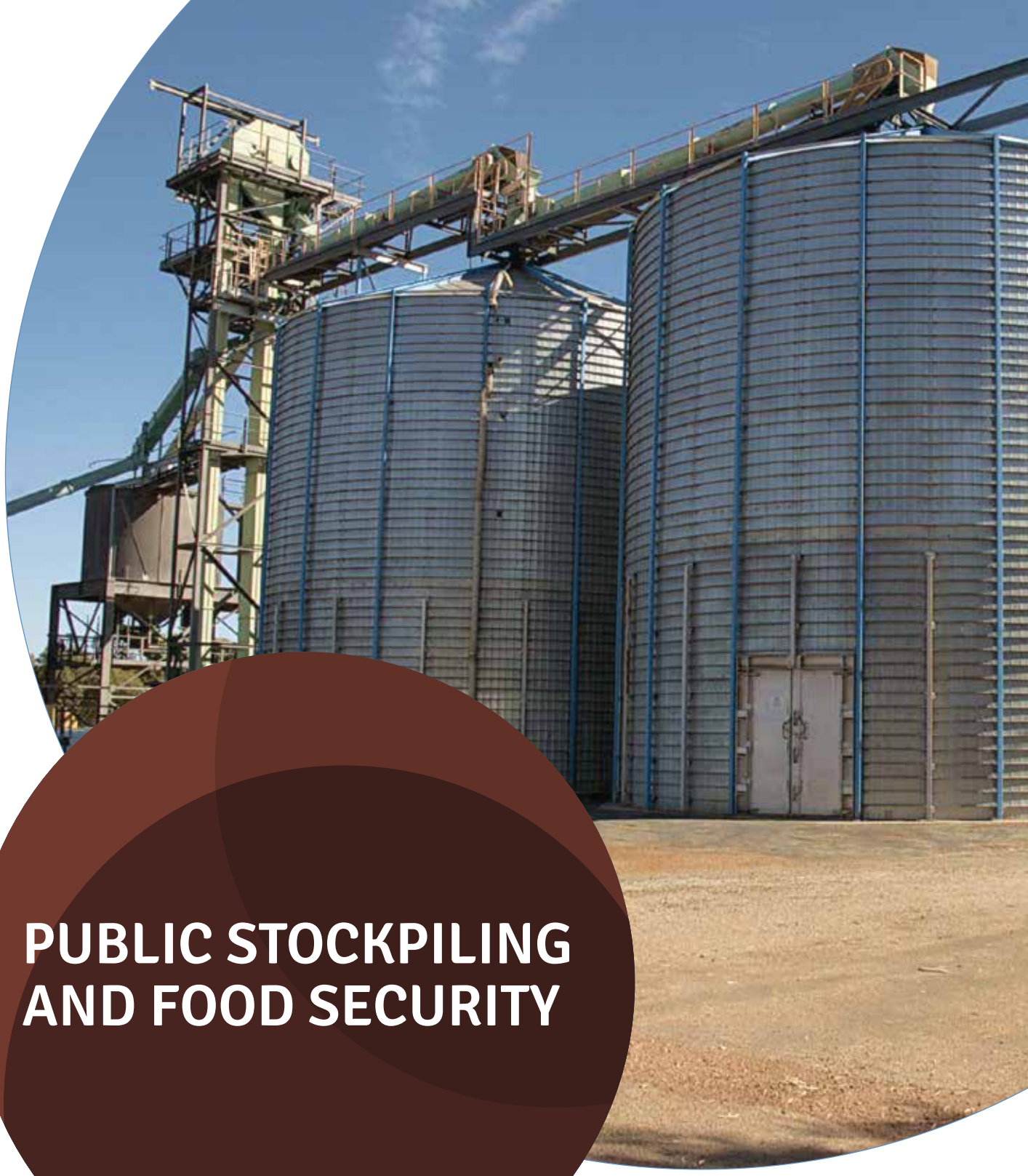


PUBLIC STOCKPILING AND FOOD SECURITY

Policy Brief
May 2015

Mely Caballero-Anthony, Paul P. S. Teng, Maxim Shrestha, Tamara Nair and Jonatan A. Lassa

