

Water Issue Brief - 27

Putting research knowledge into action

Adaptive Innovation Scaling – Pathways from Small-scale Irrigation to Sustainable Development

Determining the marketing margin for irrigation technologies in Ghana: A supply chain perspective

The context

In Ghana, only 1.7% of the agricultural land is irrigated (Baldwin and Stwalley III 2022). Climatic changes and a growing population make it imperative to intensify irrigation, particularly farmer-led irrigation, to ensure food security (Minh et al. 2021). However, farmers' investment in irrigation equipment is constrained by, for example, the high initial cost, inadequate financial services and poor market access. Determining the marketing margin for irrigation technologies can help identify inefficiencies in the supply chain, guide interventions to reduce these inefficiencies, and ultimately increase farmers' access to and investment in irrigation technologies.

Key messages

- The cost-benefit structure in the supply chain influences the strategies adopted by different actors to market their products and services, leading to different marketing margins. A high marketing margin indicates a high purchase price for end users.
- Three types of irrigation technologies were reviewed. The estimated marketing margin ranges between 5% and 25% for solarpowered irrigation pumps, 5% and 20% for fuel-powered pumps, and 10% and 20% for drip irrigation kits and systems.
- Reducing the marketing margin and cost of the irrigation technologies reviewed requires better coordination of interventions by development actors, creation of an irrigation master plan at the government level and investment in local manufacturing.

Key issues

Despite the large volume of literature on marketing margins, few studies have focused on agricultural input supply chains, including irrigation technologies. Moreover, studies focusing on one actor in the supply chain (e.g., Mandizvidza 2017) may lead to inadequate information regarding the cost-benefit structure that determines the marketing margin of a particular irrigation technology, as well as providing an incomplete picture of the efficiency of the market for that technology. Understanding the cost-benefit structure and enabling environment in which the supply chain is embedded is, therefore, essential not only for assessing market efficiency but also for designing inclusive and effective interventions to reduce inefficiencies along the supply chain.

To begin filling this research gap, the International Water Management Institute (IWMI) analyzed the supply chain for solar- and fuel-powered irrigation pumps, and drip irrigation kits and systems in Ghana. The study (Ofosu et al. 2023) was conducted under the Innovation Lab for Small-Scale Irrigation (ILSSI) project and the CGIAR Research Program on Water, Land and Ecosystems (WLE), which ended in December 2021. The aim of the study was to characterize the actors involved throughout the process from importing the irrigation technologies to supplying them to end users, identify the cost-benefit structure in the supply chain and the factors influencing this structure, and the effect of this structure on the marketing margin and sales price. The results of the study were used as a basis to make recommendations for an enabling environment that is more favorable to the diffusion and adoption of the irrigation technologies reviewed.



A farmer operating a sprinkler in Michel Camp, Greater Accra Region, Ghana (photo: Barbara van Rijn).

What is a marketing margin?

A marketing margin refers to the difference between what a company pays for a product and what it charges for the product. The term 'marketing margin' is used because it is often the role of a distributor or other actor in the supply chain to market the product, even if it does not produce the product. There may be several such actors, including manufacturers, importers and retailers, each of whom incur costs and gain financial, social and other benefits as the product moves along the supply chain. A marketing margin is distinct from a profit margin, which is the percentage of the final sales price that a company earns as direct income. However, companies use the marketing margin as a way of measuring profitability. A high marketing margin reflects a high level of profitability. For end users, it also means a high purchase price.

Factors influencing the marketing margin

Data for the study were collected between 2019 and 2022 through 51 face-to-face interviews conducted with value chain actors in Greater Accra and the Northern, Upper East and Upper West regions of Ghana. These actors included importers, manufacturers, distributors, input dealers, borehole drillers, government agencies, nongovernmental organizations (NGOs) and farmers. The irrigation technologies analyzed were selected based on their usage and popularity in the study areas and their potential market demand.

Several factors influence the marketing margin and costbenefit structure. Notably, actors in the supply chain are 'multipurpose' in that they play multiple roles as importers/ suppliers, wholesalers and retailers. Actors have tangible costs and benefits as they operate within the supply chain. They may also have intangible costs and benefits that influence the marketing margin. These are discussed in more detail in the following sections.

Different actors adopt different strategies to market their products and services, leading to different marketing margins within the supply chain. Some of the strategies adopted by actors include (i) a project-based strategy to earn a marketing margin by bidding for development and commercial projects; (ii) a strategy centered on tangible costs and benefits to determine their marketing margin; and (iii) a blended approach based on a combination of both tangible and intangible costs and benefits. Actors using the third strategy invest in establishing partnerships and building relationships that may not yield benefits in the short term. Partnerships and interactions within a chain and with other actors outside the chain may help to reduce the cost of transactions for actors, leading to a smaller marketing margin between transactions in the future. Actors may establish partnerships for several reasons, such as to facilitate product distribution, installation and training.

