Melting Profits: Heat, Corruption, and Sugarcane Inefficiency in Pakistan

Mohib Hassan

1.

Sugar is an extremely important commodity for Pakistanis, with the average person consuming nearly 26 kg in a year.[1] Despite being among the top ten sugarcane producers in the world,[2] Pakistan ranks poorly in sugarcane productivity and sugar extraction yields.¶ This poor performance is noteworthy given that the sugar industry in Pakistan is worth nearly $2 billion.[4] It is crucial to recognise that these low productivity metrics can be attributed not only to core factors affecting agricultural output but also to environmental and human-generated causes that further undermine the industry's performance.

Sugarcane is cultivated in Pakistan during the *Kharif* season, which begins with the onset of monsoon rains. Planting typically starts between April and June, and the crop is harvested from October to March, overlapping with the *Rabi* season when other essential crops such as wheat are sown. This overlap often leads to competition for resources, with shortages in water and labour complicating the sugarcane harvest even more.

Sugarcane has a growing cycle spanning 10 to 14 months,[5] depending on regional climatic conditions. As a moisture-rich crop, it requires substantial water, which is usually provided by monsoon rains and supplementary irrigation. However, rising temperatures and erratic rainfall patterns in the country are putting increasing stress on the sugarcane crop.[6] The crop is also highly sensitive to heat exposure, as it consists of about 70–75% water.[7] Prolonged periods of elevated temperatures, especially during the critical months leading up to the harvest, accelerate the dehydration of the cane. This heat stress severely impacts both the quality and quantity of sugar extracted, which is a growing concern in Pakistan.

2.

In 2015–16, I participated in Pakathon, a series of hackathons held at major U.S. universities aimed at encouraging technology startups to address challenges faced by Pakistan.

¶ Pakistan's sugarcane productivity averages just 64 tons per hectare and sugar extraction yields around 7.9%. In contrast, India averages 78.2 tons per hectare in sugarcane production and approximately 11% in sugar extraction yield.[3]

During the two-day hackathon at Harvard Business School, my team and I focused on developing an automated software solution to enhance efficiency in the sugarcane harvest and processing phases, with the goal of improving sugar extraction rates. To achieve this, we thoroughly investigated the agricultural supply chain and the sugarcane industry, which represents a significant portion of Pakistan's agricultural market value. Our proposal, titled The *Shakarganj Project*, revealed a complex network of inefficiencies rooted in outdated farming practices and compounded by the problematic actions of a reportedly corrupt industry.

My team and I selected sugarcane after surveying Pakistan's major crops with the greatest unrealised export potential. Our decision was driven by a desire to assist Pakistan in becoming more competitive in a sector where crop production volumes were already high but sugar extraction yields were low.

One of our key findings was the impact of time and heat on sugarcane quality. Once harvested, sugarcane must be processed as swiftly as possible to prevent the degradation of sucrose content,[8] which begins almost immediately after cutting. In Pakistan, the transportation of sugarcane faces serious infrastructural challenges.[9] A critical issue is the widespread use of open-top vehicles for transporting sugarcane, which exposes the crop to intense heat and sunlight, leading to substantial evaporation losses. Studies have shown that for every hour of delay in processing after harvest, the sucrose content in sugarcane decreases by 1%.[10] The poor state of the road networks in both Sindh and Punjab exacerbates these issues, resulting in longer transport times and an increased risk of sugarcane falling from vehicles during transit. Vehicles often navigate rough terrains, potholes, and narrow roads, which increases the likelihood of cane falling off the trucks. In some cases, up to 5–10% of the total harvested cane can be lost due to these factors.[11]

Moreover, the extraction process itself is intricate and involves multiple steps: crushing the cane to extract juice, which is then purified, evaporated, and crystallised to produce sugar.[12] There is a potential for loss at each of these stages, particularly if the cane arrives at the mill in a deteriorated state. In Pakistan, many mills operate with outdated equipment and lack the capacity to process cane efficiently.[13] Consequently, there is substantial loss of sugar content during extraction, aggravating the problem of low yield.

3.

We proposed *The Shakarganj Project* as an initiative to bridge the communication gap between farmers and mill operators through a dedicated application. The core idea was to develop a platform that would facilitate real-time communication and coordination between the two parties to optimise the sugarcane harvest and processing workflow.