RSiS Nanyang Technological University
S. RAJARATNAM SCHOOL OF INTERNATIONAL STUDIES

Policy Brief

PUBLIC STOCKPILING AND FOOD SECURITY

Mely Caballero-Anthony, Paul P. S. Teng, Maxim Shrestha, Tamara Nair and Jonatan A. Lassa
May 2015

Table of Contents

Introduction	3
Public food stockpile policy: A brief overview	4
Types of stockpiles	5
Types of public stockpiles	6
Recent trends in public stockpiling	8
Challenges and consequences of stockpiling policies	10
Way Forward	13
About the Authors	14
About the Centre for Non-Traditional Security Studies	16

Introduction

The World Food Summit held in Rome in 1996,[1] adopted the concept of food security defined along three dimensions (i) physical **availability** of food, (ii) economic and physical **access** to food, and (iii) **utilization** (a nutritional concern) of food. Often referred to as the fourth dimension, **stability** is considered implicit and necessary for achieving the first three. Ensuring stability in terms of availability, access and utilization of food has long been a central concern for national governments, and more recently global multilateral institutions concerned with food and agriculture.

There are many paths to ensure food stability for countries. International food markets and trade have been considered as one of the most efficient ways for centuries. Similarly, pursuing self-sufficiency policies and ensuring the production of all required food within the country has been another strategy of choice. However, neither has proved to be successful or efficient, all of the time, in the past.

Of late, especially in the aftermath of the world food (price) crisis in 2007/2008 and 2011 when the international food markets were extremely volatile, governments have been revisiting one of the oldest strategies to ensure greater stability—that of maintaining food stockpiles. Countries which have adequate food stocks can weather global food price shocks, local supply shocks from failed harvests, income shocks (from economic downturns or exchange rate shocks), disruptions in trade due to export bans, as well as during times of emergencies and calamities. As to what extent and how stockpiling can help build resilience and allow for a more robust food system continues to be debated globally.

This RSIS policy brief, based on intensive field studies in South and Southeast Asia and extensive literature review, aims to highlight some of the issues on stockpiling of food and offers some views on the policy implications of pursuing such a strategy.

Pratheepps, Creative Commons

1 See World Food Summit 1996 http://www.fao.org/wfs/

Public food stockpile policy: A brief overview

The practice of maintaining public stockpiles of essential food commodities has been a popular food policy of many governments in the past. This was especially observed during World Wars I and II, when international trade came to a complete halt. For most countries stockpiling policies continued during the early Cold War period, not only due to fears of another global conflict breaking out but also largely to boost their domestic agriculture sector by incentivising greater production. The practice however went into reverse with the onset of the Green Revolution which significantly boosted food production. It was argued then that international trade would be sufficient to guarantee a steady supply of food at lower cost across the world. This led to most countries cutting down their public stockpiles and stockpiling practices gradually.[2]

In recent times, public stockpiling has gained interest and is fast becoming an option in national food policies. This trend is particularly noticeable in countries with large populations like India, China, and Indonesia, and among countries that rely heavily on food imports such as the United Arab Emirates (UAE), Bangladesh, the Philippines, and Malaysia among others. In the Asian region, the resurgence is observed especially after the experiences of India and Vietnam banning exports of rice and grains in 2007/08, and Russia's ban on wheat exports in 2010. Maintaining stockpiles is now largely viewed as a response to international trade uncertainties and volatility.[3]

Public stockpiling is also considered a strategy for domestic food security and as an alternative to trade-based policies for food. However, there are spill-over effects of adopting such policies internationally. In the case of thinly traded commodities such as rice, should most countries strongly adopt such policies, there is likely to be fewer stocks available globally for exports, potentially leading to limited supply and higher prices.[4] Widespread adoption of stockpiling practices would therefore have the opposite effect to their intended outcomes and exacerbate volatilities in food supply and price. Since 2013, major discussions and disputes in the World Trade Organization (WTO) have centred on the issue of national stockpiling for food security and its acceptability in the global trade regime. A provision allowing public stockpiling for food security purposes has been accepted for the time being. This acceptance, although provisional and supposedly temporary, has made stockpiling an even more popular policy option for governments in order to ensure better food security for their populations.[5]

Food Corporation India

2 Bigman, David, and Shlomo Reutlinger. "National and International Policies: Toward Food Security and Price Stabilization." American Economic Association May (1979): 159–63.

