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SUMMARY OF THE STUDY ON ENHANCING INNOVATION IN THE AGRI-FOOD SECTOR IN UGANDA: SECTOR STUDIES ON ROBUSTA COFFEE PLANTING MATERIAL AND TROPICAL FRUIT PROCESSING

prepared by the Secretariat

1. The Annex to this document contains a summary of the study on “Enhancing Innovation in the Agri-Food Sector in Uganda: Sector Studies on Robusta Coffee Planting Material and Tropical Fruit Processing” undertaken in the context of the Project on Intellectual Property (IP) and Socio-Economic Development – Phase II (CDIP/14/7).
2. This study is as available as WIPO Economic Research Working Paper No. 42 (at http://www.wipo.int/econ_stat/en/economics). It has been prepared by the WIPO Secretariat, international experts and in collaboration with the Government of Uganda.

3. The CDIP is invited to take note of the information contained in the Annex to the present document.

[Annex follows]

ENHANCING INNOVATION IN THE AGRI-FOOD SECTOR IN UGANDA: STUDIES ON ROBUSTA COFFEE PLANTING MATERIAL AND TROPICAL FRUIT PROCESSING

In 2016, the Ugandan Government requested the World Intellectual Property Organization (WIPO) to conduct a study as part of the 2nd phase of the Project on *IP and Socio-Economic Development* under the Committee on Development and Intellectual Property (CDIP).

Over the last 18 months, WIPO's Economics and Statistics Division has conducted the study on "Innovation in the agro-based industry in Uganda: An empirical study of agricultural innovation in a low-income economy", in conjunction with its main authors Travis J. Lybbert (University of California, Davis, USA) and Gracious Diiro (Makerere University, Kampala, Uganda), and with inputs from Dick Kawooya (University of South Carolina, USA) and Pierre Mohnen (UNU-MERIT, Maastricht) acted as peer reviewer.¹ The project was conducted in cooperation with the Uganda National Council for Science and Technology (UNCST) and the Uganda Registration Services Bureau (URSB). It is the first study of WIPO's Economics and Statistics Division in a least-developed country.

This document summarizes the implementation and main outcomes of the study.

1. CONTEXT AND STUDY OBJECTIVES

In low-income economies, agriculture and related downstream agri-food activities often constitute the backbone of economic activity; this sector also employs the majority of the labor force, particularly in rural areas. As a consequence, the potential welfare effects of improved agri-food innovation – from upstream agricultural production to downstream post-harvest processing and marketing – could be substantial, notably by creating opportunities for investment, broader sectoral growth and poverty alleviation.

Despite the sector's importance in developing countries, however, the agri-food value chain typically suffers from low productivity and low rates of innovation. For purposes of this study, these agricultural value chains range from the supply of agricultural inputs such as seeds by input suppliers, wholesalers and retailer agro-dealers, to farming activities such as planting, farming and harvesting, to post-harvest activities such as bulking and processing of raw output, branding and marketing of value-added agri-food products that reach end consumers. Constraints along the agricultural value chain commonly curtail the incentives to innovate and adopt new and promising technologies. Policymaking in this area has not paid much attention to innovation and IP, as they are associated with high-technology sectors.

This report addresses this challenge by exploring the role of innovation in the Uganda agri-food sector. The study addresses two questions:

- What constraints prevent input supply chains in Uganda from delivering agricultural innovation in order to improve productivity and profitability?
- What constraints and disincentives prevent innovation and its adoption in the Ugandan agro-processing sector?

In doing so, the study aims to (i) improve our understanding of the role of innovation and IP in the Ugandan agricultural sector and (ii) to identify business, technical, institutional, and policy

¹ The analysis and the original background paper benefited from the contributions and research assistance of Samuel Bird, Jack Gregory and Oscar Barriga Cabanillas (PhD students, University of California, Davis). Several other experts contributed directly to this research, including Research Assistants at Makerere University Sarah Mirembe, Diana Namwanje and Kwagala Innocent, WIPO research assistant Kritika Saxena, UC Davis research assistants Amanda Gilchrist and Alicia Hsiao, and the participants of two workshops. The coffee study benefited from the expertise and insights of Emma Joynson-Hicks and Martin Fowler.

constraints that limit or otherwise dilute the impact of agricultural research and development (R&D), innovation and technology diffusion in the sector.

PROCESS AND METHODOLOGICAL DESIGN

The study was launched in Kampala in cooperation with UNCST and URSB on October 11, 2016 in coordination with Mr. Bemanya Twebaze, Registrar General, URSB and Mr. Julius Ecuru, Assistant Executive Secretary, UNCST, as Ugandan government counterparts.

The desk research, field work and below empirical strategies executed for this study were complemented and validated by two study workshops organized in Kampala (Uganda) in cooperation with UNCST and the URSB. On October 13, 2016, a first study workshop with coffee and fruits processing value chain actors and experts took place. In December 2017, a feedback and validation workshop was organized. The objective of this concluding workshop was to allow national stakeholders and experts to provide a second round of comments on quasi-final draft studies. Comments and suggestions helped to finalize the study and to refine the policy recommendations delivered to the Government of Uganda.

