Abstract:

Systems thinking is key in building the resilience of the Kyrgyz Republic's food system. The food system contains a network of interconnected components, and its stability depends on how these components interact. For a system to be resilient, it needs a diversity of nodes, which ensures that the failure of one node does not lead to systemic failure. For a food system, this could be a variety of crops and farming practices for example. Nodes should also be modular to some extent, which helps to contain disruptions from spreading. Redundancy in the system through multiple supply chains is also essential as it ensures that if one transfer is affected, alternative routes can sustain the flow of resources (1). In the case of a food system this could be key to preventing famine.

Systems thinking provides a holistic understanding of the food system. Understanding the relationships in the system allows us to leverage areas where small changes could cause large improvements. The consideration of multiple variables and their interaction helps to develop solutions that address risks across the whole system. The inclusion of various stakeholders for more comprehensive solutions is also encouraged. We have achieved this through having three proposals drawing upon expertise from across academic disciplines - economics, science, geography and politics. These are greater capital investment to improve the efficiency of the sector, collaboration with Uzbekistan for research into agricultural adaptation for climate change and farmers sharing expertise, and a regional re-imagination of the approach to water.

Solution 1: Promoting capital investment

Despite 40% of the Kyrgyz labour force employed in the agricultural sector, the sector produces only 7% of GDP (2). It is clear that the sector lacks efficiency and is in need of re-organisation and investment into capital. By contrast, in 2020, agriculture accounted for 25% of GDP and employed 20% in Uzbekistan (3). In 2022, Uzbekistan alongside the World Bank set a target to increase the number of farmers and agribusinesses using cooperatives and productive partnerships to 3000 by 2026 (4). From 2017-2021, over 28000 loans were provided to Micro, Small and Medium Enterprises (MSMEs) in Uzbekistan of which many were in the agricultural sector. These statistics show that access to finance and cooperation amongst farmers has been key in developing Uzbekistan's agricultural economy. Similarly in the Kyrgyz Republic, microfinance institutions are prevalent with the FMFC-K serving more than 18,000 clients, with over 60% in rural areas (5). However, given the lingering inefficiency in the agricultural sector, we propose new forms of encouraging capital investment and strengthening cooperation in the Kyrgyz Republic, inspired by successes in Uzbekistan, to create a more resilient food system.

In order to increase capital investment, we propose tax rebates in the agricultural sector with immediate effect (rapidly implementable), in the first instance for individual farmers and families rather than large corporations (socially equitable). Tax rebates refer to a refund of taxes that have already been paid. To encourage investment into modern machinery and better seeds, the State Tax Service under the Ministry of Finance should implement tax rebates specifically targeting the Social Fund payment. Tax exemption for agricultural producers means that all entrepreneurs involved in food

production are only liable to pay for Social Fund payments. The payment will be reduced from the typical 17.25% of a total salary (6) to as low as 10% for farmers that show proof of capital investments such as through receipts or invoices, depending on the amount of investment. This will be funded (made economically viable) by cutting the VAT exemption on imported multi-chemical fertilisers, which UNDP research recommends as it does not significantly benefit domestic farmers as over 50% are re-exported and thus the tax exemption is largely abused to make profit (7). The eligibility to future rebate schemes will be linked with performance based indicators such as yield increases and land use optimisation, which encourages farmers to effectively use the scheme. A new sub department within the State Tax Service should also be established to create clear guidelines and a streamlined application process, which allows farmers to easily apply for these rebates. The department will also be used to regularly monitor the use of the rebates through randomised audits to cross-check reported investments against on-the-ground improvements. A dedicated outreach program would also be established informing farmers of the benefits of tax rebates. One consideration is that farmers may perceive the application process for tax rebates as complex and burdensome, which deters participation. This will be mitigated through the outreach program, which will provide information and assistance to alleviate complexities and encourage engagement.

A more informal solution that will be implemented alongside the rebates is the creation of Rotating Savings and Credit Associations (RoSCAs), which are usually informal financial groups where members contribute a fixed amount of money into a common pool on a regular basis that members take turns in drawing from. A survey by the FOA found that many farmers in the Kyrgyz Republic obtain financing from informal means such as loans from friends for future harvest (8). RoSCAs would therefore be an effective scheme as a more structured and socially equitable approach to saving and borrowing. With well-defined rules such as contributions, payout schedules and membership responsibilities, RoSCAs reduce misunderstandings and provide a standard process. As members have a vested interest in each other's success, there is a strong incentive for proper use of funds. All members access the pooled funds equally, which minimises biases. RoSCAs can also create strong social bonds and help develop cooperation in small farming communities. We propose a formalisation of RoSCAs as part of the financial ecosystem in the Kyrgyz Republic. RoSCAs will be able to apply for formal recognition through their local governments. Eligibility will be contingent upon a charter or bylaws showing how funds will be managed, disclosure of group members and their roles and periodic financial reports. Formalisation allows RoSCAs to access microfinance as a larger group, increasing the potential for capital investment. Additionally, we propose a 10% match of contributions to RoSCAs by the government with the potential to upscale if the scheme has success as it is an economically feasible way of providing farmers with extra funds to purchase what they require. Additionally, risks associated with informal financial systems in unregulated RoSCAs are mitigated. As a result of climatic conditions, fruits and vegetables are only available seasonally (9). Therefore, in months where these crops are not being grown, incomes are likely to be lower. Therefore, contributions should increase during the harvest season meaning they correspond with farmers' cash flows. One challenge RoSCAs may face is reaching remote areas where forming groups can be difficult. To address this, we will allow for small and flexible group sizes to accommodate all farmers.