3 Gilbert, Christopher L. *Food Reserves in Developing Countries: Trade Policy Options for Improved Food Security. Issue Paper No. 37*. Geneva: International Centre for Trade and Sustainable Development, 2011.

4 Timmer, Peter C., "Reflections on Food Crises Past", *Food Policy* 35 (2010), pp 1–11.

5 Lassa, Jonatan A. and Maxim Shrestha. "WTO Breakthrough on Stockpiles: Sustaining Food Security." *RSIS Commentary* 245 (2014).

Types of stockpiles

There are many types of stockpiles, maintained at different levels for different purposes. Broadly, there are three main types which are useful to distinguish and understand. These are:

- Public stockpiles – directly owned, monitored and administered by governments via state owned enterprises such as Food Corporation of India, *Bulog* in Indonesia, *Bernas* in Malaysia, National Food Authority in the Philippines and Public Warehouse Organisation in Thailand.

- Private stockpiles – exclusive / complete ownership by private enterprises but can be monitored and co-administered by both the private owners and the government. The Philippines serves as an example where monitoring and reporting of private stockpiles is done by the government as well. In other places, for example Singapore, governments can use their discretionary power to ensure a minimum quantity of private stockpiles which need to be maintained for a stipulated period of time. In such instances governments can then make use of available private stock information as the basis for anticipatory decision-making in ensuring food security for their people.

- Household stockpiles – directly owned by the consumers/ small producers but monitored, to some extent, by governments. Monitoring consumers' stocks at the household level is not common practice for many countries, but when it is done (like in the Philippines) it is carried out through regular surveys. In tsunami and earthquake prone countries such as Japan, household stockpiles have been a strategic disaster preparedness policy where a three-day food ration including water is stockpiled allowing survivors to wait for external support from first responders.

Types of public stockpiles

Since the 2007/08 crisis, the need to maintain different forms of stockpiles at the national or regional level has been gaining momentum. Based on existing studies, there are essentially four different types of public stockpiles which are gaining currency and are useful to distinguish.

- Emergency/humanitarian stocks: These are stocks which are maintained to protect access to food, especially for vulnerable groups, in the event of a food shortage during emergencies. Release of such stocks happens in the event of any type of emergencies or as part of bigger post-disaster safety nets, as deemed necessary by governments. In Japan, emergency food stocks at local government level is part of an *ex ante* disaster preparedness strategy which is monitored on a regular basis.

- Stocks for food security: Often referred to as buffer stocks, food security stocks are used in order to ensure stability in the availability and price of food. Such stockpiles are commonly used by governments to control domestic supply and domestic price of food. The theoretical foundation for such stocks is for governments to procure food from farmers and/or markets on the cheap and release stocks when market prices move above what is deemed acceptable in terms of affordability.

- Safety net stocks: Safety net stocks are targeted at the lower-income segments of society. Such stocks are often sold at highly subsidized prices. This type of food stocks is sometimes maintained and stored together with stocks for food security purposes. However, unlike stocks for food security, safety net stocks are targeted at certain groups or beneficiaries based on defined poverty lines as seen in countries like India and Indonesia. Such stocks are intended to improve availability and access for populations who suffer from chronic food insecurity.

- Stocks for trade: This type of public stock is often seen as an anomaly since it is held by major

Table 1: Selected countries with existing stockpiling policies and types of stocks maintained

Entity	Country	Food Security Stockpiles	Emergency/ humanitarian stocks	Safety Net Stockpiles	Stockpile for export purposes
Country level	China	rice, wheat, corn, soya, sugar			
	Japan	rice, soybean, wheat	Rice porridge, and other emergency food supplies		
	India	rice, wheat	rice and wheat	rice and wheat	rice*
	Bangladesh	rice			
	Indonesia	rice, frozen beef*	rice	rice	
	Philippines	rice, corn, sugar	rice		corn*
	Malaysia	Rice			
	Thailand				rice, cassava
	Singapore	Rice			
	Vietnam	Soybean*			rice
Regional level	APTERR		rice		
	SAARC		rice		
	ECOWAS		rice		

*. Not officially verified/validated
Source: Authors, 2014.

exporting countries that have little urgency in terms of ensuring food availability for its people. The purpose of such stock is essentially to guarantee minimum profit margins for farmers and for export stability (See Table 1).

