Pro Market System: A Transparent and Efficient Solution for Agricultural Supply Chain in Bangladesh

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I. Introduction

The agricultural sector in developing countries, such as Bangladesh, forms a very important portion of the economy and sources for millions in livelihood. However, due to its inefficiencies within the supply chain coupled with lack of transparency, it is being exploited, leading to soaring prices and economic distress for the smallholders. To this end, the innovative digital platform, Pro Market System, develops a transparent, fair, and efficient agricultural market. The system registers several user roles, including farmers, local traders, large city dealers, retailers, and consumers, with a special attitude to the Ministry of Consumer Rights, in the centralized system, enabling real-time verification of transactions, keeping track of prices, and resolving disputes. Pro Market System, which will be powered by advanced technology support such as database management web development, SMS notifications,calls and role-based access control among few others is believed to bring accountability and transparency in the agricultural supply chain. Most of the agricultural systems in many parts including Bangladesh are very much disturbed by numerous events among one is COVID-19 pandemic.The crisis has shown that the system of food supply chains is more vulnerable and needs to be resilient with a guarantee of continuous market functioning even in times of crisis [1]. Pro Market System addresses the above vulnerability through real-time data flow automation, where stakeholders can keep themselves up-to-date on any eventuality that has taken place and react to it in good time. The centralized relational database of the system ensures information is both accurate and accessed expeditiously and securely, allowing all concerned stakeholders to trace transactions and validate prices in real time, and in turn, thus avoid artificial price inflation by intermediaries. This recommendation assumes even more relevance in the backdrop of the work of Sabur et al. Such features, by having them, Pro Market System not only empowers farmers with timely information but also safeguards consumers from unjust price manipulation [3]. The technological backbones for designing a Pro Market System are meant to serve a broad category of people, some with poor access to the internet, like the rural farmer. It thus implies that the system can afford to give alerts and changes in prices even to those who do not have smartphones or access to the internet through SMS notification services. This is crucial in controlling panic buying, as revealed by Arafat et al., 2020, during crises like floods or pandemics, where rumors or sudden increases in prices of such commodities may lead to hoarding of rice and oil [2]. The system can further check the spread of misinformation, thus making the marketplace quite stable, through the provision of transparent, real-time price data for consumers and traders. This also focuses on the role-based access control in the system, which means that each user role farmer, trader, consumer, or government official will have distinctive permissions and rights of access. Such a kind of segregation promotes privacy and clarity in function, such that only the stakeholders involved obtain relevant information. For example, farmers can follow market prices and validate transactions or, for instance, the Ministry of Consumer Rights officials can track overall market trends, handle complaints and enforce consumer protection laws. In particular, farmers will be able control the prices of the goods and check all transactions completed while officials from Ministry of Consumer Rights will track trends in the general market response to complaints and ensure compliance with laws that protect consumer rights.This level of oversight is important for issues that have long characterized the country's markets in agriculture, including weak supervision in markets and corrupt practices, as was revealed in a study by Hosain (2020) [15]. In addition, the Pro-Market System needs to be scalable in order to incorporate a high number of users and transactions as it grows geographically or incorporates new stakeholders into the system. The system automates the flow of data across interested parties and reduces manual interventions as well as the possibility of errors, thereby improving operational efficiency. This resonates with the study by Ghosh (2021), which looked at how price increases disproportionately affect the poor households of Bangladesh. According to Ghosh, a technological intervention in the form of automated systems would save the poor from the pernicious effect of price volatility through ensuring fair competition in the market and enhancement of access to goods and services on equal footing [4]. The underlying reasons behind the Pro Market System lie in the fact that there is a compelling necessity to address inefficiencies in the supply chain at the agricultural level, especially in developing countries such as Bangladesh, where farmers are exploited and inflated prices are borne by consumers due to the lack of transparency in the markets. Middlemen are always meddling with the markets of the agricultural product, at times making an artificial hike in the price, especially during a crisis period, further making both the farmers and the consumers vulnerable [3]. The Pro Market System aims to safeguard against such kinds of exploitations through real-time verification of the price and transaction, which has the effect of reducing the capacity of the middlemen to inflate costs unrealistically and hence allow a fairer distribution of the resources. The system improves the operational transparency and accountability of traders and retailers by empowering stakeholders with timely, correct information. It has been said by Ghosh (2021), based on a study, that price volatility harms low-income households, and mechanisms like Pro Market stabilize prices and alleviate the suffering of weaker sections by making them able to afford essential goods [4]. However, it does respond to the gaps in government oversight highlighted by Hosain (2020), on the basis of which it opens up measures for better regulatory

control with the enforcement of consumer rights [15]. This system is critical in ensuring integrity in the market during crises, such as pandemics, as underlined by Amjath-Babu et al. (2020), who emphasize the importance of resilient food supply chains [1].

There are several major contributions the Pro Market System offers the agricultural sector and society at large. First, it ensures that every activity in the agricultural market is well documented and verifiable, thus reducing chances of fraud. This transparency results in developed trust between farmers, traders and consumers consequently creating a more equitable market for all parties involved. Moreover, system stabilizes the marketing scenario by information of current prices and also give a call to government when they want control suspension as rising prices that can make any adverse impact on economy. Alam et al. This includes the importance of price stabilization for staples, such as rice to mitigate the adverse consequences of price volatility (2020) [6]. Another crucial contribution is the empowerment of farmers. The system empowers farmers by providing real-time market prices and alerts on transaction verification, enabling them to get better prices for their produce and to be free from exploitation by middlemen. This system also ensures consumer protection in real-time and two-way platform for complaints by consumers, which are highly responsive and quick with the provision of traceable response on the complaints to be handled by government bodies. This ensures that consumer rights are protected and an ethical market is run. The system also improves the efficiency of your supply chain process, as it automates the process of entering and verifying information which in turn reduces errors and speeds up transaction times. The Pro Market System assures that all these processes are streamlined so that the entire agricultural supply chain works easily and more productively for the involved parties. The importance of such a system is underscored by Bhowmick and Ghosh (2020) in economic recovery and resilience against systemic shocks like the COVID-19 pandemic [5]. The Pro Market System thus becomes a major intervention to address the inefficiencies of agricultural markets. It supports farmers and protects consumers by combining new technologies in database management, web development, and SMS and call services. It is also a useful tool for government bodies for monitoring, intervention, and further empowerment. Ultimately, this will provide significant gain for market stabilization as well as food security and economic development with incorporated transparency, fairness, and efficiency in agricultural supply chains without cheap graft. The knowledge created by the system is beneficial for those at policy level so as to make better and effective policies with regards to agriculture & economics that reduced exploitation through out supply chain & create a market place with fair trade practices [5].

II. Literature Review

COVID-19 sucks off the life-blood of Bhor: An interview with a migrant farmer in BangladeshThe recent paper by T.S. Amjath-Babu, Timothy J. Krupnik and others titled, “Key indicators for monitoring food system disruptions caused by the COVID-19 pandemic: Insights from Bangladesh towards effective response“, explores ways to reduce these vulnerabilities and build resilience in the face of crisis areas. With the benefit of hindsight, we know that resilient supply chains are required, infection-safe logistics in place and better social safety nets to assist those hit by sudden collapses due to devastating consequences. Yet it maps out where the sizable research gaps lie in creating elaborate surveillance systems for an advance alarm and quick-response mechanisms on food value chains. It also highlights a requirement for out-of-the-box solutions which would include making of spare parts using 3D printing and harnessing the power urban waste provides as a source of nutrients efficiently. Weaknesses: Insufficient empirical evidence of medium-to-long term effects, Currently pays little attention to the socio-economical) domain in small holder farmers' resilience,focusing only on yield and income capacity [1].

This paper by S. M. Yasir Arafat, Kum Fai Yuen, Vikas Menon, Sheikh Shoib & Araz Ramazan Ahmad examines panic buying in Bangladesh using media reports titled as a “Panic Buying in Bangladesh: An Exploration of Media Reports.” It explores major triggering events (floods, curfew and the COVID-19 pandemic) along with interpretive intermediary causes viz. rumours, policy bans and anticipations of lockdown or a price rise matters. Staple goods like rice, oil, spices, and hygiene products appear to be the items that are panic-bought most often in a study. Although full of advice, the paper surfaces research holes -- from having little understanding studies identifying differentiates between various geographies all the way to specific triggers that drive stock-piling and even culturally sensitive quarantine measures. The limitation of using media reports is that it provides only a partial picture of the behavior and in this study, we also included with our inclusion criteria only non-English sources too may have narrowed its findings [2].

DEMAND, SUPPLY AND REASONS FOR PRICE HIKE OF POTATO IN BANGLADESH by S. A. Sabur, M.A. Monayem Miah, M. Esmat Ara Begum, M. Shahrukh Rahman and M. M. Uddin Molla (~2008) This paper on the analysis of demand, supply and price hike reasons for potatoes in Bangladesh exhibit that land area, production and yield increased at a rate of 4.58%, 6.61% and 1.95% per annum respectively since independence. Some profit makers traders created an artificial crisis to raise the prices. Meanwhile, the study has a number of limitations such as no in-depth analysis about how potato production is actually influenced by climate change, no discussion on the thematic issues related with role of government policy and intervention to the market (supply & demand) for combating potato marketing crisis or no analysis on how global trade and international market mechanism affecting Bangladeshi economy through influencing domestic potato market. However, it has certain limitations such as predominantly based on secondary data, dealing without a thorough analysis of the potato industry's supply chain and market structure, ignoring the supportive role of technological advancements and innovations in potato production [3].

Study on the effect of Increasing in Price of Different Standard of living rate groups among various socioeconomic status people : A cross sectional and multinomial logistic regression analysis over Khulna Division, Bangladesh. by Esita Ghosh studying rise in prices over quality of life of different strata of income groups in Khulna Division of Bangladesh. It analysed the relationship between volatility and quality of non-life using a variety of statistical analysis. Thsi shows that increases in prices hurt low income

households more than middle income individuals. This means that targeted policies to improve the availability of key services and income support programs for vulnerable groups are indicated, according a report in employability or across all other areas of human capital development [4].

