

Resilience Analysis of the Premium Quality Rice Market System in Bangladesh

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Abstract

This study evaluates the structure, dynamics, and resilience of the Premium Quality Rice (PQR) market system in Bangladesh using the Market Systems Resilience Assessment (MSRA) framework developed by USAID. The PQR market includes various actors—farmers, paddy traders, millers, wholesalers, retailers, and consumers—engaged in the production, processing, and distribution of fine-grain, high-value rice varieties. Despite declining per capita rice consumption in Bangladesh, demand for PQR is increasing due to rising incomes, urbanization, and changing consumer preferences. Primary data were collected through two rounds of surveys: one involving 1440 rice farmers and another involving over 2000 market actors and consumers across key PQR-producing districts. Conducted during the COVID-19 pandemic, the surveys allowed examination of the market system's adaptive response to economic shocks. Resilience was assessed across eight domains categorized into structural (connectivity, diversity, power dynamics, and rule of law) and behavioral (cooperation, competition, decision-making, and business strategy) components. Findings show moderate resilience overall, with strong performance in competition and cooperation, but weaknesses in connectivity, diversity, and strategic decision-making. While the PQR market benefits from competitive structures and profitable incentives for producers, challenges such as fragmented linkages and unequal power distribution hinder its full potential. This study underscores the importance of building adaptive, inclusive, and efficient value chains to enhance the resilience of agri-food systems. Periodic reevaluation of resilience metrics is recommended to track progress over time and guide market-oriented policy and development interventions.

Keywords

Resilience, Premium Quality Rice, Market System, Bangladesh

1. Introduction

A market system constitutes a network where buyers, sellers, and various participants collaborate to trade specific products or services. Within this system, there are three distinct participant categories: 1) Direct market players like producers, buyers, and consumers, who actively fuel economic activities within the market; 2) Suppliers of supporting goods and services, including finance, equipment, and business consulting; 3) Entities that influence the business environment, such as regulatory agencies, infrastructure providers, and business consultants [1]. The “market system” of rice in Bangladesh plays a vital role in the country’s economy and food security. Rice, as the staple food of Bangladesh, relies on the market system to ensure its production, distribution, and availability to the population. The rice market system in Bangladesh encompasses various actors including farmers, paddy traders, millers, rice wholesalers, rice retailers, and consumers. Farmer cultivates rice in different regions of the country, and their harvest is then collected by paddy traders and millers who process it into various varieties of rice. Wholesalers subsequently acquire rice from millers and distribute it to retailers across the country. Finally, consumers access rice through retailers, who sell it in local markets and shops [2]. In this study we measured the resilience of Premium Quality Rice (PQR) market system by using the Market System Resilience Assessment (MSRA) tools developed by United States Agency for International Development (USAID).

In the marketing year 2021-22 (May-April) Bangladesh produced 35.8 million metric tons of rice from 11.6 million hectares of land [3]. Bangladesh is one of the world’s top rice-consuming countries. The yearly per capita rice consumption stood at 144.8 kg in 2019 compared to 170.4 kg in 2012 [4]. According to Bangladesh Bureau of Statistics, the annual per capita rice consumption further declined to 120 kg in 2022 [5]. Even though, the amount of per capita rice intake has been decreasing over the time in Bangladesh, the demand for fine-quality rice has been increasing sharply as consumer preferences and the purchasing power of the middle-class population continue to increase. Educated, affluent, and urban households in Bangladesh are increasingly consuming fine-grain (*i.e.*, long-and-slender-grain) rice, replacing ordinary-grain (*i.e.*, short-and-bold-grain) rice [6]. Even individuals from lower-income backgrounds exhibit a preference against consuming coarse rice [7].

Usually, there is no uniform definition of “rice quality” rather it is very relative and context specific [8]. For example, what is considered “low quality” for rural consumers in India may be perceived as “premium quality” by urban consumers in Senegal [9]. In this study the premium quality rice (PQR) varieties are characterized by long, slender and fine grains; they may or may not have an aroma; and command a higher price than other popular rice varieties [10]. However, to operationalize the data collection, the identification of PQR varieties considered farmer’s and trader’s own classification. Farmers in Bangladesh grow a good number of PQR varieties including Chinisagar, Basmati, Badshahbogh, BRRI dhan34,

BR5, Kalizira, Tulsimala, BRR1 dhan37, BRR1 dhan38, BRR1 dhan50, Bina dhan12 and Bina dhan15 [11]. In this study we found five varieties such as BRR1 dhan34, Chinigura, Badshabhog, Babuibogh, and Kalijira were identified as PQR variety by the farmer. While the other market actors identified many other varieties as PQR based on their preferred characteristics. PQR varieties have a 20% - 60% price advantage and 50% higher profit over other rice varieties, indicating that there could be significant interest in expanded production [10]. The total demand for PQR is growing at 5% per year because of rising per capita income, leading to increased consumption of PQR, urbanization, growth of modern food supply chains (supermarkets), and growing investment of private companies in the rice value chains [10].

Understanding the PQR Market System and Its Resilience

The market system of PQR embodies a complex web of interactions involving producers, distributors, and consumers, all engaged in the trade of premium-grade rice varieties. This intricate system is centered around delivering rice products of elevated quality standards, encompassing factors such as superior taste, texture, and nutritional value [12]. Within this market system, producers employ advanced cultivation techniques and innovative technologies to cultivate rice grains that meet these heightened standards. For example, farmers use modern rice varieties that exhibit premium characteristics in grain size and taste. The distribution facet of the PQR market system is also characterized by specialized supply chains designed to uphold the integrity of the rice variety from its source to the end consumer, reinforcing its premium status. This system garners attention from discerning consumers seeking top-tier culinary experiences and health-conscious options, driving an increasing demand for rice products that align with these preferences. Consequently, the PQR market system fosters a cycle of continuous enhancement and innovation across the rice production and supply chain, contributing not only to market resilience but also to the broader food security landscape.

Resilience is the ability of people, households, communities, countries, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth [13]. Similarly, market system resilience is the ability of market systems to allocate resources, draw on system-level resources (such as social safety nets, social capital, the financial system, or government assistance), and innovate in order to solve problems in the face of shocks and stresses [14].

At the system level, resilience is defined as the capacity of the system to marshal and allocate available resources, be they public or private, community or national, to respond to a shock or stress regardless of its nature. To illustrate, over time, market systems tend to orient toward the accumulation of resources in smaller pockets in order to weather shocks and stresses, or they evolve various interconnected mechanisms to harness resources to solve, neutralize, and/or mitigate the

risks associated with shocks and stresses.