Though a distinction is made above in the types of public stocks, in reality public stocks are usually maintained and used for different purposes. Oftentimes it is the lack of clarity in the purpose and objective of national stockpiles which leads to complications and challenges.

Other than local and national level stockpiles, there have also been initiatives on multilateral stockpiling mechanisms, some being more successful and currently operationalized. Such multilateral mechanisms largely fall into either regional food reserves or international/global food reserves.

- Regional food reserves: Probably the most cited example of a regional food reserve mechanism is the ASEAN Plus Three Emergency Rice Reserve (APTERR). Comprising the ten ASEAN member states plus China, South Korea and Japan, the reserve was set up to help the region in stabilizing rice (the region's staple food crop) supply during emergencies. APTERR currently has 787,000 tons of pledged rice at its disposal.[6] Other examples include the South Asian Association for Regional Cooperation (SAARC) Food Bank in South Asia and the Economic Community of West African States (ECOWAS) regional humanitarian reserve.[7]

- International stockpiling: The proposal for an international buffer stock was one of the pillars of the League of Nations in 1920s. In the aftermath of the 2007/08 crisis, the Agriculture Ministers of the G20 group of leading economies, met and agreed on a proposal to once again evaluate and establish a system of global humanitarian stocks. Though the details have yet to be worked out in full, it is said to take the form of a network of regional food reserves which operate using market principles and which can only be used for emergency and humanitarian purposes.[8] At present, the World Food Programme (WFP) is also coordinating the 'UN Humanitarian Response Depots' (UNHRD) to maintain an international stockpile of food of sorts. The UNHRD is a strategic stockpiling effort that 'manages strategic emergency relief stocks, including medical kits, shelter items, and ready-to-use foods in Ghana, UAE, Malaysia, Panama, Italy and Spain'.[9]

Given the re-emergence of the debate and trends towards the use of stockpiling as part of countries' food policy, it is necessary to evaluate, understand and appreciate some of the challenges and opportunities of adopting such a strategy. Since stockpiling of food is not a new concept, there are valuable lessons which can be learnt from past experiences. There are also some new considerations which governments need to be mindful of which are unique to the present international economic and political realities.

6 Personal interview with Wiroj Saengbangka, Manager of APTERR Secretariat, Bangkok, 13 September 2014 (by Lassa). See also APTERR http://www.apterr.org/images/pdf_apterr/APTERR-Leaflet.pdf

7 Op. cit., Gilbert, 2011

8 World Bank. *Using Public Food grain Stocks to Enhance Food Security*. Washington D.C.: The World Bank, 2012.

9 See Humanitarian Depots at: http://www.wfp.org/logistics/humanitarian-response-depot

Recent trends in public stockpiling

Following the 2007/08 food price crisis, complete reliance on trade and international markets for food is no longer seen as a safe option for most food importing governments. In response, there have been two separate but interlinked policy directions which have come to be seen as favourable in addressing future market uncertainties. These are (i) building up national stockpiles for essential/strategic staples and commodities, and (ii) pushing towards the goal of self-sufficiency, especially in staple grains and key commodities.

Table 1 offers a snapshot of some of the countries which currently engage in public stockpiling practices and the types of stocks they maintain. In recent years many developing countries have expressed interest in either starting or increasing their public stockholding levels through domestic procurement and imports. Middle East and North African (MENA) countries have aimed to double their wheat reserves from the previous six months of domestic consumption to twelve months. Ethiopia is working towards expanding its food security stocks from 407,000 tons to 1.5 million tons. And after the bitter experience of India's export ban, Bangladesh is now increasing its rice stock levels from 650,000 tons to 3 million tons.[10]

It has also become rather common to come across reports and articles pointing towards the procurement and building up of infrastructure related to food stockpiling from grain silos in MENA countries to store wheat, chilled warehouses in China to store meat, to the construction plans of the world's largest grain storage facility in Egypt.