The app was designed to send automated text notifications in the relevant regional languages to farmers, providing timely updates on when to start or delay harvesting based on the current traffic situation and processing capacity at the mill. This would help farmers decide when to dispatch the trucks and help prevent premature sugarcane exposure to the sun, thereby reducing moisture loss and preserving sucrose content.

To implement this, mills would need to install the simple app on their computers, allowing mill operators to monitor incoming cane and communicate directly with farmers. This system would not only streamline the harvesting process but also enhance efficiency by ensuring that the mill's processing capacity aligns with the farmers' harvesting schedules. For instance, if a mill has spare capacity for the next few hours, the app would prompt farmers to send their harvested sugarcane there rather than wait in line at a mill closer to them.

By integrating this technology, we aimed to create a seamless flow of information that would benefit both farmers and mill owners. Farmers would receive precise instructions to optimise their harvesting times, while mill operators would have better knowledge of cane arrivals, reducing delays and inefficiencies.

4.

[January 2015]
Meeting with an Embattled Private Mill Owner

With the help of familial connections, I spoke over the phone with a former proprietor of a major sugarcane mill, which had been appropriated by influential figures in rural Sindh. The mill owner voiced significant concerns regarding the monopolistic control exerted by the landowners of Sindh, who not only own the majority of sugar mills in the region but also employ coercive tactics to prevent nearby farms from selling their sugarcane to rival mills. Some of these mills came under their control through intimidation and harassment of the original owners. Such practices stifle competition and limit farmers' choices, undermining their ability to reap fair benefits from their labour.

It is common knowledge that most sugar mills in Pakistan are owned by political leaders and members of the elite class. Rural areas, therefore, become battlegrounds for political and economic interests.[14] The involvement of both the private and public sectors in this corruption is significant, as many sugar mill owners have strong political ties that enable them to operate with relative impunity. The production and distribution of sugarcane are often met with state violence at the local level, where prominent political figures try to establish sugarcane monopolies in their constituencies.

[May 2015]
Meeting with Former Agriculture Minister at Pakistan Harvard Weekend

Shortly after the Pakathon, a former agriculture minister of Pakistan spoke to us during the Pakistan Harvard Weekend about problems in the sugar industry, specifically the manipulation of environmental factors to exploit farmers. The minister detailed how mill owners engineer artificial bottlenecks in the sugarcane weighing process by intentionally slowing down the weighing procedure while simultaneously directing farmers to deliver their sugarcane. This induces extensive queues that can extend for kilometres.

Farmers face lengthy delays and risk evaporation losses, and are thus pressured into settling for much lower prices for their crop, often reduced by 40–60% from the standard rate. To minimise their harvesting costs, they are compelled to sell at these steep discounts, allowing them to offload more produce before transport trucks return. Farmers are also forced to depend on loans from mill owners to cover crop losses during adverse years and become ensnared in a cycle of debt servitude that thereby perpetuates their financial dependence and vulnerability.

5.

The Shakarganj Project was abandoned for a number of reasons. Market conditions played a significant role, as the cost of raw sugarcane turned out to be lower than expected. This meant that mill owners were able to buy sugarcane at a cheaper price than planned, leading to a larger-than-expected financial gain. We were also cautioned by the Pakathon judges that rolling out such a platform would inevitably redistribute the financial calculus between mill owners and farmers, which would not be well received and might create security concerns for us.

This experience highlighted for me that the dynamics and mechanics of wealth distribution in the country make it unlikely that a project like this might ever become viable without state backing. Many such innovative projects that could have helped unlock greater efficiencies in industry and agriculture have probably been sent to the graveyard of startups. This is probably why agricultural yield has shown little improvement over the past few decades in Pakistan.