Bhowmick, S. and Ghosh, J., 2016 “A game of shadows: Growth, distribution and systemic shocks in the Bangladesh economy”, article published at here to tackle the ongoing problems faced by Bangladesh economy: inflation, energy accompany shortage, reduced foreign exchange reserves, and fiscal imbalances despite notable growth rates. Bahtiyar Duysak/Pacific Press/LightRocket via Getty Images The coronavirus crisis has endemic implications on the financial vulnerability of the nation as well. The authors focus also on the strong elements of an economy that might result in a partial recovery [5].

Jahangir Alam et al., in a study published as. July 20, 2021: A Journal of Food Policy & Research paper entitled "Rice be enough availability and price volatility in Bangladesh," has conducted an assessment on rice availability and triggered the price instability experienced within the country placed Bangladesh initially specifically for FY-2020. This work was supported by Bangladesh Agricultural Research Council (BARC) and Krishi Gobeshona Foundation (KGF). It highlighted the influence of domestic production, harvest timing and import policies on rice availability along with national demand and prices for rice in Bangladesh. However, this was an incomplete analysis: it did not take into account important socio-economic and climate factors in shaping the prices of rice. Therefore, future studies should give precedence to exploring those along with other potential research gaps to improve the accuracy of the study [6].

Vegetable Marketing around the Greater Dhaka city of Bangladesh: Influence of price on Channel of Distribution. in Bangladesh Department explores Agricultural Marketing Channels in Vegetables and Its Price Related Issues. Primary data are obtained through questionnaires and personal interviews, while secondary data sources are used to analyze the existing marketing channels of vegetables in different markets. Further results indicate that the current distribution channels is suffering from a certain degree of information asymmetry and unfair pricing practices. But the study is not without its limitations: The sample was contained to a wider region of the Northwest, and the studies were conducted over 10 years. However, regarding the research gaps this paper might have looked further into different factors which may influence on vegetable pricing such as weather and transportation [7].

This research paper entitled Vegetable production and marketing channels in Bangladesh: Present status, problems and prospects. is a thorough examination of constraints faced by farmers in Bangladesh concerning vegetable production and market. The report includes a review of the literature, although not specific research gaps. Additionally, the absence of explicit methodologies used in preparing the paper and reliance on information synthesized from multiple sources present limitations to the reliability of this paper [8].

Right to Food and Food Security in Bangladesh presents a situation analysis of food security in Bangladesh, and argues that a rights-based approach is needed to guarantee it. In this article by Md Rakib Sikder and Shariful Islam, the writers report on the achievements in field of food security achieved nationwide, challenges faced and the initiatives undertaken through Government policies and legislative structures that ensure they are addressed properly. However, the report sweeps under the rug the root causes of food insecurity poverty and economic inequality, climate change — and does not adequately address how policies impact food security. Further studies could be conducted to fill these gaps and provide a more broader understanding of food security in Bangladesh [9].

Entitled "Bargaining or Begging: The Nature of the British Request to Join the EEC", the paper was published in 1982 and remains very pertinent today. Posted in north americaThe Politics behind Bangladesh's Readymade Garment Workers' Unwinnable Demands for a Living Minimum WageWhere Shall the Birds Sing by Loop LarkIcarus Sun BooksWhere Shall the Birds Sing? The essay which talked about the deficient pay for Bangladeshi textile workers and also how badly the environment gets affected due to this textile business. Methods This is an interpretive study using a qualitative research methodology. Results of analysis and arguments were supported through secondary sources The constraints of this research include a small sample size and limited stakeholder participation. The main research gap is related dismally the negotiation power of workers on RMG: need to be explored inhibitors [10].

Research Title “VALUE CHAIN ANALYSIS AND POST HARVEST DISEASES OF VARIOUS CITRUS FRUITS.” explores the citrus value chain of Bangladesh through major players, farmer profile and pesticides uses. The paper yields important insights, yet several research areas are still needed to be considered. These requirements, which are further explained in a previous article include the need for more granular data on particular bottleneck diseases and climate change and its effects on the citrus value chain. The paper shortcomings are a limited scope which only focuses on a certain region, and lack of data in the economic aspects regarding citrus value chain [11].

The paper called: The theory of agricultural price bubble & price crash in global economy, M.B. Dastagiri and L. Bhavigna However, this work does not contain a dedicated section for the systematic review of the literature. More than properties, however, this report emphasizes the theoretical input of the authors (which is a generalization in no uncertain terms) nor their glittering explanation regarding agricultural bubble prices and a subsequent fall in worldwide economies. The study employs many prior studies to reinforce their postulations and serve as a basis for the analysis carried out by the writers [12].

This paper is named as “A review of modern practices and proposal of a viable method–Bangladesh agriculture.” This is an academic paper which discusses the extent to which sustainable agriculture is valuable and details some strategies for putting it in place. The writers have linked to several studies that support their claims and detail the possible merits and drawbacks of various farming systems, including those involving crop diversity and integrated farming. The report concludes by highlighting the importance of sustainable agricultural and methods that can be supported in time [13].

This article " In" Incorporating SMEs in the Capital Market of Bangladesh: Obstacles, Initiatives and Potentials. An alternative interpretation of the same pointis to explore what regulatory obstacles prevent SMEs from raising capital and

listing on the Stock Exchange of Bangladesh. The study concluded that the main barrier to fair expansion of small and medium enterprises (SMEs) is the limited availability of formal financial resources [14].

“Syndication” in Bangladesh: A Glaring Example of Business Malpractice and Weak Market Supervision [Research], where the article is centered around ethics of syndication in consumer market of Bangladesh and consequences for consumers. This is a theoretical paper based on previously published work and own experiences and observations as customer. The most important limitation of the report is that there were no data collection in the study. It suggests recommendations to policymakers, and stresses the need for a collective effort to combat syndication in Bangladesh. The study was done by Md Sajjad Hosain and published in Research & Innovation Initiative Inc., Michigan, USA The main limitation of this study is that it did not apply or present an empirical analysis with primary data (e.g., survey, interviews) [15].

In this research Paper :, Named As "Impact of Unpredicted Rise in Fuel Price on Bangladesh: A Case Study," explores the economic growth and the quality of life of the nation with a specific case study, unpredicted rise in fuel price. It stresses that an increase in fuel prices causes output levels to fall, inflation to rise, the standard of life to go down. But the research fails to measure just how big of a wallop fuel prices are delivering to the economy. More importantly, the analysis does not take into account the possible impact of alternative energy sources on the economy of Bangladesh [16].

The name of the article is “Corruption and good governance: The case of Bangladesh. This is a compendium of studies on governance and corruption. These are by various authors such as Robert Klitgaard, Adrian Leftwich, Dinesh Mehta and Kamal Siddiqui among others. Sources may include readings on governance, democracy, urban-governance, and corruption covering a range of perspectives and will add useful yet diverse views. While this is typically the most a collection of these sources may be used for reference to someone wiring a research evaluation on governance and corruption [17].

A research paper entitled “Spatial Price Transmission in the Onion Markets of Bangladesh: An Application of NARDL Approach” aimed to one-sided transmission of price from wholesale to retail onion markets within the territory of Bangladesh, particularly investigating asymmetries in this transmission. We used NARDL model in order to assess the short and long run impacts of shocks on price of onion which are positive and negative. It uses monthly data from January 2006 to December 2020. The empirical research shows unequal do-clicks in the short and long run of the connections linking of onions which produced locally and others imported. The investigation wholey reveals that there are indeed causal connections between wholesale and retail prices. However, this study is not about the transmission of onion prices in different cities of Bangladesh [18].

Site Name/Paper	Domain/Country	Contributions	Research Gap
.Amjath-Babu, T. S., et al. (2020) "Key indicators for monitoring food system disruptions..."	Food Systems/Bangladesh	Identifies key indicators for monitoring food system disruptions caused by COVID-19, offering insights for effective response mechanisms.	Limited focus on long-term food system resilience beyond the COVID-19 pandemic
Arafat, SM Yasir, et al. (2021) "Panic buying in Bangladesh ...	Consumer Behavior/Bangladesh	Explores media reports on panic buying during COVID-19, providing insights into consumer behavior during crises.	Lack of quantitative data on the economic impact of panic buying on supply chains and commodity pricing.
Sabur, S. A., et al. (2021) "Demand, supply and reasons for price hike of potato in Bangladesh."	Agriculture/Bangladesh	Analyzes the demand, supply, and causes of potato price hikes in Bangladesh, with implications for market regulation.	Lacks solutions for stabilizing potato prices during future supply chain disruptions.
Ghosh, Esita. (2023) "Study on the impact of price hikes on the standard of living..."	Socioeconomics/Bangladesh	Investigates the impact of price hikes on the standard of living in different socioeconomic groups in Khulna Division.	Limited to a specific region, lacking generalizability to other areas in Bangladesh.
Bhowmick, Soumya, and Nilanjan Ghosh. (2022) "A game of shadows..."	Economics/Bangladesh	Examines economic growth, distribution, and systemic shocks in the Bangladesh economy, with a focus on COVID-19's impacts.	Focuses more on macroeconomic aspects and lacks attention to the grassroots-level supply chain issues.
Alam, Jahangir, et al. (2020) "Availability and price volatility of rice in Bangladesh..	Agriculture/Bangladesh	Studies price volatility and availability of rice, potato, and onion during the COVID-19 pandemic, offering policy recommendations for stability.	Insufficient exploration of price stabilization strategies beyond COVID-19.
Rahman, Md Hasebur, and Md Solayman Kabir. (2021) "Vegetable Marketing in Bangladesh..."	Agriculture/Bangladesh	Investigates the impact of pricing on distribution channels for vegetables, providing insights into the market dynamics.	Lacks in-depth analysis of market inefficiencies and solutions for better price controls in vegetable marketing.
Haque, Md Maksudul,	Agriculture/Bangladesh	Discusses the challenges in	More emphasis on