Resilience within market systems is a relatively underexplored domain in the realm of development. While it draws from the foundations of market development, it delves into the market system's ability to withstand, adjust, or even transform when faced with shocks and challenges. Operating within the larger economic, political, socio-cultural, and environmental frameworks, markets play a pivotal role in allocating resources to address systemic issues, particularly those arising from unforeseen shocks and strains. Experts specializing in market systems recognize the intricate web of relationships between various elements, such as actors, institutions, markets, and broader systems. The choices made by households and the behavior of firms, whether cooperative or opportunistic, ripple through, influencing not only performance but also resilience at the market system level. Additionally, policies within the broader environment can exert an impact on performance across all tiers [14].

The United States Agency for International Development (USAID) has developed and published a framework for measuring the resilience of a market system in 2018 [14]. Following that they also prepared a guidance for assessing the resilience in a market system in 2019 [15]. By adopting the USAID's Market System Resilience Assessment (MSRA) tool, this paper aimed to assess the resilience level of PQR market system in Bangladesh, using the empirical data.

2. Review of Literature

According to Barrett & Constanas, 2014 [16], resilience theory recognizes that there is an interrelated hierarchy of individuals, households, communities, and systems with bi-directional feedback across these levels of the organization. Resilience at each level is connected to and can be dependent on resilience at other levels. Resilience isn't a fixed characteristic; rather, it arises as a property within complex systems. According to complexity theory, the only effective approach to gauging thresholds in such intricate systems is by traversing them [17]. These thresholds are pivotal junctures where there's a substantial shift in the behavior of a system or the values it holds [14].

Agricultural market systems can face a range of critical shocks that impact their stability and functionality. These shocks encompass various dimensions. Economically, price volatility can pose a significant challenge, causing fluctuations that affect both producers and consumers. Social shocks, including political instability and governance issues, along with inadequacies in trade policies, can disrupt the smooth functioning of agricultural markets. Environmental shocks, such as natural resource degradation caused by floods, droughts, erratic rainfall, and soil fertility problems, can severely hamper agricultural productivity and distribution. Additionally, health shocks, exemplified by diseases and pandemics like COVID-19, introduce unexpected disruptions, impacting the labor force, transportation, and overall market operations. These key shocks collectively underline the vulnerability of agricultural market systems and emphasize the need for strategies to

enhance their resilience and adaptability [18].

Bahadur *et al.* (2015) [19] utilize the three as approach as a foundational concept for categorizing the impacts of projects on resilience. While this approach's strength lies in its simplicity, the extent to which these three capacities—adaptive, anticipatory, and absorptive—are readily distinguishable as separate entities remains a subject of debate. This framework was specifically developed for the Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) program. However, notably absent from their categorization is the transformative aspect, as Bahadur *et al.* (2015) [19] assert that transformation is not a standalone capacity. Rather, they characterize it as an encompassing approach, aimed at holistically and fundamentally enhancing people's ability to adapt, anticipate, and absorb shocks and stresses. According to them, transformation isn't a self-contained capacity within resilience. Instead, it emerges from the fusion of adaptive, anticipatory, and absorptive capacities, coupled with various internal and external factors, ultimately leading to a redefined state. While the Three As framework offers a relatively uncomplicated method for classifying capacities, alternative frameworks offer more comprehensive guidelines and insights for assessing and comprehending resilience across various contexts, ranging from households and food systems to market systems. This viewpoint also contrasts starkly with the theoretical framework adopted by the Food and Agriculture Organization (FAO) of the United Nations (UN), which classifies capacities as adaptive, absorptive, and transformative [20] [21].

The FAO's Resilience Index Measurement Analysis II (RIMA II) serves as a pragmatic analytical tool, building upon the guidelines presented by the Food Security Information Network (FSIN) to gauge the resilience of food security. Similar challenges arise when applying absorptive, adaptive, and transformative capacities, much like encountered in the Three As approach, to systematically define indicators for resilience measurement [22]. RIMA II primarily relies on household-level data and revolves around six key modules: 1) Access to essential services; 2) Social safety nets; 3) Food security; 4) Assets; 5) Adaptive capacity; 6) Shocks [22]. Both FSIN and RIMA II advocate for the utilization of panel data [22], ensuring that measurements are dynamic—incorporating temporal aspects or changes in the concerned outcome variable(s) [23]. While RIMA II includes both indirect (inferential) and direct (descriptive) variables, it omits “exogenous variables”, encompassing factors like the environment, socio-political dynamics, and institutional dimensions [24]. Observable indicators of “resilience achievements” within RIMA II encompass changes in monthly per capita food expenditure and dietary diversity [24]. Acknowledging the comprehensive nature of RIMA II, the FAO concedes that its implementation can be resource-intensive and time-consuming, often infeasible for countries facing fragility and conflict; consequently, a condensed questionnaire format has been developed by the FAO.

While a few tools do exist, they are relatively limited in their emphasis on Market Systems Resilience (MSR) [15] [25]. Among them is the Market Systems Di-

agnostic tool developed by Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance [25]. This tool has been implemented in Honduras to gauge the competitiveness, inclusivity, and resilience of the industry-level market system [25]. The Market Systems Diagnostic tool primarily evaluates enterprises within several major industries, aiming to assess the overall health and resilience of the entire market system [25]. Notably, this tool seems to exclude households and smaller market participants, which might be attributed to its development for high-value industries. Additionally, it doesn't consider external factors such as the natural environment, which can influence market system resilience.

While specialized tools for measuring household resilience (STRESS, GOAL, RIMA II) are established and operational, and tools for measuring market systems resilience (like the Market Systems Diagnostic) are under development, there's currently a lack of widely utilized tools that effectively combine theory-based resilience assessment for households and market systems. What's needed is a tool that's replicable, adaptable, and relatively straightforward for development practitioners to use. Ensuring practicality in terms of time and resource requirements for data collection, as well as flexibility to swiftly capture both post-shock responses and long-term development progress, are essential considerations in enhancing resilience measurement tools, thereby delivering actionable insights to practitioners [26].

The Market System Resilience Index (MSRI) takes a comprehensive approach to assessing market resilience across multiple tiers, considering external factors like the ecological environment—setting it apart from comparable tools. Originating in 2018 through the efforts of International Development Enterprises (iDE) as part of a Bangladesh-based market development initiative, the MSRI has evolved and integrated insights from the Resilience Evaluation Analysis and Learning (REAL) Award under the USAID Center for Resilience [15]. iDE's contributions to the Market System Resilience (MSR) framework by the USAID Bureau of Food Security [14] have also informed its development. The MSRI model from iDE amalgamates core resilience elements to gauge the effectiveness of market systems in anticipating, enduring, and adapting to internal and external shocks and pressures.