Government policies and the business operating environment significantly impact prices and marketing margins. Foreign exchange fluctuations and (import) taxes on agricultural products are also key influencing factors. In 2019, the Government of Ghana introduced a policy to benchmark certain commodities to the prevailing global prices as a risk management tool. Under this policy, a discount of up to 50% on port charges was provided for several products, including irrigation equipment. In February 2022, the government revised the benchmark value from 50% to 30% (GRA 2022). Importers of irrigation equipment now pay an additional 20% on port charges, which may be passed on to farmers. Additionally, an amendment to the valueadded tax (VAT) rules in 2021 requires small- and mediumsized wholesalers, distributors and importers of goods with annual revenues above a certain amount to apply the standard VAT rate of 19.25% instead of the 4% they were previously charged (EY 2022). This increase may also be passed on to farmers.

Calculating the marketing margin

Based on Mendoza's (1995) formula for calculating the marketing margin for food crops, we devised two formulae to calculate the marketing margin for irrigation technologies. The first formula was used in instances where an actor serves simultaneously as an importer, wholesaler and retailer:

 $MMssc = \frac{(sales \ price - marketing \ cost) - IP + IC)}{consumer \ or \ sales \ price} \ x \ 100$

where: MMssc is the marketing margin of imported irrigation technology, *IP* is the import price and *IC* is the import cost.

The second formula was used in instances where the technologies are locally manufactured, e.g., drip lines, and an actor serves simultaneously as a manufacturer, wholesaler and retailer:

where: MMlp is the marketing margin of locally manufactured irrigation technology and *MC* is manufacturing cost.

The estimated marketing margin for the technologies reviewed ranges between 5% and 25% for solar-powered pumps, 5% and 20% for fuel-powered pumps and 10% and 20% for drip irrigation kits and systems. For each technology, the cost-benefit structure of the supply chain and the basis for these estimates are described below.

Solar-powered irrigation pumps

Solar-powered irrigation pumps (SPIPs) available in Ghana include submersible, surface and hybrid pumps. Pumps are imported from several countries, including Germany, the Netherlands, China and India, and may be sold to end users individually or as part of a package. A package typically contains a pump and solar panels, sometimes with accessories for installation or a toolkit for repairs. Importers often import pumps from known and trusted manufacturers. However, they import solar panels from cheaper sources, mainly China, to reduce the initial cost of the installation. Importers may also import pumps in anticipation of demand. Other pumps are imported only to realize projects won during bids. These projects include irrigation systems for commercial farmers or government-supported community water supply and/ or irrigation initiatives. As the demand for SPIPs is generally low, this project-based strategy is adopted to avoid tying up working capital in unsold irrigation equipment.

Marketing margin and cost-benefit structure for SPIPs

The marketing margin and cost-benefit structure for SPIPs vary between suppliers and transactions (Figure 1).

Supplier-end user (farmer) transactions

In transactions between suppliers and end users (farmers), the marketing margin is relatively high (10%–25%), because farmers pay a retail price. Data analysis identified a set of **tangible costs** that contribute to the sales price of multipurpose suppliers. Besides import, storage and transportation costs, a service cost occurs when suppliers offer additional benefits to end users, such as a warranty and maintenance. Demurrage is a fine or charge that is levied by a courier or freight forwarder for not removing goods from a port within an indicated time. Importers pay waiver filing fees annually to Ghana's Energy Commission to enable them to benefit from tax waivers on SPIPs imported for agricultural purposes. Operational costs refer to staff salaries, rent, utilities and other costs associated with maintaining an office.

Intangible costs include bureaucracy, non-adaptation, and political and poor collaboration costs. Actors incur bureaucracy costs from the multiple government organizations involved in the tax exemption process. Non-adaptation costs are incurred when actors lose the opportunity to increase the SPIP market in Ghana because imports are too expensive and beyond the reach of target users. Globally, the cost of solar-based technologies has dropped substantially over the last 30 years (Steffen 2020). However, solar technologies imported into the country are too expensive for the average smallholder farmer. Pay-as-you-go and pay-as-you-own options have not been adequately explored in Ghana compared to other African countries, although promising initiatives are underway (IWMI 2023).

Political costs relate to the loss of business for suppliers as a result of political activities. Seasonal demand for solar irrigation equipment has been observed in Ghana, coinciding with general elections. Politicians tend to invest more in solar irrigation projects close to general elections in order to get more votes, but scale back on these projects in the first two or three years after winning an election. Poor collaboration costs



Figure 1. Solar-powered irrigation pumps: marketing margin and cost-benefit structure along the supply chain.

relate to other business losses that actors experience because of a lack of synergy. There is limited collaboration between government agencies, development partners, private sector entities, research institutions and farmers. As a result, efforts to increase the SPIP market are often duplicated, market linkages are weak and innovative solutions that meet the needs of end users remain underutilized.