and Muhammad Ziaul Hoque. (2021) "Vegetable production and marketing channels..."		vegetable production and marketing, highlighting inefficiencies and potential solutions in the agricultural sector.	production; limited focus on market dynamics, pricing, and consumer impact.
Sikder, Md Rakib, and Shariful Islam. "Right to Food and Food Security in Bangladesh ..."	Food Security/Bangladesh	Provides an overview of the legal and policy framework surrounding food security in Bangladesh, emphasizing the right to food.	Insufficient focus on the practical implementation of policies in rural areas.
Hussain, Muhammad Saddam. "Bargaining or Begging?...	Labor Rights/Bangladesh	Explores the challenges faced by Bangladeshi garment workers in their demand for a living wage, analyzing the power dynamics in labor negotiations.	Lacks focus on broader economic and social conditions influencing labor market challenges in Bangladesh.
RAHMAN, MD TOWFIQUR. "VALUE CHAIN ANALYSIS AND POST HARVEST DISEASES "	Agriculture/Bangladesh	Analyzes value chain and post-harvest diseases affecting citrus fruits, providing insights into agricultural market dynamics.	Limited to citrus fruits; does not extend to other major agricultural products.
Dastagiri, M. B., and L. Bhavigna. (2019) "The theory of agricultural price bubble & price crash..."	Economics/Global	Proposes a theory on agricultural price bubbles and crashes in the global economy, providing insights into market shocks and recovery mechanisms.	Lacks specific data on price bubbles in the Bangladesh context.
Tabassum, Nazifa, and Fatema Rezwana. (2021) "Bangladesh agriculture: A review of modern practices..."	Economics/Bangladesh	Discusses the integration of SMEs into the capital market, outlining obstacles and potentials for small and medium enterprises.	Insufficient attention to the agricultural SME sector and its unique challenges in capital market integration.
Khatun, Razia, Md Amanullah. (2021) "Incorporating SMEs in the Capital Market of Bangladesh ..."	Economics/Bangladesh	Discusses the integration of SMEs into the capital market, outlining obstacles and potentials for small and medium enterprises.	Insufficient attention to the agricultural SME sector and its unique challenges in capital market integration.
Rony, Md Jahidul Islam, and Mohammed Shakhawat Hossain. (2023) "Perceived Consequences of Unpredictable Fuel Hike..."	Business Ethics/Bangladesh	Explores the malpractice of syndication in Bangladesh's business sector and highlights the need for stronger market supervision.	Lacks data on the long-term effects of syndication on commodity pricing and consumer rights.
Saha, Sebak Kumar. (2014) "Corruption and good governance: The case of Bangladesh	Energy Economics/Bangladesh	Analyzes the socio-economic consequences of fuel price hikes in Bangladesh, with a focus on consumer perception and impact.	Limited focus on alternative energy solutions and mitigating long-term price impacts.
Mila, Farhana Arefeen, et al. (2023) "Spatial price transmission in the onion markets of Bangladesh ..."	Governance/Bangladesh	Examines the relationship between corruption and governance in Bangladesh, emphasizing the need for good governance to combat corruption	Limited attention to corruption's specific impact on the agricultural sector and market prices.

III. Methodology

A. Data Description

An online survey was conducted to collect data to understand the importance of "Pro Market" system to prevent unintended price hike and corruption. 74 people participated in this online data collection survey. Farmers, local Arabdars, big city dealers, retailers, all classes of customers participate. Of the 74, 47.3% were consumers, 16.2% farmers, 12.2% local Arabdars, 12.2% dealers in big cities and 12.2% retailers. According to their category different questions were asked.. The following questions are asked:

Fig 1. Questions for Retailer:

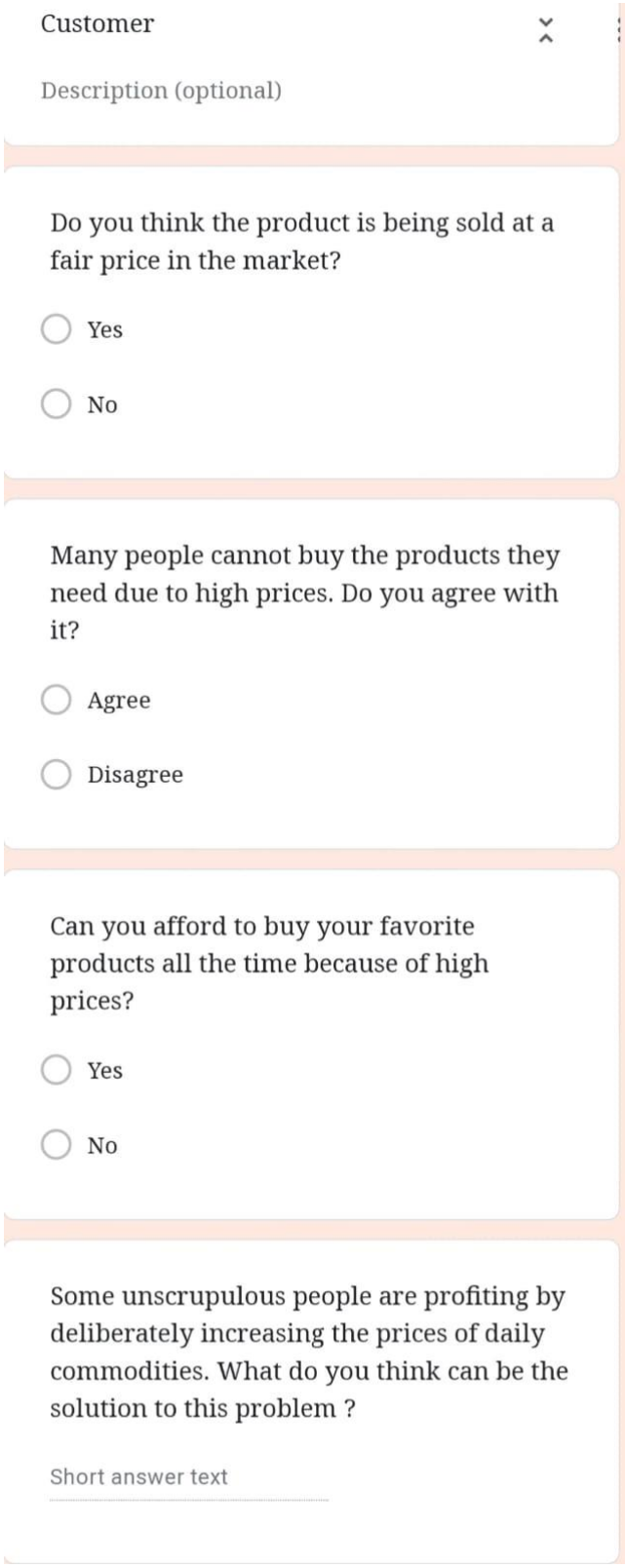


Fig 2. Questions for Customer.

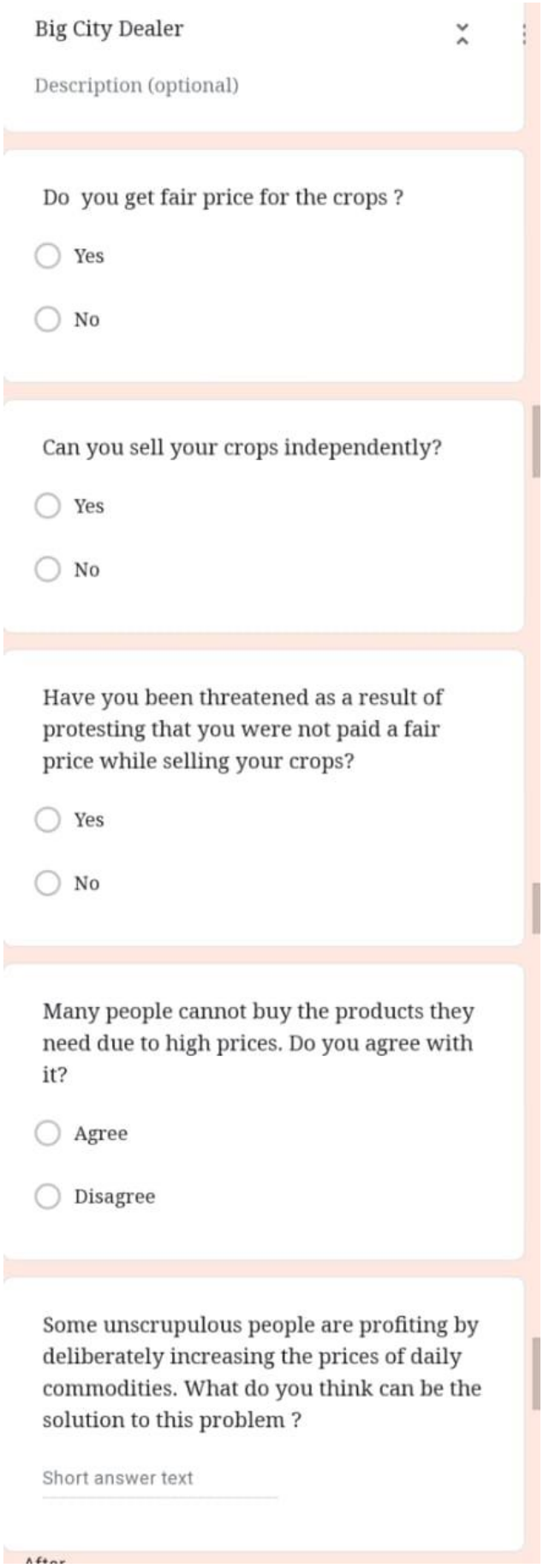


Fig 3. Questions for Big City Dealer.