In the same vein, other major importers in the Southeast Asian region, who have usually depended on trade to make up for shortfalls in their domestic production of staples like rice, are also changing their policies. Indonesia, the Philippines, and Malaysia are currently pursuing policies and strategies geared towards 100 per cent self-sufficiency, especially in rice, and building up their buffer stocks.[11] Stockpiling

IRRI, Creative Commons

10 Wright, Brian, and Carlo Cafiero. "Grain reserves and food security in the Middle East and North Africa." *Food Security* 3 (2011) (Suppl 1): S61–S71.

practices and policies are now seen as an integral part of their larger food policies.

There are also emerging reports of governments adopting a pro self-sufficiency stance despite the economic and opportunity costs involved in pursuing such a strategy. The clearing of new land for rice production in Borneo and Sumatra, the push for soybean production in Indonesia as well as attempts to introduce the cultivation of palm oil in India point towards such a direction.[12]

Michael Trolove, Creative Commons

11 Based on authors' fieldwork in Indonesia, Philippines and Malaysia during September-November 2014

12 Ibid.

Challenges and consequences of stockpiling policies

Effective stockpiling practices can contribute significantly towards the goal of food security. It can ensure stability in supply and prices of food commodities, as well as serve to boost domestic production, and improve farmer incomes. There are, however, a number of challenges and consequences to stockpiling practices which need to be considered.

There are many examples from the past where public stockpiling programs have failed to achieve their goals and have ended up burdening taxpayers and the economy. Adoption of domestic stockpiling policies can also have international consequences, leading to a net negative at the aggregate level.[13] China has recently started to significantly increase its grain stockpiles via imports since 2012. It is predicted that by the end of 2015, China's corn stockpile may reach 150 million tons.[14] Such behaviour from China can relay incorrect signals to the world market, indicating potential domestic production crises despite the fact that China reports some degree of surplus in food commodities.[15]

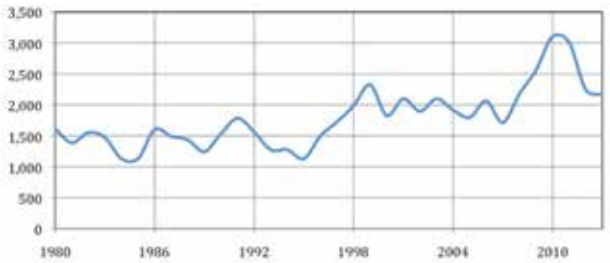
To create a robust food stockpiling system through rational decision-making policies remains a challenge in food policy studies. Stockpiling policies need to be clear in terms of rationale, goals, and objectives. Mere accumulation of public stocks does not always guarantee more stable prices or better food security. Policy makers should ensure proper justification for stockpiling policies in order to fully assess its impacts as well as potential pitfalls.

These are some of the issues which governments need to be mindful of if they are to run successful stockpiling programs.

Politicization of public stocks

The use of public stocks or buffer stocks often becomes a political issue, as has recently been evident with the Paddy Pledging Program in Thailand. Thailand's stockpiles were used in a populist policy to serve political interest. Therefore, public stockpiling can be held hostage by political power dynamics rather than generating benefits for food economy in the country.

Figure 1
Trend in Philippines Public Rice Stockpile (in '000 tons)



Source: Authors, based on data from National Food Authority of the Philippines 2014.

In the Philippines, the rice buffer stock policy is calculated at 30 days of total daily consumption. This works to approximately one million metric tons at any given month. However, it is observed that public stockpiles in the Philippines has remained consistently higher than calculated, and even more interestingly, tend to spike during or immediately prior to election years. This was especially seen in 2010, where the stock level was more than three times the stipulated requirement (Figure 1). The political rationale for this could be attempts by incumbent governments to depress general food prices at best, or contain food inflation at the very least, which is always perceived as a favourable development by the electorate.

Given that issues surrounding food and agriculture often fall under the shared purview of various government agencies, bureaucratic hurdles and inefficiencies have often crept into public stockpiling programs. This has, on numerous occasions, led to delays in technical decision-making, proper interventions (in terms of procurement, replenishment and release) to avoid major market disruptions, as well as susceptibility to politicization of stock management. Transparency in terms of operation and decision-making with regards to public stockpiling programs is important and necessary.