Tangible benefits for SPIP suppliers are economic profit and import tax waivers. Waivers for import duty and VAT are available for the import of agricultural machinery, including solar-based irrigation technologies.

Intangible benefits include partnerships, visibility, new business opportunities, reputation and new markets. Partnerships provide mutual benefits for the actors involved. These partnerships may be with product and/or service providers, including pipe manufacturers, borehole drillers, pump repairers, government organizations, NGOs, research institutions and development partners. The partnership between Pumptech (an SPIP distributor), IWMI, the Ministry of Food and Agriculture (MoFA) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is an example of a mutually beneficial partnership. MoFA leverages workshops organized by IWMI to provide training to extension agents on crop water requirements, irrigation practices and improved irrigation technologies. Meanwhile, GIZ and IWMI have benefited from sharing costs related to field expenses for organizing solar pump demonstrations and market linkage workshops. This partnership between GIZ and IWMI has also given IWMI the opportunity to test irrigation scaling models in the Upper East and Upper West regions of Ghana, while helping Pumptech identify key market segments for its products and tap the market potential in these regions. This led to Pumptech opening a new office in the Upper East Region in 2021 and increasing pump sales by more than 80% in comparison to sales in 2020 (WLE 2021).

Supplier-agent or supplier-government agency/NGO transactions

SPIP importers often sell their products directly to end users. However, formal or informal agents may be involved in the sale in instances when the distance between the retail outlet and end users is significant. Formal agents have an agreement with suppliers to sell products and/or offer services on behalf of suppliers. Informal agents may be extension agents, input dealers, pump repairers, borehole drillers or mechanization experts who buy products on behalf of end users.

In supplier-agent or government agency/NGO transactions, the marketing margin is lower at 5%-20% in comparison with supplier-end user (farmer) transactions (10%-25%). There are three reasons for this difference in marketing margin. First, suppliers usually offer a discount when agents are involved, so that agents can sell products to end users at the same or slightly higher price above the suppliers' retail price. This motivates farmers, who are often price sensitive, to buy from the agent instead of traveling a long distance to buy from the supplier. Second, agents may buy more than one item at a time at a wholesale price. Third, agents build business relationships with suppliers and may be able to negotiate to buy products at a lower price and thereby reduce the marketing margin.

Agent-farmer or government agency/ NGO-farmer transactions

The marketing margin for agent-farmer or government agency/ NGO-farmer transactions could not be calculated because of insufficient information. However, the cost-benefit structure of these transactions differs from that of the supplier-end user (farmer) and supplier-agent or supplier-government agency/ NGO transactions. Although agents may earn economic profit from these transactions, government agencies and NGOs often seek intangible benefits such as social and political profits. Social profit refers to the positive social impact of providing beneficiaries with SPIPs, which may include women's empowerment and improved food security. Political profit refers to the credit the government receives for improving the lives of beneficiaries through the provision of SPIPs. Supplier advertisement refers to communication to potential customers through traditional and social media that may create awareness and generate sales of SPIPs for agents.

Fuel-powered pumps

Fuel-powered pumps are powered by petrol or diesel and come in several capacities. The use of low- to mediumcapacity pumps from 1–7.5 horsepower is common among smallholder farmers and readily available. Higher capacity pumps are often imported on demand. Pumps are imported mainly from China and have an average lifespan of two to three years. They require regular servicing, which is carried out by farmers themselves or by local pump technicians. Farmers may abandon pumps because of frequent breakdowns or high fuel consumption as the pumps age. It is, therefore, common for farmers to own two or more fuel-powered pumps.

Ghana's fuel-powered pump market consists of many actors because of the low barriers to market entry. Fuel-powered pumps are relatively cheap to import, and actors import multiple brands depending on the cost of the equipment and customer preference.

Agents/distributors of fuel-powered pumps are individuals and companies who sell the pumps to farmers, serving as a link between suppliers and farmers. These agents/distributors include agro-input dealers, agricultural extension agents, pump repairers and borehole drillers. They may have a retail outlet for irrigation equipment and/or other agricultural inputs, or they may purchase products for farmers on demand. Government agencies and NGOs help smallholders to access fuel-powered pumps through projects. Pumps may be provided as part of irrigation packages for farmer-based organizations, or farmers may acquire pumps with the help of financing schemes such as matching funds.