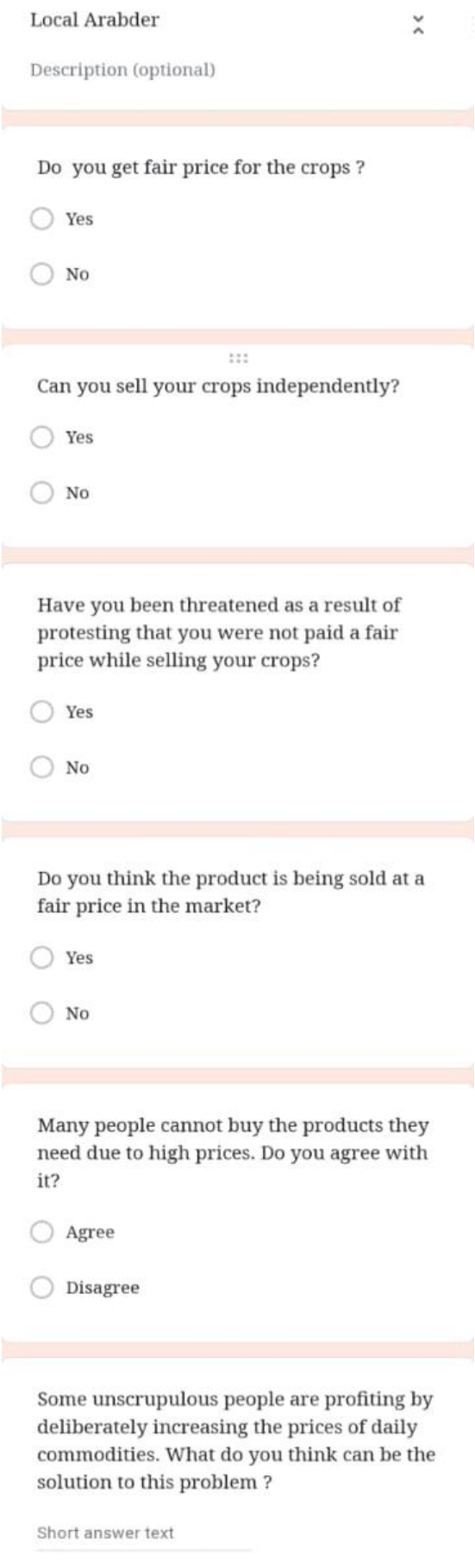


Fig 4. Questions for Local Arabdar.

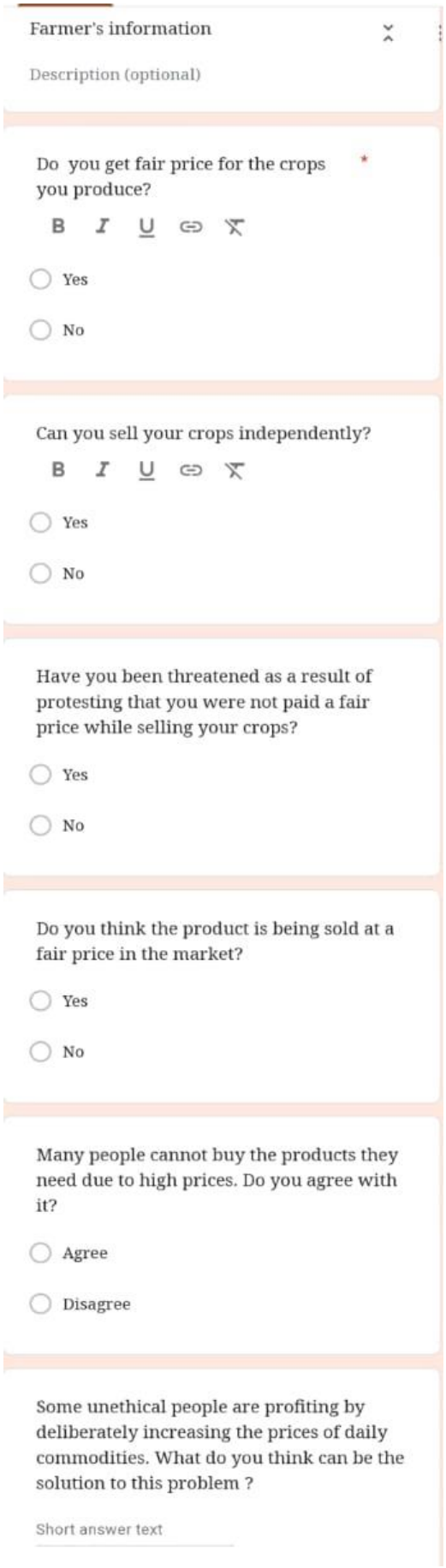


Fig 5. Questions for Farmer.

OutComes from the survey

Retailer:

66.7% of retailers feel they cannot buy products at fair prices. 56.6% feel that they cannot independently sell their purchased products. Among them, 33.3% have been threatened while protesting the price of goods

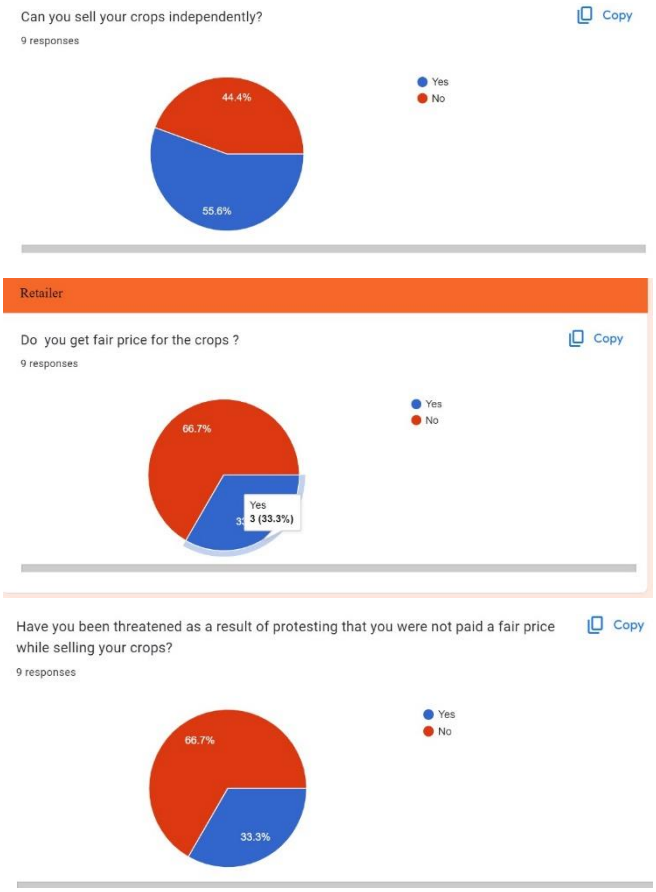
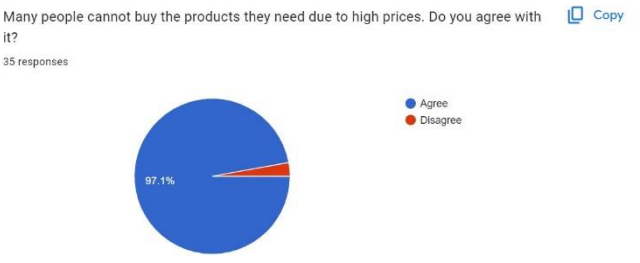


Fig 6. Retailer survey response.

Customer:

82.9% of the customers feel that they cannot buy the product at a fair price from the market. 97. 1% of customers think that people cannot buy the products they need because of high prices. 88.6% feel that people cannot buy their favorite products due to excessive price.



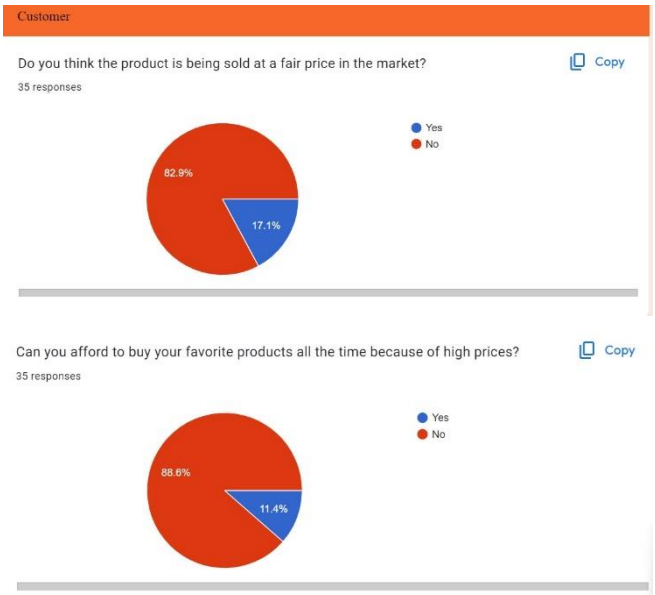


Fig 7. Customer survey response.

Big city dealer:

44.4% of big city dealers feel they cannot buy products at fair price. 56.6 percent feel that they cannot independently sell their purchased products. Among them, 33.3 percent have been threatened while protesting the price of goods.

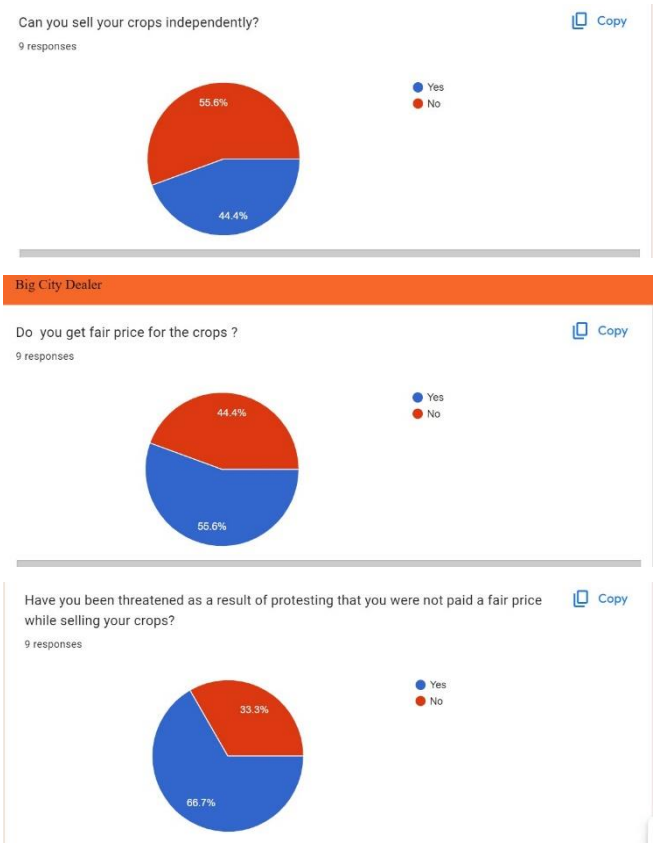


Fig 8. Big city dealer survey response.