In contrast to guidance by the USAID, which segregates market resilience and market inclusion as distinct facets to be measured and pursued, the MSRI intertwines inclusivity within market resilience measurement. By embedding social dimensions and vulnerabilities into the assessment, the MSRI captures the human side of resilience alongside financial aspects, acknowledging the social nature of markets. Recognizing that market systems hinge on households and vice versa, the MSRI stands out for incorporating households into its analysis, offering a systemic perspective that transcends mere household-level measurement [27].

The MSRI extends from the Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP) tool's agroecological indicators,

creating a more holistic instrument aligned with the notion of planetary and social boundaries. This distinguishes the MSRI by bridging sectoral divides that often treat climate and the environment as separate issues. Understanding the interdependence of households, markets, and the ecological environment, the MSRI integrates ecological indicators to better gauge these complex relationships' impact on market system resilience.

The SHARP tool developed by FAO is designed as an instrument to assess the resilience of farmer and pastoralist households to climate change. It addresses the need to better understand and incorporate the situations, concerns and interests of family farmers and pastoralists relating to climate resilience [28]. While inspired by SHARP's agroecological indicators, the MSRI was meticulously designed to address operational challenges that could impede its application. It was crafted as a modular, adaptable tool, ensuring context-specificity without compromising comparability. Opting against creating new measurements for each project, the MSRI strikes a balance between qualitative and quantitative measurements, enhancing both comparability and nuanced insights. By maintaining a judicious range of determinants, the MSRI remains user-friendly, flexible, and poised to serve diverse projects. Building on the collective wisdom from prior tools and frameworks, the current iteration of the MSRI stands as a versatile and valuable instrument ready for a variety of applications [27].

3. Methodology

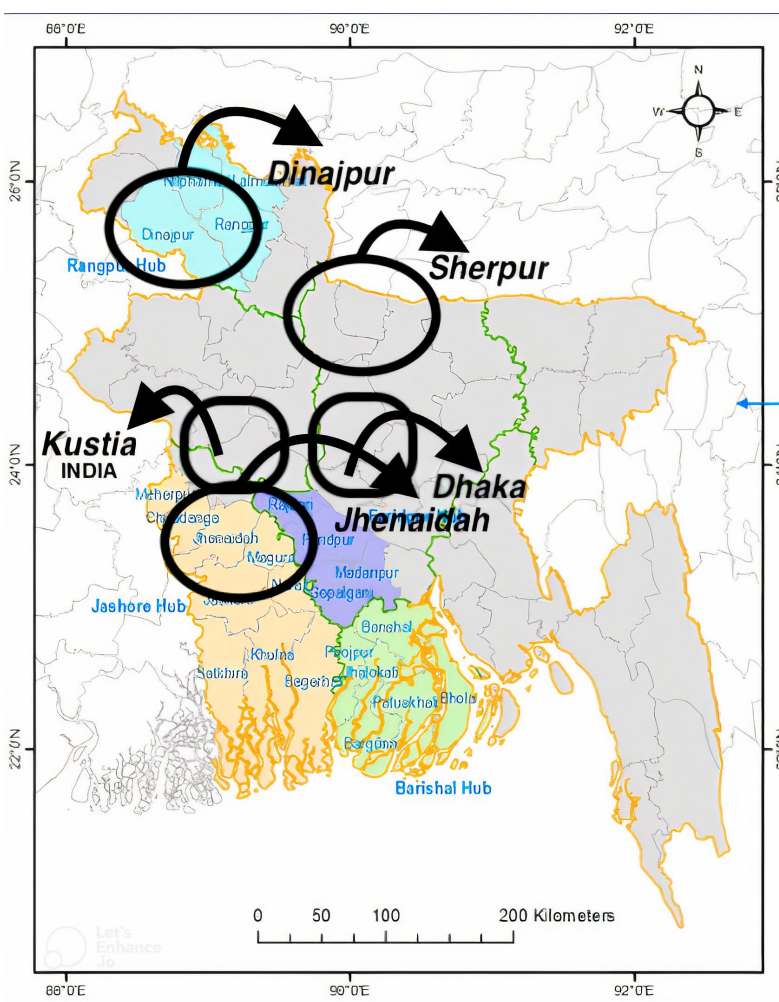
3.1. Study Area

The Cereal Systems Initiative for South Asia, Phase-Three (CSISA-III) project designed with the primary goal of fostering the development of producer groups dedicated to cultivating PQR. With the funding support from United States Agency for International Development (USAID), the International Rice Research Institute (IRRI) has implemented the project in several districts in Bangladesh.

To increase farmers' profitability in rice production, CSISA has worked to expand the cultivation of PQR since Phase III of the Activity was initiated in 2016, starting in south-west Bangladesh (the Khulna region), and in 2019 in the northern region (Rangpur and Dinajpur). It focuses on ensuring a consistent supply of high-quality PQR seeds to the producers through innovative private sector engagement. This involves facilitating partnerships between producer groups and seed companies through a business expansion model, thereby establishing a sustainable mechanism for seed supply. The project also endeavors to enhance the linkages between these seed companies and the Bangladesh Rice Research Institute (BRRI) to ensure a regular supply of breeder seeds.

This study conducted two rounds of surveys. The first round of the survey was conducted in 2020 that only interviewed rice farmers from Dinajpur, Sherpur, and Jhenaidah districts of Bangladesh (Figure 1). These districts were chosen purposively because they are famous for cultivating different varieties of PQR. Among the selected districts, Dinajpur and Jhenaidah were taken from the CSISA project

intervention areas while the Sherpur district was taken from non-project intervention areas. Usually, farmers cultivate PQR during the *aman* season (August to November) [29] and this study collected PQR production and marketing related data for *aman* season 2019. The second round of survey was conducted in 2021 that interviewed paddy trader, rice miller, rice wholesaler, rice retailer, and consumer from Dinajpur, Sherpur, Jhenaidah, Kustia, and Dhaka district (Figure 1). Study samples were taken from both intervention and non-intervention areas to improve the generalizability of the results. To integrate the data from the 2020 farmer survey and the 2021 market actor survey by focusing on common domains and indicators of resilience. Even though the surveys were done at different times, the same framework was used to analyze both, allowing conduct one overall assessment.



Source: CSISA Project.

Figure 1. PQR production and market actor survey locations in Bangladesh.

3.2. Sampling and Data Collection

3.2.1. Farmer's Survey

The farmer's survey used a disproportionate sampling technique to find the sample farmer. In the first stage of selecting the sample farmer, six sub-districts

(Upazila) from Dinajpur, three sub-districts from Sherpur, and three sub-districts from Jhenaidah were chosen based on the area and volume of PQR production. A total of 144 villages from 12 sub-districts were chosen randomly. In the second stage, 10 farmers from each village were identified randomly (Figure 2). Hence, the study identified and surveyed 1440 sample farmers combining both PQR and non-PQR farmers. The farmer's survey was conducted in 2020 and primary data were collected through face-to-face interview by using a structured questionnaire employed in *surveybe*, a computer assisted personal interview (CAPI) software. A group of data enumerators was recruited and trained on the questionnaires and CAPI tools. Each enumerator was provided with a laptop. They visited the sample households, interviewed the farmers, and obtained their consent prior to the interview. About 20 observations were excluded from the analysis due to missing information.

