebi & Qinqin Dong
- 2008-31 *Changing Configuration of Alternative Energy Systems* by Radhika Bhuyan and Lynn Mytelka

- 2008-32 *Promoting clean technologies: The energy market structure crucially matters* by Théophile T. Azomahou, Raouf Boucekkine, Phu Nguyen-Van
- 2008-33 *Local Knowledge Spillovers, Innovation and Economic Performance in Developing Countries: A discussion of alternative specifications* by Effie Kesidou and Adam Szirmai
- 2008-34 *Wage effects of R&D tax incentives: Evidence from the Netherlands* by Boris Lokshin and Pierre Mohnen
- 2008-35 *Cross-border Investment and Economic Integration: The Case of Guangdong Province and Hong Kong SAR* by Naubahar Shari and Can Huang
- 2008-36 *Radical versus non-radical inventions* by Wilfred Schoenmakers, Geert Duysters & Wim Vanhaverbeke
- 2008-37 *Localized Innovation, Localized Diffusion and the Environment: An Analysis of CO<sub>2</sub> Emission Reductions by Passenger Cars, 2000-2007* by Bart Los and Bart Verspagen
- 2008-38 *The economic impact of AIDS in sub-Saharan Africa* by Théophile T. Azomahou, Raouf Boucekkine, Bity Diene
- 2008-39 *Further results on bias in dynamic unbalanced panel data models with an application to firm R&D investment* by Boris Lokshin
- 2008-40 *A multilevel analysis of innovation in developing countries* by Martin Srholec
- 2008-41 *Experimentation with strategy and the evolution of dynamic capability in the Indian Pharmaceutical Sector* by Suma Athreye, Dinar Kale & Shyama V. Ramani
- 2008-42 *The Impact of Social Capital on Crime: Evidence from the Netherlands* by I.Semih Akcomak and Bas ter Weel
- 2008-43 *Portrait of an Odd-Eyed Cat: Cultural Crossing as a Trademark for a Dutch-Thai Strategic Alliance* by Nantawan Noi Kwanjai & J Friso den Hertog
- 2008-44 *The challenge of measuring innovation in emerging economies' firms: a proposal of a new set of indicators on innovation* by Luciana Manhães Marins
- 2008-45 *Intra-firm Technology Transfer and R&D in Foreign Affiliates: Substitutes or Complements? Evidence from Japanese Multinational Firms* by Rene Belderbos, Banri Ito, Ryuhei Wakasugi
- 2008-46 *To Be or Not to Be at the BOP: A One-North-Many-Souths Model with Subsistence and Luxury Goods* by Adriaan van Zon and Tobias Schmidt

- 2008-47 *Habit Formation, Information Exchange and the Social Geography of Demand* by Zakaria Babutsidze and Robin Cowan
- 2008-48 *Agenda Disputes and Strategic Venue Preferences: The Doha Crisis and Europe's Flight to Regionalism* by Francisco P. Toro
- 2008-49 *The determinants of the outward foreign direct investment of China and India: Whither the home country?* by Paz Estrella Tolentino
- 2008-50 *Comparing Chinese and the Indian Software MNCs: Domestic and Export Market Strategies and their Interplay* by Jorge Niosi and F. Ted Tschang
- 2008-51 *Internationalising to create Firm Specific Advantages: Leapfrogging strategies of U.S. Pharmaceutical firms in the 1930s and 1940s & Indian Pharmaceutical firms in the 1990s and 2000s* by Suma Athreye and Andrew Godley
- 2008-52 *Internationalization and Technological Catching Up of Emerging Multinationals: A Case Study of China's Haier Group* by Geert Duysters, Jojo Jacob and Charmianne Lemmens
- 2008-53 *India's Outward Foreign Direct Investments in Steel Industry in a Chinese Comparative Perspective* by Nagesh Kumar and Alka Chadha
- 2008-54 *Internationalization Trajectories – a cross country comparison: Are Large Chinese and Indian Companies different?* By Fabienne Fortanier and Rob van Tulder
- 2008-55 *Europeanisation strategy of Chinese companies: It's perils and promises* by Sergey Filippov and Tina Saebi
- 2008-56 *Public capital, income distribution and growth* by Yoseph Yilma Getachew
- 2008-57 *Growth with Endogenous Migration Hump and the Multiple, Dynamically Interacting Effects of Aid in Poor Developing Countries* by Thomas Ziesemer
- 2008-58 *Nanotechnology Publications and Patents: A Review of Social Science Studies and Search Strategies* by Can Huang, Ad Notten and Nico Rasters
- 2008-59 *When a good science base is not enough to create competitive industries: Lock-in and inertia in Russian systems of innovation* by Rajneesh Narula and Irina Jormanainen
- 2008-60 *Alliance block composition patterns in the microelectronics industry* by Geert Duysters & Charmianne Lemmens
- 2008-61 *FDI and Innovation as Drivers of Export Behaviour: Firm-level Evidence from East Asia* by Ganeshan Wignaraja

- 2008-62 *Russia's Emerging Multinationals: Trends and Issues* by Sergey Filippov
- 2008-63 *Working remittances, migration, accumulation and growth in poor developing countries* by Thomas H.W. Ziesemer
- 2008-64 *The Innovative Performance of Alliance Block Members: Evidence from the Microelectronics Industry* by Geert Duysters, Charmianne Lemmens, Wilko Letterie and Wim Vanhaverbeke
- 2008-65 *Formal and informal external linkages and firms' innovative strategies. A cross-country comparison* by Isabel Maria Bodas Freitas, Tommy Clausen, Roberto Fontana and Bart Verspagen
- 2008-66 *The Heterogeneity of MNC' Subsidiaries and Technology Spillovers: Explaining positive and negative effects in emerging economies* by Anabel Marin and Subash Sasidharan
- 2008-67 *EU enlargement and consequences for FDI assisted industrial development* by Rajneesh Narula and Christian Bellak
- 2008-68 *Private Capacity and Public Failure: Contours of Livestock Innovation Response Capacity in Kenya* by Ekin Keskin, Mirjam Steglich, Jeroen Dijkman and Andy Hall
- 2008-69 *Learning Networks Matter: Challenges to Developing Learning-Based Competence in Mango Production and Post-Harvest in Andhra Pradesh, India* by Laxmi Prasad Pant, Helen Hambly Odame, Andy Hall and Rasheed Sulaiman V.