Both schemes are bottom-up in nature. Tax rebates encourage farmers to make investments without proposing a rigid top-down solution whilst RoSCAs are inherently bottom-up and allow for local adaptation. Formalisation would support and strengthen the existing mechanisms of RoSCAs. Furthermore, as around 90% of the population is Muslim (10), RoSCAs are a suitable tool as they align with Islamic finance principles, particularly the prohibition of interest and the promotion of fairness and mutual support (11).

In relation to the broader food system, tax rebates will create stronger and more diverse nodes, specifically small farmers, as they become more productive. Additionally, the links of the system are less brittle. This is because farmers may rely less on manual labour and are better able to employ capital, which means the system will be more resilient to shocks such as labour shortages. Similarly, RoSCAs strengthen the nodes as individual farmers are effectively able to use funds to cover their diverse needs. Each node has financial autonomy to respond to their own circumstances and a varied use of funds reduces the risk of synchronised failures as farmers use the money differently.

Solution 2: Research and Farmer Collaboration

Whilst the first solution has detailed an equitable and efficient proposal for the future of the Kyrgyz food system, this solution focuses on developing a long-term resilience, particularly in light of the climate-related risks that the Kyrgyz Republic faces. This solution revolves around pooling together existing expertise in two main strands: scientific research to develop fundamental resilience against the threats posed by climate change, and inter-farmer workshops to share best practice.

The first part of this solution involves harnessing existing political relationships and joining international research initiatives to develop potential modifications to the Kyrgyz food system to make it more resilient to the effects of climate change. The World Bank (12) (13) outlines that the threats climate change poses to the Kyrgyz Republic are numerous. Just two examples are: glaciers cover 4% of the country yet have declined by 16% since 1970 as a result of global warming, reducing the reliability of snowmelt to irrigate crops in the warmer spring and summer months (13), and temperatures are predicted to rise by up to 8°C this century (15), leading to more frequent droughts and drier soils (12). Simultaneously, the issue is that the crops upon which the Kyrgyz Republic relies are very water-intensive: apples, apricots and cherries being three major examples (16). Here is where collaboration with Uzbekistan can hold the key to success - as a fellow Central Asian country, they are in a very similar position (regarding droughts and heatwaves (17)) and have thus set up the International Strategic Centre for Agri-Food Development (ISCAD) (18). We propose that the Agricultural Division of the Kyrgyz Academy of Sciences (19) enter into an official collaboration with ISCAD with a primary goal to develop science-based solutions to improve the resilience of Kyrgyz-Uzbek agriculture to climate change based risks. For example, work on developing GMO varieties of apple trees that are more drought-tolerant (20) or developing even more effective yet affordable precision irrigation techniques (with recent breakthroughs including pressurised drip irrigation and gravity powered micro irrigation, but these two - especially the former - are very expensive methods (21)), to allow long-term sustainability in agriculture.

This is a realistic proposal because Uzbek-Kyrgyz relations are already very close, as both are former Soviet states that are important members of the Commonwealth of International States (22) and thus already cooperate on a range of matters via the Interstate Council (23). In the long-term, there is potential for cooperation to be expanded with other CIS members too. It is economically viable as the cost of the research will be borne across the two nations, so no one institute is burdened too much. It is rapidly implementable as such a collaboration can begin immediately, with an annual report being released on 16th October (World Food Day) to detail the progress that has been made by then (24). One consideration might be that immediate results might be difficult, but the first annual report will primarily just summarise all existing scientific knowledge that is directly helpful to Kyrgyz and Uzbek farmers, so that immediate changes can be made in terms of agricultural sustainability. We then believe that the five year point is a realistic benchmark for more substantial, new research to be released; until then, reforms based on existing knowledge can be made.