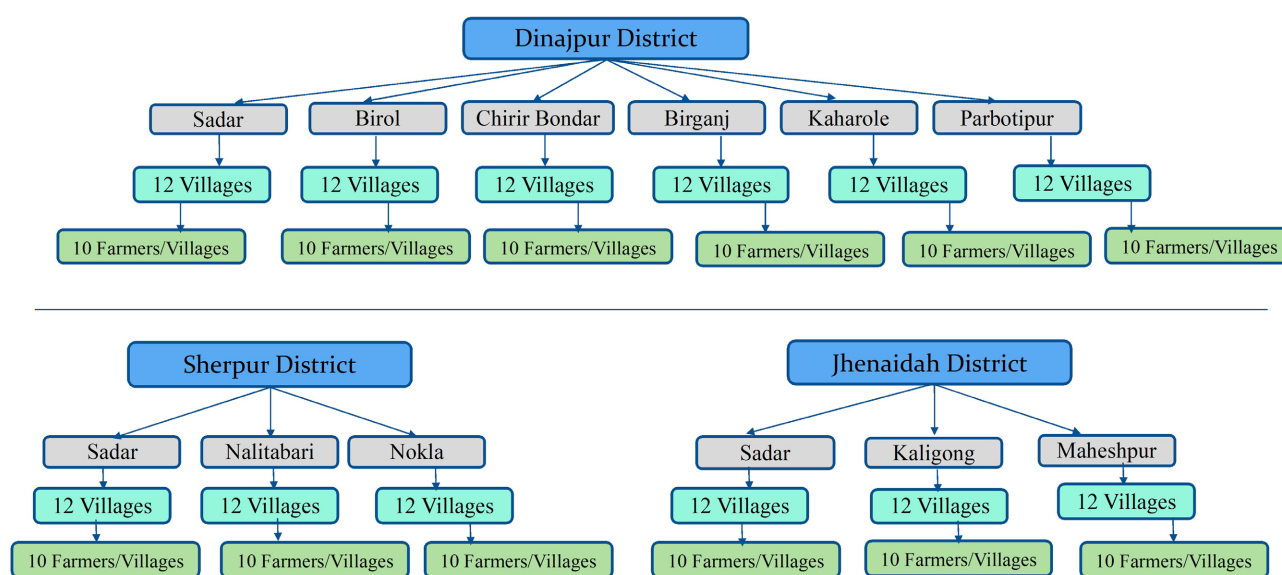


Figure 2. Disproportionate sampling framework of identifying sample farmers.

3.2.2. Market Actor's Survey

Various market actors involved in PQR value chain were interviewed during the second round of the survey that included 200 paddy traders, 200 rice millers, 125 wholesalers, 275 retailers, and 1194 consumers from Dinajpur, Sherpur, Jhenaidah, Kustia, and Dhaka districts. In this second round, Kustia and Dhaka districts were included for interviewing rice wholesalers, retailers, and consumers.

This second round of the survey was conducted over a significant period throughout 2021 due to its large volume and higher sample size. This strategic timeframe was selected to highlight the profound impact of COVID-19-related shocks on the complex market system. By conducting the survey during this period, the study also aimed to explore not only the PQR value chain, but also the ways in which the PQR market system responded, adapted, and demonstrated resilience in the face of the unprecedented disruptions caused by the global pandemic along with other shocks and vulnerabilities. Following Table 1 shows the

sample size of different market actors from the surveyed districts.

Table 1. District-wise Sample Size of Paddy traders, Millers, Wholesalers, Retailers, and Consumers.

| Market Actors | Districts | Sample Size |
|------------------|-----------|-------------|
| Paddy Traders | Dinajpur | 74 |
| | Sherpur | 64 |
| | Jhenaidah | 62 |
| Millers | Dinajpur | 75 |
| | Sherpur | 50 |
| | Jhenaidah | 75 |
| Rice Wholesalers | Dinajpur | 25 |
| | Jhenaidah | 25 |
| | Kustia | 25 |
| | Dhaka | 50 |
| Rice Retailers | Dinajpur | 50 |
| | Jhenaidah | 50 |
| | Kustia | 50 |
| | Dhaka | 125 |
| Consumers* | Dinajpur | 200 |
| | Jhenaidah | 200 |
| | Kustia | 200 |

3.3. Adopting the MSRA Framework

This study adopted USAID's Market Systems Resilience Assessment (MSRA) framework to assess the resilience of the PQR market system in Bangladesh across eight key domains. The USAID's MSRA framework was presented by Downing, J. (2018) [14] where the author described the theory of measuring resilience of a market system using empirical data. The MSRA tools were developed based on eight broad domains and these domains are categorized into two groups: four that pertain to structural aspects and four that delve into behavioral facets. The structural characteristics encompass connectivity, diversity, power dynamics, and the rule of law. On the other hand, the behavioral characteristics encompass cooperation, competition, decision-making, and business strategy [14].

These characteristics serve as pivotal measures for assessing the capacity of market systems to embody resilience. Moreover, they hold the potential to serve as catalysts for steering system transformation from a state that curtails resilience capacities to one that fosters and amplifies such capacities. Notably, characteristics impeding resilience capacities contribute to what is termed in this paper as "reactive" market systems. Conversely, characteristics that empower or reinforce resilience capacities contribute to the emergence of "proactive" market systems. Finally, these characteristics likely play out very differently in different contexts and thus needed to be contextually defined or adapted [14].

3.3.1. Defining Proactive and Reactive Market System Orientations

Proactive market system orientation refers to the capacity and willingness of market actors to anticipate future shocks, adapt to emerging trends, and invest in long-term system improvements. This approach emphasizes forward-looking behavior, innovation, risk mitigation, and strategic collaboration aimed at building systemic resilience before disruptions occur [14] [16].

In contrast, reactive market system orientation reflects how actors respond to shocks after they occur. It involves short-term coping strategies, emergency adjustments, and recovery efforts that help the system regain functionality. While essential during crises, reactive responses often indicate limited preparedness and expose underlying vulnerabilities in the market system.