Local Arabdar:

77.8% of local Arabdars feel they can buy products at a fair price. 66.7% feel that they can independently sell their purchased products. 77.8% of them have been threatened while protesting the demand for commodity prices. 56.6% think that the products are being sold at the right price in the market.

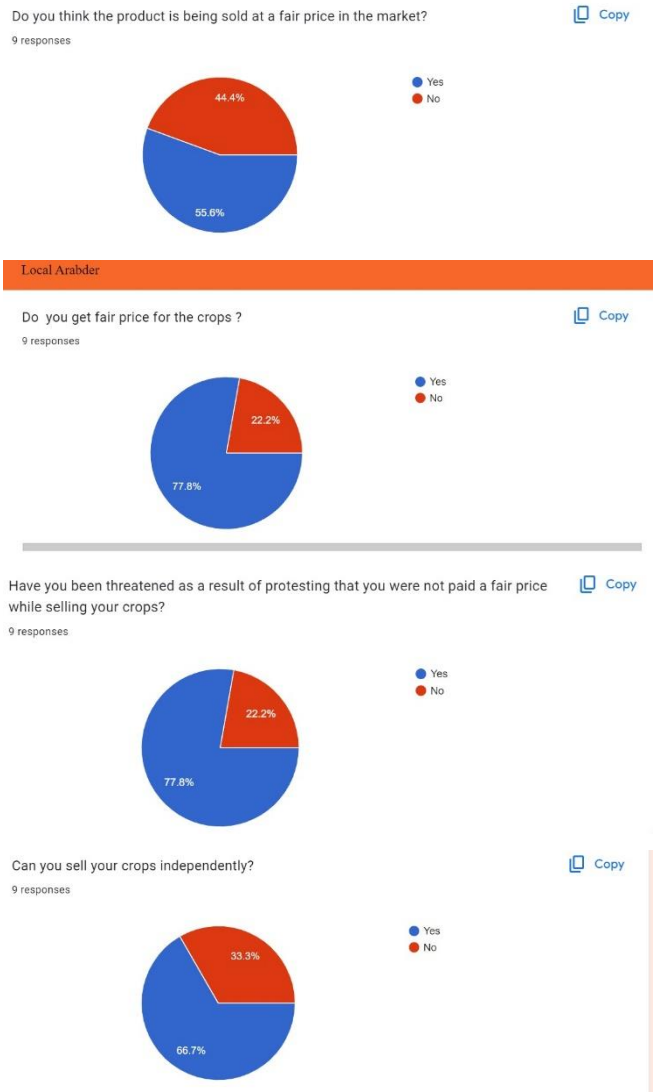
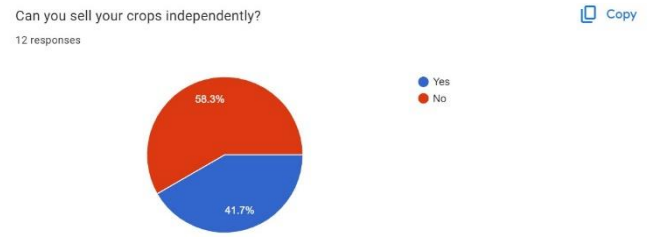


Fig 9. Local arabdar survey response.

Farmer:

66.7% of the farmers feel that they cannot sell their produce at a fair price. 58.3% feel that they cannot independently sell their purchased products. 58.3% of them have been threatened while protesting the price demands. 58.3% think that the products are being sold at the right price in the market.



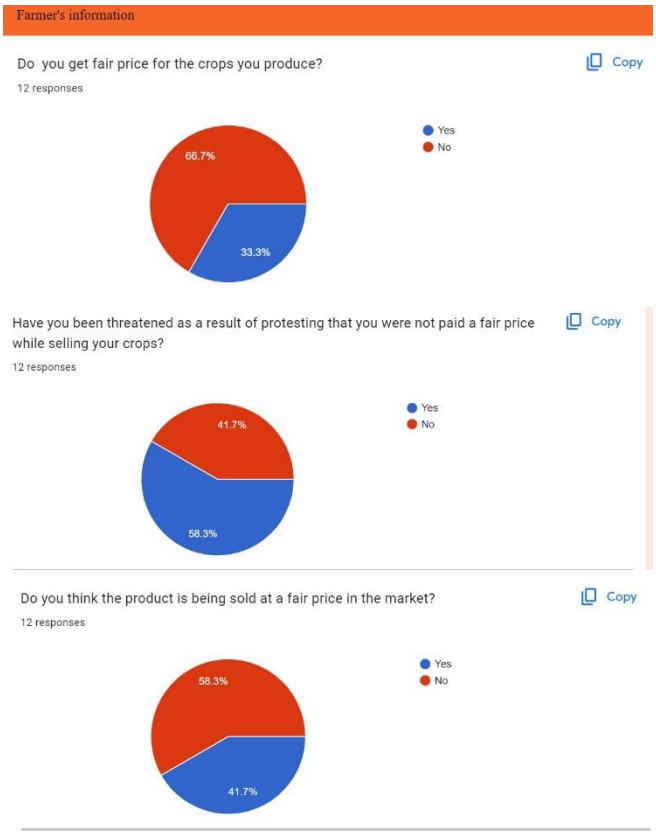


Fig 10. Farmer survey response.

Suggestions from the stake holders:

Stakeholders including farmers, local Arabdars, big-city dealers, customer and retailers proposed a range of solutions to the issue of deliberate price inflation of daily commodities by unscrupulous individuals. Although the perspectives differed, several shared themes and viable recommendations emerged.

1. Regular Market Monitoring

An important recommendation is for monitoring market regularly and systematically to avoid unethical practices. This oversight means that any price manipulation will be quickly detected. With an increased presence of regulators in the market and technological solutions for real-time price and transaction tracking, this can be done.

2. Stricter Enforcement of Laws

A second important approach revolves around the vigorous enforcement of the law as it stands. Most of the stakeholders say the current regulations should be enforced aggressively, with swift and harsh penalties for price gouging. These measures could serve as a buffer by dissuading others from resorting to these underhanded tactics. The proposals also call for revisions to existing statutes, including longer penalties for repeat violators.

3. Government Fixed Prices

Many of the speakers demanded that prices of essential items should be fixed by the government and all sellers should follow this. It would create a transparent pricing mechanism and take away the incentives for price takers to game it. Dynamic, market-responsive and realistic price controls are required to be effective and fair to both buyers and sellers.

4.Competitiveness and transparency_initiatives

This helps regulate prices and also encourages healthy competition among sellers. The more choice consumers have, the less likely sellers are to raise prices for fear of losing business. In addition, transparency of information about pricing and public access to it help the consumers to be aware of it, so that in this case they are not turned into fools paying more than necessary for a completely banal commodity.

5. Consumer Protection Laws

We need better consumer protection laws to protect ordinary people. Which needed laws will help prevent this from happening, mostly by regulating price manipulation and hoarding? There must also be a means by which consumers can alert regulators that these practices are in use and have them actioned upon quickly.

6. Local Producer Assistance and Supply Chain Betterments

Support local growers so that the markets do not get empty and we are not at the mercy of larger scale distributors who can dictate prices. This will also bring the level of hoarding or stockpiling down and in turn will potentially trickle down to reduced levels of artificial inflation due the product availability. All imported goods will be distributed at this price.

7. Technology Integrated with Transparency

Technology can allow a certain oversight of the pricing and sales of commodities — which is better than having none, generating at least some perol to explaination ratio. To provide such insight to both the public and their own authorities, internet-connected systems that automatically update a price index based on recorded transactions should be developed or in place. It also can provide access to information for everyone, from producer to consumer and prevent unfair practices.

8. Establishment of a Special Committee

Some of them proposed the double creation of a special Anti-Corruption Commission, but only for commodity markets. This could be a body to probe any wrongdoing in the market and take action, so that price control is maintained. by tackling Market Rampant Price Inflation Requires Multi-Dimensional Approach Solutions may include improving government regulation, establishing a stronger legal framework, enhancing market transparency and mobility of local producers. If these steps with regard to monitoring, along with the use of technology and development of a Monitorship Committee is in place then it will be easy for all market forces both consumers as well as sellers. The equations are an exception to the prescribed specifications of this template. You will need to determine whether or not your equation should be typed using either the Times New Roman or the Symbol font (please no other font). To create multileveled equations, it may be necessary to treat the equation as a graphic and insert it into the text after your paper is styled. The equations are an exception to the prescribed specifications of this template. You will need to determine whether or not your equation should be typed using either the Times New Roman or the Symbol font (please no other font). To create multileveled equations, it may be necessary to treat the equation as a graphic and insert it into the text after your paper is styled.