The study project and corresponding methodological design consisted of two elements.

- First, the study applied a conceptual framework assessing innovation in the agri-food sector in Uganda. Innovation barriers to agricultural value chain innovation were identified both by conducting desk research, by studying the academic literature and by working with available secondary data, that is, household and business enterprise surveys, the agricultural census, and, where relevant, available innovation and IP statistics.
- Second, empirical studies were conducted in two agricultural sub-sectors of Uganda, namely, (i) the Robusta Coffee Planting Material Pipeline (CPMP) and (ii) the Tropical Fruit Processing Sector.

Research design - Robusta Coffee Planting Material Pipeline

The Robusta CPMP was studied as a critical link between upstream R&D of improved coffee varieties and downstream coffee farmers that shapes the benefits flowing to consumers through international coffee value chains, the returns on upstream R&D investments and the incentives that exist within the agricultural innovation system. A key question was how specific features of agricultural input supply chains limit the availability of improved inputs and transmit production potential to producers and value to consumers. In this particular case, agricultural inputs are first and foremost coffee seedlings – and thus planting material – but also fertilizer, pesticides and other inputs.

To understand the current constraints and opportunities in the Robusta CPMP, a detailed survey of Coffee Nursery Operators (CNOs) was designed and implemented. CNOs are used by the Ugandan Coffee Development Authority to propagate and disseminate coffee planting material through their vast network. First, key-informant interviews with actors throughout the CPMP took place to finalize the sampling frame in three Ugandan regions with significant Robusta coffee production and to elaborate a suitable survey instrument. The final sample consisted of 178 CNOs spread across 14 districts. About two-thirds of respondents were owners of their operation; the remaining third were managers and employees of the nursery. To explicitly identify clusters of like nurseries, cluster analysis was used. This is a standard exploratory data analysis methodology for grouping observations based on similarities among multiple pre-defined dimensions.

The questionnaire was designed to capture important differences among CNOs, including the size, age, cost structure, planting material sources, and the customers of the nurseries. It also included several questions about “best practices” to serve as a proxy for both the knowledge of the CNO and the quality of the planting material they produce.

The survey work was complemented by field visits to CNOs, by interviews of counterparts at the Ugandan Coffee Research Institute and with managers from a number of large private in-house coffee nurseries.

Research design - Tropical Fruit Processing Sector

The tropical fruit processing sector, in turn, was studied, with a particular view on the sector’s technology adoption, technology modification and improvement by the concerned value chain actors. The focus was primarily on private sector firms that procure primary products from Ugandan farmers and cooperatives, in particular to analyze how value is added in the form of processing, packaging or distribution.

In that light, the analyzed components of the fruit processing value chain in Uganda ranged from the supply of fruit (by farmers), wholesaling and retailing of fresh fruits to processors (by whole fruit intermediaries), fruit processing, packaging and branding agencies, and distribution of value-added fruit products that reach end consumers, and R&D institutions. During the first field visits to the Kayunga Fruit Processing Cluster and to the industrial areas of Jinja, preliminary decisions on primary data to be collected via a survey of farm units and structured interviews of food processing clusters were taken.

The core of this sector study however consisted of case studies of selected Ugandan fruit processors, mostly on the basis of expert interviews with employees of fruit processing companies with a view to identifying the main drivers and barriers to innovation. Meetings with farmers, cooperatives and public research institutes took place to complement these interviews.

2. LESSONS LEARNED

This was the first study of the Economics and Statistics Division in a least-developed economy, which presented a unique learning opportunity that is particularly relevant to the CDIP.

The study of the agricultural sector in a low-income economy poses a number of challenges for empirical research. The data availability on innovation activities in this sector is sparse. Typical innovation data sources such as R&D, innovation surveys or IP statistics - the corner stone of similar studies in developed economies - are either non-existent; formal innovation expenditures are not undertaken; actors rarely seek or rely on particular IP rights.

Lacking secondary data sources, research needs to rely on the collection of primary data via surveys or interviews. Yet, the implementation of surveys or other forms of methods to collect primary data are equally challenging. The agricultural sector is diverse and geographically spread out; respondents have widely varying educational backgrounds and often lack explicit records of past and future investments or transactions. Good survey design, proper sampling and experience with running such surveys in the context of low-income economies and rural areas are key to obtain representative results.

Indeed, in some instances, case studies based on structured interviews are the only viable research strategy. Properly designed case studies which are based on structured interviews

can yield interesting and pertinent insights. At the same time, for the most part case studies do not generate large solid databases enabling follow-on quantitative research; they are more qualitative in nature.

Another important point is that, in the great scheme of things, the role of IP is mostly low or negligible in such settings. Studying IP statistics, or any observed behavior with respect to patents, trademarks, plant varieties or other forms of IP, is generally not an option. This was also a core finding in other economics work conducted for the CDIP to respond to Development Agenda Recommendation 34 on the role of IP in the informal sector, see CDIP/8/3 REV./STUDY/INF/1). Rather the task is to identify potential for IP use and elaborate on potential barriers and future outcomes. This is strictly different to empirical studies in high-income countries which aim to provide empirical assessments of the current, and not prospective, use of IP.