Marketing margin and cost-benefit structure for fuel-powered pumps

The estimated marketing margin and cost-benefit structure for fuel-powered pumps are shown in Figure 2. The marketing margin ranges from 8% to 20% for supplier-end user (farmer) transactions. Farmers buy at the retail price, and the relationship between suppliers and farmers is mainly transactional. This differs from the SPIP supply chain, where interactions are more dynamic: SPIPs are more complex than the other irrigation technologies reviewed and may require regular servicing. Ongoing interactions between buyers and sellers of SPIPs may also lead to additional business due to recommendations and upgrades by farmers.

In supplier-agent/distributor transactions, the marketing margin for fuel-powered pumps ranges from 5% to 8%. The marketing margin is low because agents can access multiple suppliers and negotiate to buy products at a lower price. Agents/distributors also benefit from discounts as a result of bulk purchases. Further, fuel-powered pumps sell faster than SPIPs or drip irrigation kits and systems due to their relatively low price and government efforts to promote their usage. Profit-making actors can turn around their working capital faster, also helping to reduce costs.

Drip irrigation kits and systems

Drip irrigation kits and systems include imported brands from countries such as Spain, India, Israel and China. Interplast, a leading producer of plastic pipe systems in West Africa, has a dedicated department for irrigation – InGreen – which locally manufactures drip irrigation kits under the brand name INGREEN. Several unbranded irrigation technologies are also available on the market, especially from China. Farmers can install the kits and systems themselves.

As with the other irrigation technologies reviewed, actors in the drip irrigation supply chain play multiple roles. Multipurpose suppliers may offer a package that includes the drip irrigation kit along with agro-inputs such as seeds and fertilizers. Low-capacity drip irrigation kits and systems are sometimes stocked in anticipation of demand, whereas highcapacity kits and systems are usually imported to meet the demands of projects won.

The INGREEN brand of drip irrigation kits benefit from the cost savings that result from being part of a larger manufacturer, Interplast, developing its products targeting the markets in West African countries. Interplast also enjoys the benefits of



Figure 2. Fuel-powered pumps: marketing margin and cost-benefit structure along the supply chain.

having a monopoly on the manufacture of drip pipes and tapes. Consequently, the company spends less money advertising its products.

End users are mainly vegetable farmers engaged in dry-season farming. They use drip irrigation to manage scarce water resources during the 6-7 months of the dry season in northern Ghana. Farmers grow vegetables for both home consumption and sale.

Marketing margin and cost-benefit structure for drip irrigation kits and systems

The estimated marketing margin and cost-benefit structure for drip irrigation kits and systems is shown in Figure 3. The marketing margins between supplier-government agencies/ NGOs and supplier-end user (farmer) are estimated to be 10%-20%. However, government agencies and NGOs have an advantage over farmers because they can negotiate with suppliers for lower prices and thereby reduce the marketing margin when the contract value is high or involves the purchase of multiple kits and systems. In this supply chain, agents/contractors may also be involved. These are often companies that purchase equipment to fulfill the demands of projects won through government or private tender processes.

The way forward

The findings show that the irrigation technology supply chain in Ghana consists of a small number of actors who fulfil multiple roles. Prices are mainly determined by manufacturing costs in the country of import, foreign exchange dynamics, and other contextual and institutional factors in the business environment. Actors in the supply chain do not have significant influence over the prices of technology. Based on these findings, several recommendations can be made.



Figure 3. Drip irrigation kits and systems: marketing margin and cost-benefit structure along the supply chain.

Coordinate interventions

For NGOs and development actors, coordinating interventions will benefit farmers more. Collaboration with other actors working towards improving farmers' access to irrigation technologies will minimize duplication of efforts and reduce the tangible and intangible costs incurred by actors. For instance, co-designing and co-planning interventions will give importers adequate time to import irrigation equipment to meet project timelines, minimizing transportation and storage costs.

Develop an irrigation master plan

For government actors, developing a master plan to support equitable irrigation development will limit haphazard investments based on political or donor interests. Abandoned projects, and thus wasted resources, from previous political administrations will also be reduced. Simplifying the tax exemption process is critical for improving the enabling environment for adoption of irrigation technologies, and encouraging more irrigation equipment suppliers to apply for the exemptions. Government actors could use online application systems or centralized units in regional capitals to serve as one-stop offices for tax exemption applications. The need to contact multiple government agencies currently makes the application process slow, prone to corruption and may lead to importers incurring additional costs as a result.

Invest in local manufacturing

Investing in the local manufacture of irrigation technologies is key to bringing down the cost of, and increasing the demand for, the technologies. It will also reduce the importation of low-quality brands that discourage farmers from investing. The private sector should be incentivized to invest in local manufacturing using the Ghana Free Zones scheme. Organizations operating under this scheme enjoy tax breaks on imports and exports (GRA n.d.), which could encourage manufacturers of irrigation technologies to set up production or assembly plants in Ghana.



A woman in a field with a bucket of red peppers in Volta Region, Ghana (photo: Barbara van Rijn).

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