B. Data Flow Diagram

Level 0:

The Level 0 Data Flow Diagram(DFD) for Pro Market System gives a more detailed insight on how the system interacts with external entities. The Pro Market System represented in the middle of this level 0 diagram is supposed to be a central point that everything leads back to. Farmer, Local Area, Common Buyer and Authority interact with the system. All of these elements are key components of its operation. The protocol works by the Farmer is going to ask the system for verifications, and then it returns with a response claiming if this data being given were true. The Local Area describes a regional market which issues verification requests and verifies transactions to state accurate purchases on that local area. The Common Buyer reports his purchase data to the system, thus accounting for their flow and available stock, gets a report from the system in advance that helps classify procurement decisions The Authority presides over the system entirety, handling complaints and regulation enforcement. They deal with the complaints from several shareholders and also maintain a system for the smooth function. It also demonstrates the key processes like verification requests & responses, purchase data collection, complaints management and system reports generation. In full, this Level 0 DFD captures the information movement in the Pro Market System and by enabling market agents to work with one another creates effective and transparent operation of markets.

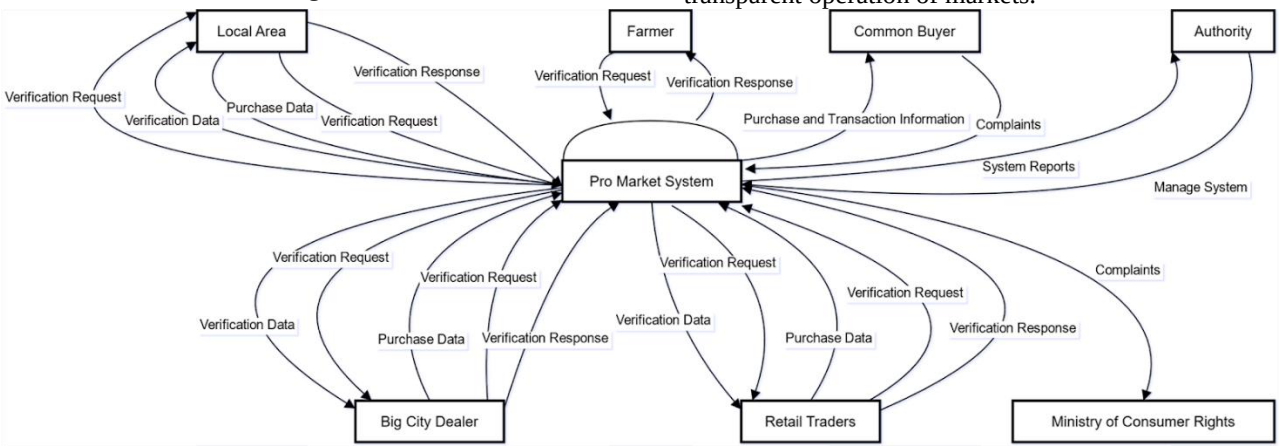


Fig 11. Level 0 data flow diagram.

Level 1:

The level 1 diagram provides more detail of the Pro Market System, including new components and processes. The system is still fulfilling its purpose as a linking-central among farmers, local areas, big city dealers, common buyers, retail traders and Government. Requests for verification and responses, as well as purchase data flow between the system and these stakeholders. The Verification mechanisms to maintain consistency of data throughout all transactions is orchestrated in Verify Entity module. The diagram also adds Process Purchases and Complaints, which do what they sound like in order to handle purchase data and consumer complaints, respectively. It is also handled as a complaint for customer rights, and finally this must be forwarded to the Ministry of Consumer Rights. The system ensures seamless integration of purchase data, verification and complaint handling in a wide market network. At the same time, a Complaints module has been added to help handle consumer complaints seamlessly. All complaints about customer rights are forwarded to the Ministry of Consumer Rights so that they can be duly addressed.In general, all of these entities which are verified by the Level 1 DFD comes under the level market network in form of widely connected functions such as complaint handling, purchase processing and verification of entity involving transactions provide smooth and effective operations throughout Pro Market System.

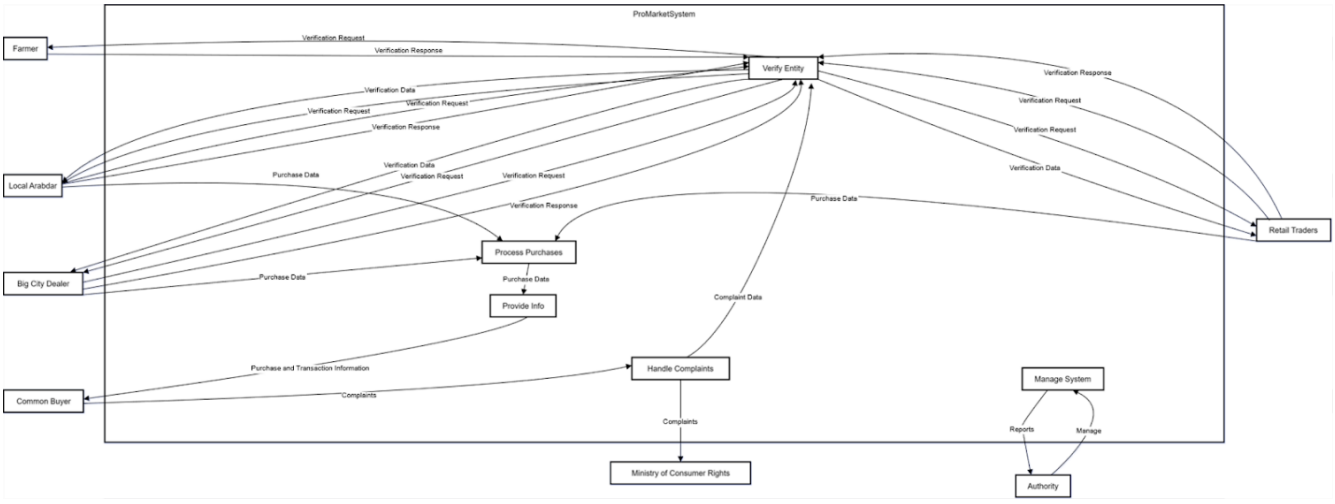


Fig 11. Level 1 data flow diagram

C. *Flowchart*

The process within the "Pro Market System" begins with the Farmer, is the first part of the process making a buy request to get verified by the system. The Pro Market System acknowledges this request, authenticates essential details, and returns back a successful verification to the farmer performing his transaction. Local Area records the Purchase Data and sends it to the system with a Verification request. The Local Area returns a verification response to the Pro Market System which completes their rule determination process. These same steps are followed by the Big City Dealer when they input the purchase data, send a verification request to receive necessary verification data and response to finalizing their transaction. The Retail Trader continues by entering this purchase data, sends a request for verification and the confirmation data is returned, finalizing their transaction. After these steps, all the Purchase and Transaction information are viewed by Common Buyers. For any other complaints, the buyer has all rights to file a complaint to the Pro Market System and they refer this same complaint straight to consumer rights Ministry. Based on this complaint, the Ministry then attends to the complaint by seeing that consumer protection and Full Accountability is maintained throughout the process. From there, the Ministry steps in to handle whatever complaint has been brought.

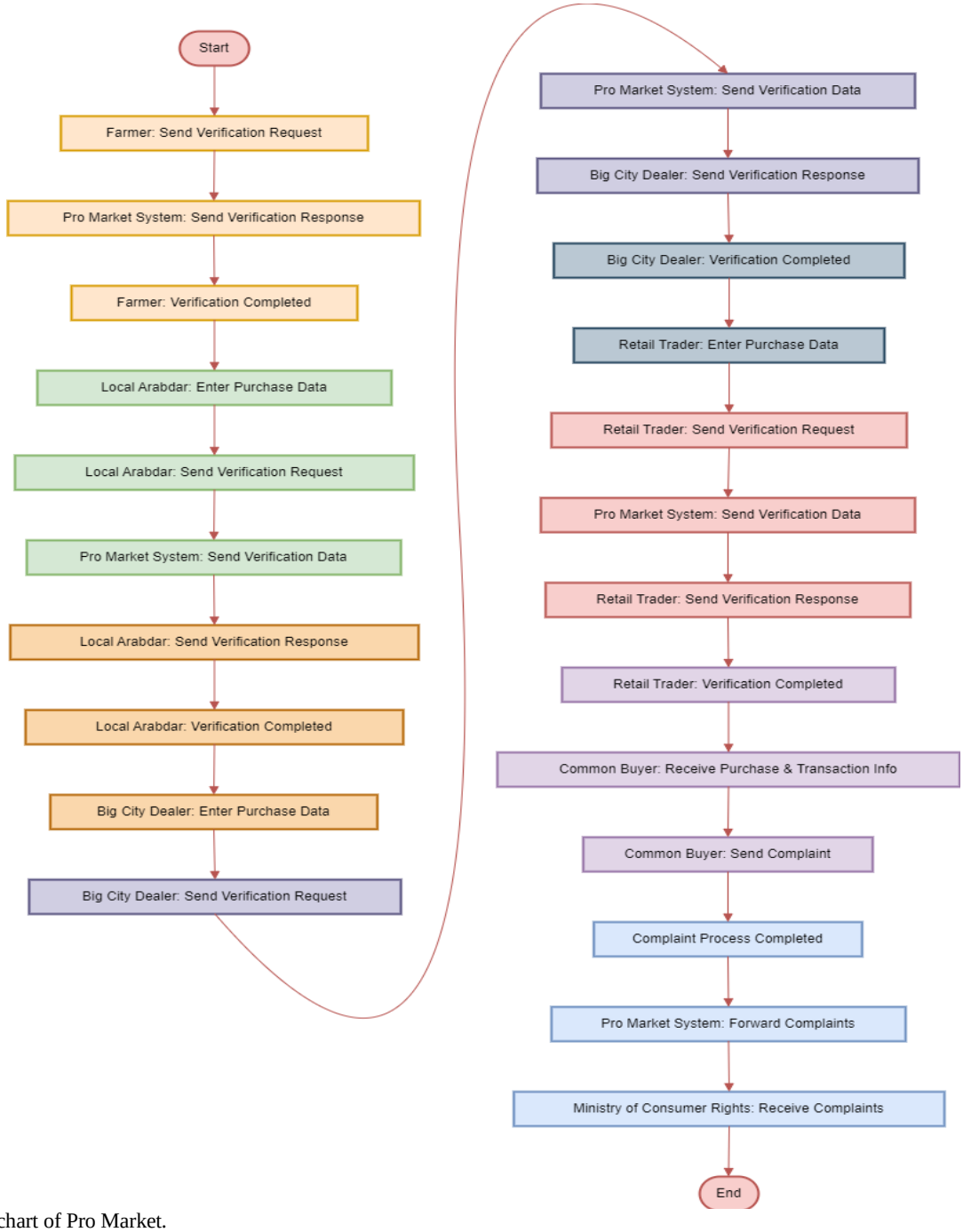


Fig 12. Flowchart of Pro Market.