Notes

1. Pakistan Sugar Mills Association, "Sugar Consumption."
2. ChiniMandi, "Major Sugar Producing Countries."
3. Nazar et al., "Factors Affecting Sugarcane Production."
4. VIS Credit Rating Company Limited, *Pakistan Sugar Sector Report*, 4.
5. Khan, "Sugarcane Crop Developmental Stages and Water Requirement: A Review," 1–5.
6. Government of Pakistan, *Climate Change in Pakistan.*
7. Singh et al., "Phytochemical Profile of Sugarcane," 45–54.
8. Solomon, "Post-Harvest Deterioration of Sugarcane," 109–123.
9. Khushk and Saeed, "Analysis of Sugar Industry Competitiveness," December 2015.
10. Chen and Rauh, "Technical and Economic Justification," 1990.
11. Solomon, "Post-Harvest Deterioration of Sugarcane," 109–123.
12. Singh, "Hybrid Membrane Systems," 201–220.
13. Khushk and Saeed, "Analysis of Sugar Industry Competitiveness in Pakistan."
14. Bari, "Vicious Cycle of Sugar Politics."

Pakistan Sugar Mills Association. "Pakistan Sugar Mills Association Sugar Consumption Per Capita in Pakistan." Accessed November 19, 2024. https://www.psmacentre.com/statistics.php?stid=1&type=national&status=1&link=23&tpage=sugar_consumption.
ChiniMandi. "Major Sugar Producing Countries." Accessed October 14, 2024. https://www.chinimandi.com/statistics/major-sugar-producing-countries/.
Rehman, Shafiq. *Sugar Annual: Pakistan*. Islamabad: United States Department of Agriculture, Foreign Agricultural Service, April 22, 2021. Report No. PK2021-0006. https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Sugar%20Annual_Islamabad_Pakistan_04-15-2021.pdf
Directorate of Economic & Statistics, Department of Agriculture, and Farmers Welfare. *Notes: 2023-24: Provisional*. https://finance.gov.pk/survey/chapter_24/2_agriculture.pdf
DES. *Pocket Book of Agricultural Statistics 2016*. Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers Welfare, 2016. https://desagri.gov.in/document-report/pocket-book-of-agricultural-statistics-2016/
Rana, Shahbaz. "Export of 140,000MT Sugar Approved." *The Express Tribune*, October 13, 2024. https://tribune.com.pk/story/2497555/export-of-140000mt-sugar-approved.
Khan, Muhammad Ehsan. "Sugarcane Crop Developmental Stages and Water Requirement: A Review." *Pakistan Sugar Journal* 38, no. 2 (April-June 2023): 11-15.
Nazir, Adnan, Ghulam Jariko, and Mumtaz Junejo. "Factors Affecting Sugarcane Production in Pakistan." *Pakistan Journal of Commerce and Social Sciences* 7 (2013): 128–140.
Singh, Amandeep, Uma Ranjan Lal, Hayat Muhammad Mukhtar, Prabh Simran Singh, Gagan Shah, and Ravi Kumar Dhawan. "Phytochemical Profile of Sugarcane and Its Potential Health Aspects." *Pharmacognosy Reviews* 9, no. 17 (January - June 2015): 45-54. https://doi.org/10.4103/0973-7847.156340.
Government of Pakistan. *Climate Change in Pakistan*. Islamabad: Sugarcane Production Conference, 2024. https://scp.gov.pk/Conference2024/downloads/Climate_Chage_in_Pakistan.pdf
Solomon, Sushil. "Post-Harvest Deterioration of Sugarcane." *Sugar Tech* 11, no. 2 (June 2009): 109-123.
Khushk, Ali Muhammad, Aslam Memon and Ikram Saeed. "Analysis of Sugar Industry Competitiveness in Pakistan." December 2015. https://www.researchgate.net/publication/265431871.
Singh, Rajinder. *Membrane Technology and Engineering for Water Purification*. Second edition Oxford: Butterworth-Heinemann, 2015.
Bari, Khadija. "The Vicious Cycle of Sugar Politics." *The Express Tribune*, March 26, 2020. https://tribune.com.pk/story/2176785/vicious-cycle-sugar-politics.
Javadi, Siamak, Mark Kroll, and Yu Liu. "The Dark Side of Competition in Developing Economies: Evidence from Closely Held SMEs." *ScholarWorks@UTRGV: Finance Faculty Publications and Presentations*, June 30, 2024. https://scholarworks.utrgv.edu/cgi/viewcontent.cgi?article=1021&context=fin_fac.