3.3.2. Structural Characteristics of Market System Resilience

1) Connectivity: Connectivity in a market system refers to the extent and quality of relationships among actors, resources, and institutions across social, geographic, and economic domains. It encompasses both horizontal and vertical linkages, including relationships among producers, processors, traders, and input providers. A balanced degree of connectivity is critical for resilience. Overconnectivity can lead to inefficiencies, resource saturation, and reduced responsiveness to innovation, while underconnectivity can cause fragmentation and system fragility, where the failure of a single node disrupts the broader system [30]. Strategic redundancy—such as maintaining multiple marketing channels or sourcing inputs from diverse suppliers—enhances resilience by providing alternative pathways when disruptions occur. This optimal range of connectivity, referred to as the “window of viability”, represents the threshold where the system maintains adaptability without becoming rigid or disconnected [14].

2) Diversity: Diversity within market systems refers to the variety and distribution of actors, products, marketing channels, and end markets [14]. High levels of diversity contribute to system flexibility by enabling multiple pathways for adaptation and response to shocks [31]. For example, a resilient system may include a mix of large and small firms, niche and commodity markets, or various customer segments. A lack of diversity—such as market dominance by a single firm or homogeneity in customer behavior—can lead to systemic vulnerabilities. In resilient systems, diversity is not only present but also balanced across different levels and nodes, contributing to the system’s capacity for innovation, risk distribution, and dynamic adjustment [32].

3) Power Dynamics: Power dynamics in market systems describe how influence and control over resources, decision-making, and access are distributed. When power is overly concentrated, it may lead to monopolistic behavior, exclusionary practices, and a suppression of innovation, which can significantly weaken resilience. Conversely, systems with overly diffuse power may struggle to coordinate responses or build consensus. Resilient market systems typically feature distributed and accountable power structures that allow for inclusive participation and mitigate exploitative behavior. Such systems are better positioned to adapt

and recover from disturbances because they are supported by diverse actors with agency and access to decision-making processes [33].

4) Rule of Law: The rule of law underpins a stable and predictable market environment by ensuring consistent enforcement of regulations, contracts, and property rights. It enhances trust among market actors and reduces transaction costs and uncertainty, which are essential for long-term investment and innovation [14]. In resilient systems, the rule of law guarantees equitable access to justice and protection of rights, fostering fair competition and inclusive participation [16]. A strong legal framework contributes to the system's ability to absorb shocks, respond to market failures, and maintain functional integrity under stress.

3.3.3. Behavioral Characteristics of Market System Resilience

1) Cooperation: Cooperation refers to the extent to which market actors engage in collective actions to achieve shared objectives. While cooperation can enhance resilience by promoting knowledge exchange, coordination, and mutual support, its effect is context-dependent. When motivated by rent-seeking or exclusionary practices—such as collusion or price manipulation—cooperation can distort markets and reduce system adaptability [14]. In contrast, inclusive and transparent forms of cooperation foster trust, shared learning, and joint problem-solving, all of which are critical to a system's adaptive capacity.

2) Competition: Competition shapes the incentives that drive innovation, efficiency, and responsiveness within market systems. Healthy competition encourages firms to improve their value propositions, invest in technology, and adapt to changing market conditions, thereby reinforcing resilience [29]. However, unregulated or predatory competition can undermine these benefits, leading to market concentration, exclusion of smaller firms, and short-termism. A resilient market system maintains a balance where competition drives performance but is tempered by regulatory oversight and mechanisms that safeguard fairness and inclusion.

3) Decision-Making: Effective decision-making is central to resilience, as it determines how actors anticipate, prepare for, and respond to shocks. Resilient systems feature inclusive and evidence-based decision-making processes that consider diverse perspectives and are informed by real-time data and foresight [32]. Transparent governance structures that facilitate timely and adaptive decisions enable the system to adjust course when conditions change. Decision-making in such systems also reflects a balance between short-term operational needs and long-term strategic resilience objectives.

4) Business Strategy: Business strategies within resilient market systems extend beyond immediate profitability to include long-term sustainability and adaptability. Firms that prioritize diversification, innovation, and strategic collaboration are better equipped to withstand and recover from disruptions [34]. For instance, diversifying product lines or sourcing arrangements reduces dependency on single points of failure, while partnerships enable resource pooling and shared learning. Business strategies aligned with resilience principles contribute to the robust-

ness and agility of the wider market system, enhancing its capacity to navigate uncertainty and complexity.

3.4. Assessment of Market System Resilience

The MSRA Tool is designed to be flexible to fit different country contexts—recognizing there will always be limitations on data availability, time, and resources to conduct an assessment. The tool follows a simple three step process:

- Selecting indicators/variables
- Collecting data and score domain
- Assessing systematic resilience

3.4.1. Selecting Indicators/Variables

Our approach involved utilizing the USAID’s Market System Resilience Assessment (MSRA) Framework, which encompasses eight domains designed to delineate resilience capacities. Each domain comprises both “fast” and “slow” variables, characterizing the market system’s orientation on a continuum from reactive to proactive in response to shocks and stresses. These variables are interrelated and can only be defined in relation to each other. Fast variables typically manifest changes within shorter timeframes. For instance, transactions are considered fast-moving variables, reflecting present occurrences. The MRSA recommends opting for 3 - 4 indicators for fast variables and 2 - 3 for slow variables (totaling 6 - 8) in each domain. These selections should adhere to two criteria: Relevance: are the indicators pertinent and meaningful within the context of the specific market system; and Feasibility: can the assessment team feasibly collect data within the available resources and timeframe.

3.4.2. Scoring Process

The data collected against those indicators were compiled to evaluate each domain’s orientation on a 4-point scale, ranging from “very reactive” to “very proactive”. This assessment was data-driven and rigorous, utilizing the indicators. However, considering the inherently social and somewhat intangible nature of these systems, the final assessment score (ranging from 1 to 4) inevitably involved a subjective judgment (Figure 3).

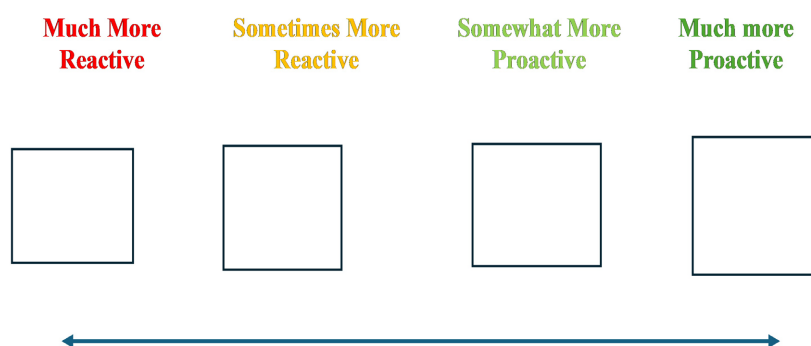


Figure 3. 4-point Scale (source: USAID’s MSRA Tool).

3.5. The Indicators/Variables (04 Structural Domains + 04 Behavioral Domains)

This study adopted a total of 47 indicators under eight domains of PQR market system resilience. The indicators are as follows.