One consideration is that the above might not be considered socially equitable due to its top down nature. This is remedied by the second strand: as part of the above scientific collaboration (focussing on governments and scientific institutes as stakeholders), we also propose creating more grassroots collaboration (with farmers as the focus stakeholder). This is by inviting Uzbek farmers to rural Kyrgyz farming communities to share any progress or new knowledge they have gained from the existing Uzbek programme (which has had a sizeable head start). Not only will this be a far more affordable measure than hiring international experts or consultants (25), but this will be far more effective because the Uzbek farmers know what struggles farmers in the region face and have had to firsthand experience the challenges that climate change puts forth, thus are in the best position to share best practice. Given that over 62% of the Kyrgyz population lives in rural areas (26), farmers visiting these remote villages will be far more effective than centralised government workshops. However, the government will not be completely uninvolved, complementing this knowledge sharing by embarking on a campaign to ensure that all Kyrgyz farmers are aware of the benefits that the new government schemes (like those outlined in solution one) offer to them.

Lastly, this solution can be tied back to the broader systems framework. A more resilient system is one whose components - transfers and nodes - are not brittle, and can withstand external shocks without breaking (27). To this end, the best practice sharing facilitates the nodes (Kyrgyz farmers) in being more flexible and able to adapt to external shocks like climate change better, and the scientific research can help ensure that the processes and transfers - like crop growth adding to the domestic food supply - are similarly flexible.

Solution 3: Water

Arguably the most crucial resource for any nation to be successful in agriculture is water, yet this is something that the entire Central Asia region struggles with greatly (28). This is in large part due to the disintegration of the Soviet Union, meaning that national waters (like the Aral Sea) became international waters, and prior water sharing agreements that were previously centrally decided in Moscow for the benefit of the whole region are now the subject of multilateral negotiations between the five Central Asian nations (29). The issue is that Tajikistan and the Kyrgyz Republic, the

upstream countries of the two major rivers in the area - the Syr Darya and Amu Darya - are fossil fuel poor, whereas Kazakhstan, Uzbekistan and Turkmenistan are fossil fuel rich but downstream (30). In the Soviet Days, the upstream countries would release water to the downstream ones in return for fossil fuels for energy. Whilst it was attempted to maintain this system after the USSR collapsed (e.g., via the Almaty Agreement and Interstate Commission for Water Coordination in Central Asia), nationalist tendencies and the desire for the upstream countries to become more self-sufficient by switching to HEP meant that these efforts have largely failed (30), with the region being on the verge of armed conflict numerous times (31).

Climate change will only reduce water supplies further and make the risk of drought higher, hence it is crucial for some sustainable water usage agreement to be reached between the nations. We propose a revival of the Central Asian Power System (32), which was an electricity grid in the Soviet era which connected the domestic energy grids of all five Central Asian Republics. A regional accords would then have to be established by 2027 (enough time to negotiate but soon enough in light of the climate crisis) which plots out the exact ratio of exchange between energy and water that the upstream and downstream countries would get. This would involve a mandatory two year consultation period with all affected Central Asian nations if any projects (e.g., HEP dams) that could disrupt the balance of energy and water sharing are planned by any country, as well as a clear international method of enforcement. For example, an agreement that the International Court of Justice can prosecute any nation in breach of the agreements, with non-cooperation with ICJ investigations allowing for an expedited ruling against the offending nation being passed. In the long-term, we would hope that closer Central Asian ties, e.g., via solution two's schemes, will reduce the need for such enforced cooperation and instead foster more genuine cooperation between these nations, thus becoming more socially equitable in the long-term. However, until then, a realistic solution is only one that has tough enforcement measures possible (unlike the agreements in the 1990s which did not and ended up collapsing (30)).

Conclusion:

Our systems-oriented proposal is a comprehensive approach towards creating a resilient and equitable food system in the Kyrgyz Republic.

The implementation of tax rebates and formalisation of RoSCAs, which mirrors Uzbekistan's successes in providing finance and enhancing cooperation amongst farmers, not only are economically feasible but also will empower farmers through their bottom up nature to adapt to their specific needs. By aligning financial practices with Islamic principles, RoSCAs ensure inclusivity. Additionally, the flexibility in the size of RoSCAs will allow disenfranchised farmers in remote areas to access finance. Together, these economic tools will create stronger nodes in the Kyrgyz food system and increase resilience.

Long-term resilience is also improved through research and farmer collaboration, which combines both scientific and theoretical innovation with practical on-the-ground collaboration. Cooperation with Uzbekistan through the Uzbek-Kyrgyz expert council will be vital in ensuring an effective response to regional threats that climate change poses towards the food systems of the region. Increased collaboration between experts and farmers will strengthen socio-political ties and engage various

communities. The solution will also complement and enhance the first solution as with better innovation and knowledge farmers are more effectively able to invest their money to improve their productivity and income potential.

Addressing water security through strengthening water security ensures that the most important input into the food system can be sustained over the long term. Clear frameworks will promote international cooperation and serve to strengthen political ties in the region, which reduces the risk of future conflict and its devastating impacts as a shock on the food system.

To conclude, our solutions display a socially equitable approach by practically engaging small-scale farmers. Leveraging regional collaboration will mitigate climate risks and create prosperity over the long-term, in an economically feasible yet rapidly implementable way. Our holistic approach through the use of systems thinking will ensure the security of the Kyrgyz Republic's food system.

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