These circumstances are typical for a vast majority of research settings in least-developed countries. As a consequence, this study was a welcome opportunity to improve the application of quantitative and qualitative research methods in the context of low-income countries. It benefitted from the guidance of one of the leading agricultural economists, Prof. Lybbert, and his Ugandan research counterparts who – with their experience and local network of experts and persons trained to conduct these surveys – acted as experts for the study.

3. SUMMARY OF STUDY RESULTS

Innovation Constraints in the Agri-Food Sector of Uganda

In sum, the study found that Ugandan farmers and producers, like their counterparts throughout much of Africa, face many innovation bottlenecks, including unreliable growing conditions; natural disasters; liquidity constraints; uninsured production and market risk; lack of access to or poor quality of agricultural inputs; lack of training, information, and awareness; limited output market opportunities; and limited spillovers from public agricultural R&D.

Barriers to entry disadvantage small-scale producers that have little capital to invest, use traditional techniques, and depend on family labor. Such an environment causes difficulties in meeting product standards and makes it difficult to compete with larger-scale, more efficient, and more technologically sophisticated multinational corporations. Without market knowledge or competitive products, many small-scale producers fail to take advantage of larger markets or the techniques that could help them do so.

Furthermore, coordination failures are typically the result of a trust deficit or asymmetric relationships. This often leads to excessive risk mitigation, causing inefficiencies and reduced value addition. Moreover, for commodities with low value added, such as raw agriculture staples, partners in high-income countries capture the high-value portion of the chain, thereby excluding small-scale farmers from participating in larger markets. These obstacles constrain the ability of lower-end chain actors from innovating in a way that not only increases their agricultural productivity but also upgrades their systems.

Importantly, to the extent that farm-level constraints discourage farmers from adopting new technology, they also discourage private-sector investments in the development, distribution, and marketing of improved agricultural inputs and other technologies. Downstream markets for agricultural outputs are similarly suppressed by low farm productivity and concerns about the stability and quality of outputs.

Further sector specific innovation obstacles were identified as part of the sector studies.

Innovation Constraints as identified in the Sector Studies

Robusta Coffee Planting Material Pipeline

Innovation constraints in the Ugandan CPMP stem from the current environment that favors quantity over quality and which fails to incentivize investments and upgrading along the value chain and planting pipeline. The study found that smallholder farmer constraints limit investments through both capital and liquidity constraints and risk rationing. Capacity and capital constraints among nursery operators similarly restrict investments in improved practices. Institutional, cultural and perhaps informational constraints make contracting with private sector entities such as tissue culture laboratories sparse and ineffective as the basis for public-private partnerships. Finally, in many cases, upstream innovation in inputs (e.g., improved germplasm) involves significant public sector support, but the ultimate return on this public R&D is constrained by the inefficiency of the input supply chains that deliver these inputs to producers.

Tropical Fruit Processing

Constraints in the fruit processing sector also include an unfavourable innovation and policy environment, coupled with inferior and unpredictable fruit production and weak financial and organization linkages throughout the value chain. Liquidity, credit and capital constraints among processors combined with expensive equipment and unavailable access to spare parts complicate the situation. Limited access to market opportunities (local, regional and international market opportunities) especially the small-scale processors and the new entrants, hamper sales and profits of the firms and negate their investment in better innovations. In particular stronger linkages would be needed between the National Agriculture Research Organization (NARO), agricultural engineering units in academic institutions, the local artisans, processors and farmers to model and develop suitable low cost machinery for fruit processing. New models of cooperation are also required to overcome the lack of access to more efficient packaging materials and machines.

On the specific issue of IP, and in the case of both sectors, the study finds that more innovation in the agro-processing subsector in Uganda could result from a more active use of IP by agribusinesses. Currently, only a few agribusinesses in Uganda formally register their innovation as IP, leaving many innovators unprotected mainly due to lack of awareness of the benefits of innovation, the benefits of IP, and high transaction costs associated with IP acquisition. A few initiatives such as the Innovation Systems and Clusters Program Uganda (ISCP-U) at Makerere University are currently facilitating the process of acquiring IP but lack adequate resources to provide support to the many entrepreneurs and firms that need assistance.

CONCLUSION

Uganda has a growing focus on innovation as a driver of development in some of its key sectors. Within the agricultural sector, Uganda is prioritizing investments in modern biosciences, with a particular focus on disease diagnostics, vaccine development, crop productivity improvement, and value addition. The government is also taking steps to improve institutional capacity, as evident through the growing importance of work of R&D institutions.

To stimulate further growth, the government should emphasize the creation of an enabling environment for agri-food innovation by addressing the above-mentioned obstacles that impede value addition and innovation in agri-food systems.

To conclude the study proposes a number of policy options, which cover typical issues such as needs for improved policy coordination, as well as specific policy suggestions, for example to improve the knowledge transfer and innovation environment for farmers, also furthering the spillovers from public R&D to the agri-food sector. The study also formulates suggestions on IP policy and how to create and maintain more effective IP institutions with a view to fostering increased agri-business innovation.

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