Domain 1: Connectivity: The Logical Dependence between Components within a System

Indicators:

- 1) Number of suppliers/distributors/customers (Horizontal and Vertical, within/outside group, with family/friend)
- 2) Volume of Transaction
- 3) Commercial relationship Churn
- 4) Availability of finance
- 5) Delays in financial flows
- 6) Labor patterns

Domain 2: Diversity: The Different Ways that the Component Parts of the System can be Assembled

Indicators:

- 1) Redundancy Rate
- 2) Diversity of types of products, services, etc. in a sector
- 3) Business failure rate
- 4) Business start-up rate
- 5) Diversity of channels
- 6) Variations in financial services
- 7) Growth of specialized services targeting business within an industry

Domain 3: Power Dynamics: The Concentration and Exercise of Power in a System

Indicators:

- 1) Market Structure (monopoly/perfect competition/oligopoly etc.)
- 2) Level of pricing control
- 3) Income Inequality
- 4) Government Investment in road, utilities, health, and education
- 5) Existence of special interest group
- 6) Perceived level of corruption

Domain 4: Rule of Law: Equality Before the Law

Indicators:

- 1) Existence of uniform grades and standards
- 2) Awareness of laws and regulation
- 3) Adherence to agreements
- 4) Press Freedom Index
- 5) System Legitimacy

Domain 5: Cooperation: How Agents Work Together for Mutual Benefit

Indicators:

- 1) Number of joint initiatives/partnerships
- 2) Emergence of industry associations

- 3) Cooperation to add value (e.g., joint marketing or branding, advocacy to improve policies and regulations, agreement on standards to increase industry)
- 4) Cooperation to gain fair advantage (level the playing field)
- 5) Cooperation to gain unfair advantage
- 6) Emergence of Specialized business to business services

Domain 6: Competition: How Agents Establish Superiority over Others Who are Trying to Do the Same

Indicators:

- 1) Number of new market entrants
- 2) Co-investment along value chains
- 3) Number of repeat customers
- 4) Perceived subsidy capture
- 5) Perceptions of being cheated

Domain 7: Evidence-Based Decision-Making: How Agents Make Operational Decisions

Indicators:

- 1) Level of spend on market research
- 2) Number of alliances between academia and businesses
- 3) Influence of science on social and market systems
- 4) Patterns of information flows
- 5) Presence of industry journals, networks and meetings

Domain 8: Business Strategy: How Agents Achieve their Goals

Indicators:

- 1) YTD R&D expenditure
- 2) YTD capital expenditure
- 3) Investment in data gathering an analysis
- 4) Level of sophistication in branding
- 5) Investment in customer service
- 6) Customer Loyalty trends
- 7) Access to Finance

4. Results and Discussions

To comprehensively evaluate the resilience of the PQR market system, the study undertook a systematic approach involving a questionnaire survey. This survey served as our primary means of data collection, enabling us to capture a well-rounded perspective encompassing both qualitative insights and quantitative data. Across all eight domains that comprise the market system resilience framework, the study meticulously gathered information from diverse market actors, stakeholders, and experts.

However, it's important to acknowledge that despite our comprehensive efforts, certain indicators within these domains posed challenges in terms of data availability or feasibility through the survey alone. In response to this, we augmented our dataset by incorporating secondary information from reliable sources, ensur-

ing that the analysis remained robust and representative.

To further enhance the accuracy and depth of our assessment, we engaged experts with deep-rooted knowledge in the intricacies of the PQR market system. Their invaluable expertise played a critical role in evaluating specific indicators, enriching the scoring process with insights that spanned beyond the confines of the survey data.

4.1. Scoring the Indicators

The culmination of our data collection and analysis resulted in quantitative values for most indicators, forming the foundation for calculating resilience scores across individual domains. In line with the methodology outlined in USAID's Market Systems Resilience Assessment (MSRA) tools, we employed a participatory approach by organizing a stakeholder workshop to validate and refine these scores. During the workshop, we presented initial scores—ranging from 1 to 4—for each indicator, derived from both data analysis and expert input. Participants reviewed and discussed the proposed values, providing critical feedback based on their sectoral knowledge and field experience. This workshop played a pivotal role in ensuring the credibility, accuracy, and contextual relevance of the scoring process. Following in-depth discussions, consensus was reached on the final scores for each domain. This systematic and participatory method enabled a standardized yet context-sensitive assessment, revealing both the strengths and areas requiring improvement within the PQR market system's resilience.

Following **Tables 2-9** show the individual indicator's score and overall domain scores of a scale of 1 to 4.

For a visual representation of these domain scores and a comprehensive overview of the PQR market system's resilience landscape, we present the findings in the subsequent table, showcasing the resilience scores assigned to each domain. This quantitative evaluation, coupled with qualitative insights, forms a comprehensive foundation upon which recommendations and strategies can be built to enhance the overall resilience of the PQR market system. **Table 10** shows the overall scores of all eight domains.

Table 2. Scoring of connectivity domain.

| SL # | Indicators | State | Market Actors | | | | | Average Score | |
|------|---|-------|---|--|-------------|--|----------------------------------|---|-----------|
| | | | Farmers | Traders | Millers | Wholesalers | Retailers | | Consumers |
| 1 | Number of suppliers/distributors /customers (Horizontal and Vertical, within/outside group, with family/friend) | F | 68% PQR producer, 32% non PQR producers | small traders, aratdar with commission, arottdar without commission, with and without commission, numerous farmers, and buyers | 200 millers | 83% from millers, 15% from other wholesalers | 12 suppliers, numerous consumers | Numerous suppliers including online shops | 3 |

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| | | | | | | | | | |
|----------------------|--|---|-----------------------------|-----------------------------------|---|---|--------------------------------------|------------------|----------|
| 2 | Volume of Transaction | F | 80% of the produces | 3814 kg | 5120 kg | Average 2000 kg/transection | average 180 kg per day | 3 kg per month | 3 |
| 3 | Commercial relationship Churn (maintaining of long-term business relationship) | F | 50% new | 50% new supplier, 50 % new buyer | 120 buyer, | 15% new supplier, 50% new buyers | 25% new suppliers, 10% new consumers | 25% new supplier | 2 |
| 4 | Availability of finance | F | 58% yes, 42% no | 55% have access to credit | 85% have access to finance | 29% have access to credit | 14% have access to credit | Not Applicable | 2 |
| 5 | Delays in financial flows | S | No delays, cash on delivery | 5 - 15 Days | delayed payment, 30 - 45 days | while buying 15 days, while selling 15 - 30 days | Cash on delivery | Cash on delivery | 2 |
| 6 | Labor patterns (labor movement e.g. within/between area/region/country) | S | family labor, hired labor | 56% does not have permanent labor | Labor from mostly the local area and the technical persons from different areas | 36% have no permanent employee, 31% have one permanent employee | 74% have no permanent employee | not applicable | 1 |
| Overall Score | | | | | | | | | 2 |

Source: Author's calculation based on primary data and validation assessment by the stakeholders.