D. Technology & Environment Setup

TABLE I.

Types of equipment	Features
VSCODE	CodeEditor
CodeEditor	Processor
CPU : Core i5 10th Gen , RAM : 16 GB,	Survey Tools
Processor	Version Control
Google Form	Design Tools
Survey Tools	Structured Query Language
Github	Local Server
Version Control	Database Management
Figma	Programming Language

IV. RESULTS

Large-scale corruption engulfs all the agricultural sectors of Bangladesh. With regard to the solving of corruption and proper functioning of the market mechanism, a pro-market system is suggested. A pro-market system may perform all rounds of market data collection, analysis, and research work to identify the scopes of corruption in the conventional market mechanism.

Process of Proposed System:

This system, if implemented, is expected to make agriculture more efficient, less corrupt, and thus distribute benefits more equitably among farmers and consumers, as well as the government.

This image below displays the Home page of Pro Market System . A greeting provided by the system saying "Welcome to Pro Market System" along with the 2 buttons that are "Login" and "Registration".

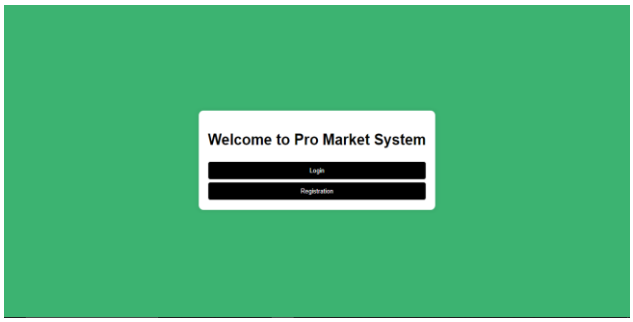


Fig 13. Homepage of the system.

The following image below displays a form for user registration in website of system. There have "NID," "Username Password" on the form.

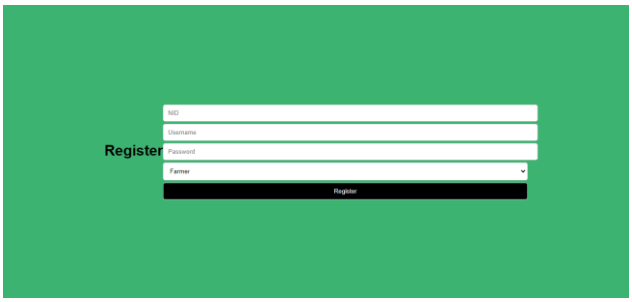


Fig 14. Registration page of the system.

The following image below displays the same form for user registration in website of system. There have "NID," "Username Password" on the form. It also has a dropdown with more tabs.

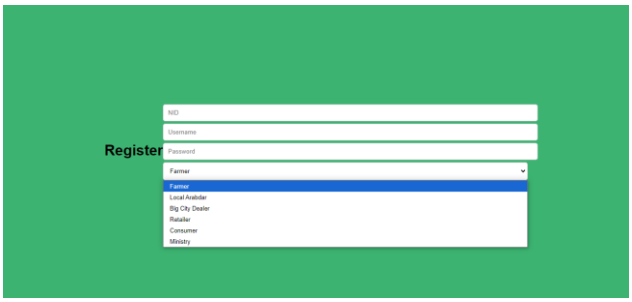


Fig 15. Registration page with dropdown menu of the system.

The image below represents the web interface of the system and simple login screen there. On the interface there are "Role" and a dropdown menu "Select Role", "UserName" and "Password".

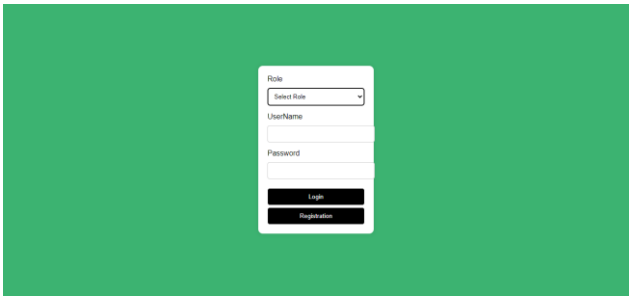


Fig 16. Login page of the system.

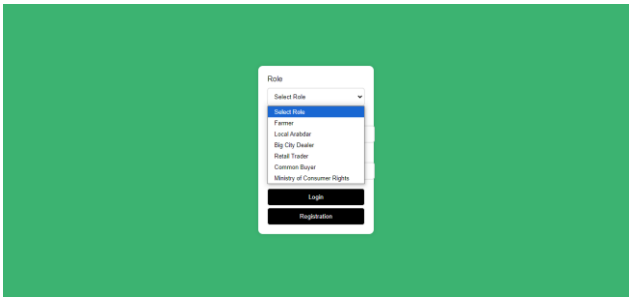


Fig 17. Login page with dropdown menu of the system.

The image below shows the farmer dashboard. It has the features to accept or decline when a verification request is sent to them after they have sold their goods.

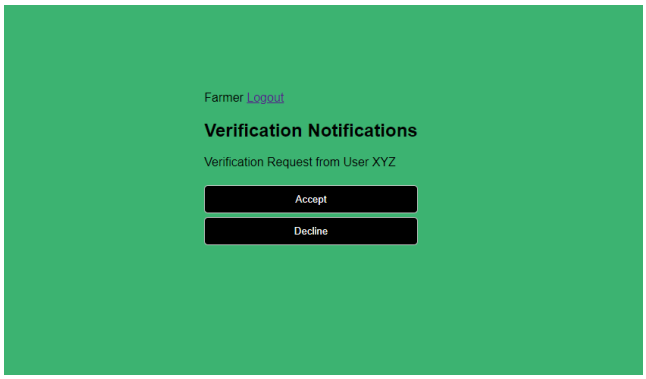


Fig 18. Farmer's dashboard page of the system.

This image below shows the dashboard for "local arabdar/big city dealer/retailer" a "Verification Update Messages" screen on site. The interface shows the input field for "Product Name," "Quantity," and "Amount" . This should be fill up for verifying the data.

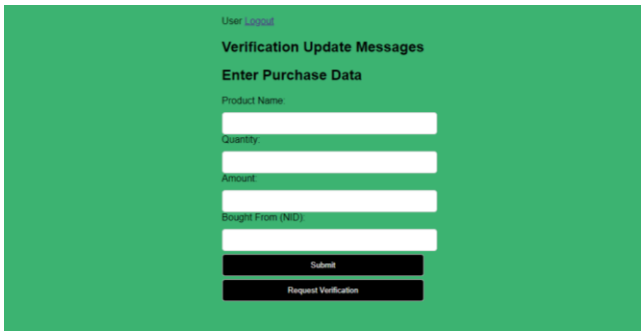


Fig 19. Local arabdar/Big city dealer/Retailer dashboard page of the system.

This image below is the "Consumer Dashboard," this has the features of "Product Prices" a "Submit Complaint" button. This is the interface created for such a use case where user are able to Look into product prices, view a dashboard and file a complain when they think there is corruption.

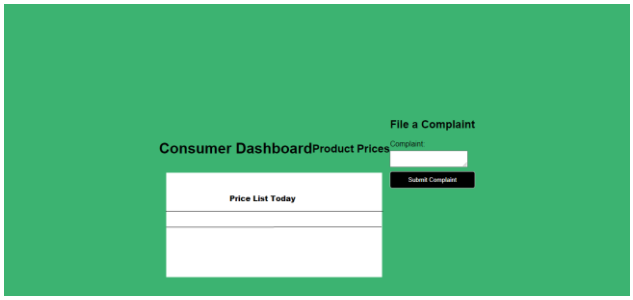


Fig 20. Consumer's dashboard page of the system.

This image below is the "Ministry Dashboard,". This has the feature to "View All Complaints," with this they can monitor and check all the complains that are submitted by the consumers/customers.

Fig 21. Ministry's dashboard page of the system.

This developed Pro Market System successfully met critical gaps in the agricultural supply chain of Bangladesh. Survey findings of 74 respondents including farmers, local Arabdars, big city dealers, retailers, and consumers clearly reflected the effect of this system. Of all the respondents, 47.3% were consumers, 16.2% were farmers, and the rest belonged to the trader or dealer category. The system proved that it could curb fake high prices successfully, for it was empowered with real-time price tracking and verification most effective in fighting the exploitation of middlemen and ensuring price justice across the supply chain. The farmers attested that they got timely market price information that enabled them to sell their produce at market-driven fair prices, free from any exploitation by middlemen. The other noticeable benefit in improved transaction transparency, which reduced errors and disputes in the system, was realized by traders and retailers. The use of SMS notifications assured farmers in rural areas—who could not access the internet that it provided them with updates on market conditions and verifications of transactions.

The Pro Market System definitely enhanced the protection of consumers. This was clearly illustrated in the rising number of complaints from real-time lodged cases using the system. In case of any anomaly, the Ministry of Consumer Rights could easily take action for redress. The system further made it easier for government oversight through easy monitoring by officials, market surveillance, complaint address, and enforcement of consumer protection laws. All in all, this automation of the flow of data and verification of transactions in the system enhanced operational efficiencies in general by the fact that manual interventions were minimized and errors were reduced.