Table 3. Scoring of diversity domain.

| SL # | Indicators | State | Market Actors | | | | | | Average Score |
|----------------------|--|-------|------------------|------------------|---------------------|-----------------|-----------------|------------------|---------------|
| | | | Farmers | Traders | Millers | Wholesalers | Retailers | Consumers | |
| 1 | Redundancy Rate | F | low | medium | low | low | low | low | 1 |
| 2 | Diversity of types of products, services, etc. in a sector | F | 21 PQR varieties | 22 PQR varieties | 17 PQR varieties | 8 PQR varieties | 8 PQR varieties | 15 PQR varieties | 3 |
| 3 | Business failure rate | S | very few | medium | very few | very few | very few | - | 1 |
| 4 | Business start-up rate | F | medium | very low | very low | low | low | - | 2 |
| 5 | Diversity of channels | S | - | less diversified | somehow diversified | diversified | diversified | diversified | 3 |
| 6 | Variations in financial services | S | Low | medium | many | medium | lower | very lower | 2 |
| 7 | Growth of specialized services targeting business within an industry | F | medium | Low | medium | Low | Low | medium | 1 |
| Overall Score | | | | | | | | | 2 |

Source: Author's calculation based on primary data and validation assessment by the stakeholders.

Table 4. Scoring of power dynamics domain.

| SL # | Indicators | State | Market Actors | | | | | | Average Score |
|----------------------|---|-------|---------------------|-----------|-----------|---------------------|---------------------|---------------|---------------|
| | | | Farmers | Traders | Millers | Wholesalers | Retailers | Consumers | |
| 1 | Market Structure (monopoly/perfect competition/oligopoly etc.) | S | Perfect Competition | Oligopoly | Oligopoly | Perfect Competition | Perfect Competition | - | 3 |
| 2 | Level of pricing control | S | No control | little | mostly | little | little | no control | 3 |
| 3 | Income Inequality | S | little | little | high | little | high | high | 2 |
| 4 | Government Investment in road, utilities, health, and education | F | moderate | moderate | moderate | moderate | moderate | moderate | 2 |
| 5 | Existence of special interest group | F | yes | yes | yes | yes | yes | yes | 4 |
| 6 | Perceived level of corruption | F | no corruption | moderate | high | medium | low | no corruption | 2 |
| Overall Score | | | | | | | | | 3 |

Source: Author's calculation based on primary data and validation assessment by the stakeholders.

Table 5. Scoring of rule of law domain.

| SL # | Indicators | State | Market Actors | | | | | | Average Score |
|----------------------|---|-------|---------------|------------|------------|-------------|------------|-----------|---------------|
| | | | Farmers | Traders | Millers | Wholesalers | Retailers | Consumers | |
| 1 | Access to legal services | F | low | low | high | high | moderate | Low level | 3 |
| 2 | Awareness of laws and regulation | F | Low level | 35%-medium | very aware | 41%-Medium | 26%-medium | low level | 2 |
| 3 | Adherence to agreements (commitment of agreement/word) | F | very high | high | high | high | high | high | 4 |
| 4 | Press Freedom Index (particularly for PQR rice related news) | S | high | high | medium | medium | medium | high | 3 |
| 5 | System Legitimacy (obeying the law) | S | medium | low | low | low | low | medium | 2 |
| 6 | Orientation to equity (an index around consumer protection, number, management orientation, funding etc.) | S | not at all | very low | high | high | low | high | 2 |
| Overall Score | | | | | | | | | 3 |

Source: Author's calculation based on primary data and validation assessment by the stakeholders.

Table 6. Scoring of cooperation domain.

| SL # | Indicators | State | Market Actor | | | | | | Average Score |
|----------------------|---|-------|--------------|---------|-----------------------|-------------|-----------|----------------|---------------|
| | | | Farmers | Traders | Millers | Wholesalers | Retailers | Consumers | |
| 1 | Number of joint initiatives/partnerships | F | High | High | 72%-joint partnership | High | Medium | low | 3 |
| 2 | Emergence of industry associations | F | medium | low | high | high | medium | low | 3 |
| 3 | Cooperation to add value (e.g., joint marketing or branding, advocacy to improve policies and regulations, agreement on standards to increase industry) | F | High | High | High | High | High | High | 4 |
| 4 | Cooperation to gain fair advantage (level the playing field) | F | High | low | low | low | low | high | 2 |
| 5 | Cooperation to gain unfair advantage | S | low | medium | high | high | medium | low | 2 |
| 6 | Emergence of Specialized business to business services | S | medium | medium | high | high | high | not applicable | 3 |
| Overall Score | | | | | | | | | 3 |

Source: Author's calculation based on primary data and validation assessment by the stakeholders.

Table 7. Scoring of competition domain.

| SL # | Indicators | State | Market Actors | | | | | | Average Score |
|----------------------|---|-------|---------------|---------|----------|-------------|-----------|----------------|---------------|
| | | | Farmers | Traders | Millers | Wholesalers | Retailers | Consumers | |
| 1 | Number of new market entrants | F | high | medium | low | medium | medium | high | 3 |
| 2 | Co-investment along value chains | F | medium | low | high | medium | medium | high | 3 |
| 3 | Number of repeat customers | F | high | high | high | high | high | high | 4 |
| 4 | Level of protectionism (to protect own business/company) | S | medium | medium | high | high | high | not applicable | 3 |
| 5 | Perceptions of being cheated/perception of trust by consumers | S | low | low | very low | low | medium | medium | 3 |
| 6 | Extent of labor violation | S | low | low | low | low | low | - | 4 |
| Overall Score | | | | | | | | | 4 |

Source: Author's calculation based on primary data and validation assessment by the stakeholders.

Table 8. Scoring of evidence-based decision-making domain.

| SL # | Indicators | State | Market Actors | | | | | | Average Score |
|----------------------|--|-------|--|---|---|---|---|--|---------------|
| | | | Farmers | Traders | Millers | Wholesalers | Retailers | Consumers | |
| 1 | Level of spend on market research | F | little | little | medium | high | high | little | 2 |
| 2 | Number of alliances between academia and businesses | F | medium | not at all | medium | not at all | little | little | 1 |
| 5 | Presence of industry journals, networks and meetings | F | medium | little | medium | high | low | not at all | 2 |
| 3 | Influence of science on social and market systems | S | medium | not at all | high | little | little | not at all | 2 |
| 4 | Patterns of information flows | S | TV, Cell phone (94%), Smartphone (14%) | TV, Cell phone (100%), Smartphone (45%) | TV, Cell phone (100%), Smartphone (40%) | TV, Cell phone (100%), Smartphone (54%) | TV, Cell phone (100%), Smartphone (32%) | TV, Cell phone (89%), Smartphone (22%) | 3 |
| 6 | Level of academic connectivity to private sector | S | medium | low | high | low | low | not at all | 2 |
| Overall Score | | | | | | | | | 2 |

Source: Author’s calculation based on primary data and validation assessment by the stakeholders.

Table 9. Scoring of Business Strategy Domain.

| SL # | Indicators | State | Market Actors | | | | | | Average Score |
|----------------------|--|-------|-----------------|---------|---------|-------------|-----------|-----------|---------------|
| | | | Farmers | Traders | Millers | Wholesalers | Retailers | Consumers | |
| 1 | YTD R&D expenditure (Yearly Research Expenditure) | F | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| 2 | YTD capital expenditure (Yearly Capital Expenditure) | F | 0 | medium | high | low | low | no | 2 |
| 3 | Investment in data gathering an analysis | F | 0 | | low | low | | | 1 |
| 4 | Level of sophistication in branding | F | 0 | | medium | medium | | | 2 |
| 5 | Investment in customer service | F | 0 | | medium | medium | medium | | 3 |
| 6 | Customer Loyalty trends | S | not applicable | medium | good | good | good | medium | 3 |
| 7 | Job Satisfaction Level (market players) | S | medium | medium | high | medium | medium | medium | 3 |
| 8 | Access to Finance | S | 58% yes, 42% no | medium | high | high | medium | low | 3 |
| Overall Score | | | | | | | | | 2 |

Source: Author’s calculation based on primary data and validation assessment by the stakeholders.

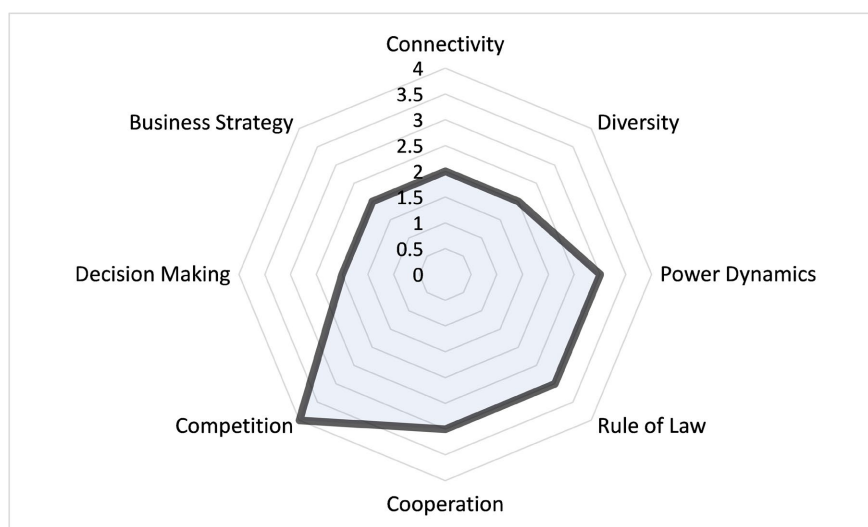
Table 10. Market system resilience domains and their score.

| Domains | Sore |
|-------------------|------|
| Connectivity | 2 |
| Diversity | 2 |
| Power Dynamics | 3 |
| Rule of Law | 3 |
| Cooperation | 3 |
| Competition | 4 |
| Decision Making | 2 |
| Business Strategy | 2 |

Source: Author's calculation based on primary data and validation assessment by the stakeholders.

4.2. Assessing the Systemic Resilience

We plotted the score for each domain on the radar diagram (Figure 4). The market system's inclusivity and resilience level increase as the line moves farther from the center. Resilience isn't an all-or-nothing concept, which is why the eight dimensions introduce nuance—different aspects of the market system might demonstrate varying degrees of inclusivity, with some elements displaying more inclusive behaviors while others might lag behind.

**Figure 4.** PQR Market system resilience.

The obtained results offer valuable insights into the resilience dynamics within the PQR market system. The data highlights a distinct trend where the competition domain emerges as notably more proactive compared to the power dynamics, rules of law, and cooperation domains, which exhibit a moderately proactive disposition. This pattern suggests that the market actors within the PQR context benefit from a conducive competitive environment. The presence of well-established

conditions for perfect competition becomes evident across all actors involved in the PQR market. This alignment with the principles of perfect competition signifies an equitable landscape, where market participants engage on equal footing, fostering a level playing field that bolsters the system's resilience. However, further exploration could delve into the nuances within the power dynamics, rules of law, and cooperation domains, shedding light on potential factors influencing their somewhat proactive stance and contributing to the overall market system's ability to absorb and navigate disruptions.

Conversely, when we examine the connectivity, diversity, decision-making, and business strategy domains, an intriguing pattern emerges: these domains exhibit a somewhat reactive orientation. This observation points to a distinct facet of the market system's resilience landscape. It suggests that within these specific dimensions, the market system demonstrates a comparatively lower level of inherent resilience when confronted with shocks and vulnerabilities. This low scores of the connectivity, diversity, decision making, and business strategy were also affected by the COVID-19 pandemic that limits the overall business performances of various market actors of the PQR market system. The marked reactivity in these domains implies that there might be underlying factors contributing to a diminished ability to promptly absorb, adapt, or respond to disruptions. Delving deeper, we could explore the intricate interplay between connectivity and information flow, the spectrum of diversity within market participants, the efficiency of decision-making processes, and the alignment of business strategies with resilience objectives. This multifaceted investigation could uncover insights into potential areas for improvement, strategies for enhancing these domains' resilience, and the broader implications for bolstering the overall market system's capacity to navigate uncertainties effectively.

5. Summary and Conclusions

In summation, the present assessment provides an initial exploration into the resilience dynamics of the PQR market system within the context of Bangladesh. However, this endeavor is not meant to be a singular endeavor. On the contrary, it serves as a foundation for an ongoing journey towards understanding and enhancing resilience. Recognizing the ever-evolving nature of market systems and the dynamic socio-economic landscape, our approach supports the notion that resilience is not static; it evolves over time. Therefore, we emphasize the importance of periodic reevaluation to track the progression of systemic resilience.

In conclusion, this initial assessment lays the groundwork for an ongoing exploration into the resilience fabric of the PQR market system. By embracing a cyclical and context-specific approach, we set the stage for fostering a resilient ecosystem that can not only endure shocks and uncertainties but also thrive in the face of evolving challenges. As we continue to unravel the intricacies of resilience, this journey becomes an instrumental part of fortifying the PQR market system's capacity to navigate the complexities of an ever-changing landscape.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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