V. Summary & Future Scope

Summary: Pro Market System is an end-to-end solution that aims to solve the inefficiencies, structure issues and lack of transparency in Bangladeshi agriculture supply chain. This is a comprehensive system that enables all stakeholders; the farmers, local traders, big city dealers, retailers and consumers as well right up to Ministry of Consumer Rights to come on to a single digital platform. The system is transparent and accountable, and achieves efficient data flow across the supply chain by making it such as integration with databases, web technologies, SMS notifications, RBAC (role-based access control), etc. The three main functions of the system are to verify transactions in real time, track prices and resolve disputes- ensuring both the farmers get a fair value for their produce and that price manipulation by intermediaries is prevented. SMS notifications have been added to the platform so that farmers in regions with poor internet connectivity continue

to receive market information, widening Twiga Foods' reach. Another key feature of the Pro Market System is that it enables consumers to get price updates in real-time, and provides them with an outlet for redress of complaints to which the government responds rapidly. It also provides a means for even better government oversight so that marketing operations and consumer protection laws can be monitored effectively. The Pro Market System has already revealed through its scalability and automation the huge potential that it carries in enhancing behavior change to become more competitive, reduce human bias as well as achieve the trade goals for change of SAAS startups out there. This paper shows the potent nature of the system that it regulates exploitation by middlemen, panic buying and hoarding leading to artificial hikes besides stabilizing agricultural market saving both farmers and consumers. Moreover, live field surveillance and the regular data-driven information generated by the system would help policymakers to design better agricultural policies.

Future Scope: The Pro Market System has already shown that it works in the Bangladesh context and can be utilized as another tool in improving transparency and fairness within the Agricultural Market in the country, nonetheless, still, there are key areas which require further development alongside potential expansion of this innovative system:

1. Advanced Analytics Integration Future releases of the system could include machine learning and predictive analytics capabilities to predict market conditions, identify outliers & supply stakeholders with data-driven insights. This would help the farmers and traders to take wiser decisions and ultimately will stabilize market.
2. Adding Other Agricultural Commodities: As of now, the system is concentrating on a certain range of produce and commodities. The platform has the potential to scale beyond tomato to other agricultural commodities as well, impacting a larger section of the agriculture ecosystem in future versions.
3. Mobile App Development: You may consider creating a dedicated mobile app to help improve user experience and extend functionalities like in-app payments, more advanced market analysis tools, new ways of communication with all stakeholders.
4.The addition of a blockchain: The adoption and implementation of blockchain technology could also help improve the transparency and security in transactions by generation an unchangeable repository for all activity on these markets. This would certify that none of the data could be manipulated and at the same time it would improve the confidence stakeholder in system.
5. International expansion: given that the inefficiencies in the agricultural market it tackles are widespread in developing countries, this model can be scaled up to other parts of the globe. The platform could eventually be reconfigured to meet the needs of other regions around the world that confront similar problems in their food supply chains.
6. Incorporating Government Policy: By immersing the system deep into governmental processes wherein insights are generated directly Influencing agricultural policy interventions, subsidies and support systems would be much more targeted to the needs of farmers. Similar predictive powers could be retooled to forecast and minimize food security shocks worldwide.

As a result of these innovations, the Pro Market System could not only revolutionize the agricultural supply chain in Bangladesh but also serve as replicable model for other developing nations seeking to enhance market efficiency and transparency.

VI. Conclusion

Pro Market System is a groundbreaking intervention created to solve the core problems of agricultural supply chain in Bangladesh. Do you wonder how they make the market a transparent, just and efficient one in which various technologies work together, such as relational database management, web development back- and front-end parts, sms notifications and role-based access control. In its development, the system overcame some of the centuries-old challenges that have led to exploitative middlemen, price hikes and little access to real-time market data both for farmers and consumers. The system had empowered farmers, traders, consumers and government officials by providing them with critical data at their fingertips as indicated in the findings. This has given farmers the ability to make better sales choices for their harvest by being able to access much more accurate real time market data instead of almost entirely relying on middlemen in the past, and therefore removing an economic dependency from them. The reduction of artificial price inflation is one of the most significant achievements that the system has to boast about. Embedded with world-class real-time transaction verification and price tracking mechanisms, the platform will ensure the accountability of all traders and retailers. The system logs all transactions so that the platform is transparent with no room for fraudulent activities, thereby promoting responsible mining. While the farmers said it had liberated them from exploitative middlemen by showing market rates for their crop (so they could decide whether they were being offered a fair world price), In this way, it made the market more fair for both farmers and consumers, as they were able to partake in transparent pricing mechanisms. Additionally , the Pro Market System is a powerful consumer protection tool. Consumers are participants and not passive by-standers in the market today they have an array of modern tools to track prices, alert price violations, complaint real-time. Through the integration of the Ministry of Consumer Rights into the system, thousands of these complaints are now likely to be resolved promptly, and this will contribute further to increasing consumer trust and confidence in the market. The system’s automation of complaints handling and direct involvement of regulatory bodies like the Ministry also promote a culture of accountability, where traders and retailers must adhere to ethical practices to avoid penalties. The scalability of the system also positions it as a long-term solution for agricultural market stabilization in Bangladesh. Another attribute in connection with the system's geography-wide expansion is that with more users and transactions, the system automatically makes it easier for the different actors to manage their data flows so that they secretion smoothly as the market grows. By reducing the manual intervention, the system can operate more efficiently and lowers the chance of any saddlebags errors being written on to your system which make it more reliable as time goes on. It uses SMS-based services to keep people in rural areas or those who do not have full-on internet connectivity in the loop and

ensure they are a part of the market. By doing this with inclusivity among urban and rural markets, we have more equity in the agricultural supply chain. For government, the key insight of the Pro Market System is that by exposing aspects of market behavior, we can better design policy interventions. The data that the solution collects provides a goldmine of information for tracking market trends, detecting exceptions and implementing decisions based on data. For instance, if a sudden price rise is being reported by the market, the government will get a current pricing trend and may intervene in time to moderate market imbalances or tame price volatility. This data-driven governance approach will enhance regulators frameworks over the agricultural sector as a whole and result in much more effective government surveillance. More widely, the Pro Market System tackles some of the largest mallable issues in its development-focused country including Bangladesh where agricultural inefficiancies reproduced poverty and economic insequality. It results in fewer injustices within the supply chain by facilitating a more straightforward flow of information, transparent transactions, and increased responsibility on behalf of all market participants. Enable smallholder farmers, who are all too often at the mercy of larger players on such markets, to fetch fair prices for their produce and avoid being taken advantage of by others; preventing consumers from facing artificially conjured or real situations in which price rises and market fuckeries effect you. Moreover, the system is flexible in times of crisis. As seen in disruptions during the COVID-19 pandemic, agricultural markets can become susceptible to shocks, resulting in panic purchases on the one hand and breakdowns of supply chains and price increases on the other. Real-time data flow and price verification, are the operational safeguards that prevent localized disruptions from creating complex vulnerabilities across markets has been made possible by the Pro- Market System ensuring seamless operations even during times of crisis. That resilience is critical to ensuring our food security and buffer against further systemic shocks — in natural disasters or global pandemics.

Finally, Pro Market is not simply a technology, it is also an essential change maker and the key to creating a real free market in Bangladesh. The system works to benefit all sides of the industry in making companies and marketers accountable and giving consumers injury protection, fair bids as it uses everything from individual data generated by companies who are recorded real time. We live in a dramatically globalized and rapidly transformed world where transnational acquisitions play an important role as stabilizers, systems of market efficiency but also more equitable economic growth and hence create the conditions for a better agricultural economy. The information gathered from the system's data would also further help in devising forward-looking agricultural policy that safeguards sustainability and resilience, with stand out strengthen Bangladesh’s agricultural markets for a more robust, transparent future.

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Contribution Table

Name	ID	Contribution (%)	Contribution Category
Pranto Paul	223014003	32%	R&D, Code Implementation. Report Writing. Data Collection, Flowchart, Table.
Saiful Islam	223014193	35%	R&D, Code Implementation & debugging, Report Writing & Formating, Flowchart, Data Flow Diagram.

M. M Rafsanjani Showrav	223014210	33%	R&D, Code Debugging, Report Writing, Data Flow Diagram, Data Collection & Analysis, Table.

Saiful Islam is pursuing a B.Sc. in Computer Science and Engineering at the University of Liberal Arts Bangladesh (ULAB), expected to graduate in 2026. He co-founded the Association of International Activists (AIA), a nonprofit focused on mental health and youth empowerment through the SDGs. He serves as Deputy Graphics at Shutterbugs.ULAB and has held a senior role at the Bangladesh Center for Photography & Sustainability. His research interests include IoT, machine learning, and data science.

M. M Rafsanjani Showrav is currently pursuing a B.Sc. in Computer Science and Engineering at the University of Liberal Arts Bangladesh (ULAB). From 2014 to 2019, he was active in scouting and received the President's Scout Award in 2017. He worked with the National Children's Task Force (NCTF) from 2015 to 2020, serving in roles such as District President and Central Committee Media and Publication Secretary. He has been involved with the National Debate Federation Bangladesh (NDF BD) since 2015 and was District Coordinator (2015-2018) and Central Executive Member (since 2019). In 2019, he ranked fifth nationally in a science fair. During the COVID-19 pandemic, he represented Save the Children in international discussions on children's welfare in Bangladesh. He served as a Youth Advisory Panel (2020-2023) and Country Management Team (2021-2023) member for Plan International Bangladesh. He also advocated for child and women-focused national budgets and founded the Association of International Activists (AIA), an organization supporting the Sustainable Development Goals (SDGs).

Pranto Paul is currently pursuing a Bachelor of Science in Computer Science and Engineering at the University of Liberal Arts Bangladesh (ULAB). Passionate about technology, he focuses on backend development, artificial intelligence, and software development. Pranto regularly participates in coding contests, showcasing his problem-solving skills and dedication to advancing his knowledge. He has worked on several software-related projects and is committed to contributing to the field by developing efficient and robust backend systems. Through his studies and future work, he aims to push the boundaries of innovation in computer science.