13 Lilliston, Ben and Andrew Ranallo (eds). Grain Reserves and the Food Price Crisis: Selected Writings from 2008 –2012. Institute for Agriculture and Trade Policy, 2012.

14 See report on 12 April 2015 http://www.brecorder.com/agriculture-a-allied/183/1172690

15 "China's grain stockpiling distorts market" reported by by Fred Gale on March 17, 2015. See http://asia.nikkei.com/viewpoints/perspectives/china-s-grain-stockpiling-distorts-market

The cost of stockpiling

Common challenges of public stockpiling programs are high administrative and storage costs, stock losses due to improper storage and handling, leakage or theft of food from stockpiles, and high incidence of corruption. In countries which have maintained public stockpiles the total fiscal costs have ranged, on average, between 0.5 to 2 per cent of national GDP.[16]

Factors which determine fiscal costs are the size of stocks and the length of time stocks are kept. In countries which decide to increase their stockpiles (for example, doubling in terms of total tonnage) or increase storage times (for example, from 3 months to 6 months' supply), the cost per additional unit of stockpiling increases disproportionately. In other words there is often diminishing marginal returns to investments after a certain point. Policy makers need to be mindful of this economic reality and weigh out the costs and benefits before deciding on increasing public stockpiles.

Based on historical data on national stockpiling, on average, storage alone accounts for 20 per cent of the costs; transportation of the stocks accounts for approximately 16 per cent; and operations approximately 10 per cent. These are costs which do not yet take into account losses from damage and deterioration of stocks, as well as other factors and processes like bagging and re-bagging when adopted.[17]

Challenges of humanitarian stockpiles

In the case of humanitarian stockpiles, instances where stocks were maintained centrally have not always been effective, since sometimes an emergency or disaster disrupts transportation and/or access to affected areas. However, maintaining disaggregated or distributed smaller stocks in different geographic locations across the country increases the costs and the associated risks. Finding a good balance between increased cost and ease of access to humanitarian stockpiles has been a concern. Efficiency and effectiveness of humanitarian/emergency stocks is also dependent on the existence and quality of early warning systems. There is often a lack of coordination between public stockholding organizations and other non-governmental relief/distribution agencies which also respond in cases of emergencies and often provide food aid.

Challenges of safety net stocks

Efficiency and effectiveness of safety nets are dependent on proper identification and targeting

IRRI, Creative Commons

16 Op. cit., World Bank 2012

17 Ibid.

of the most vulnerable groups and communities. This has often been problematic. There is also a lack of integration of statistical data on targeted groups. Some of the problems of targeting the right beneficiaries often arise from the fact that different agencies use different poverty criteria resulting in conflicting data and information.

Opportunity costs and negative impact on private sector

Public food stockpiles are not entirely suitable to address the underlying causes of lack of availability and food price volatility in domestic markets. The main cause of such price and supply shocks are usually low resilience of production or poor infrastructure. In the context of food producing nations, there have been concerns regarding the opportunity costs associated with the shift from potential investments in innovation and technology in agriculture towards inefficient stockpiling practices.[18] In such cases investing in agricultural research, irrigation and extension services could potentially yield far better results in the long run, rather than continuously relying on public stockpiles as safety nets.

There is also a danger that public stockpiling policies could lead to the government's monopolization of food procurement and trade in the country. This can negatively impact the private sector and its development. In the long run it could jeopardize the economy in terms of investments and jobs in the food and agriculture sector.

Regional mechanisms

While there are some clear advantages of having multilateral regional food reserves like cost savings from economies of scale and independent management preventing national governments' interference, there are obstacles as well. Firstly, strong commitment from governments to reserve a percentage of their national stocks and continued international collaboration is a must. Secondly, release of such stocks can usually require time-consuming negotiations which could make such reserves less effective in responding to emergencies.[19]

The experience of APTERR suggests that there is still work to be done in creating an effective reserve mechanism. In the recent case of typhoon Haiyan/ Yolanda, despite the request of the Philippines government for support, APTERR emergency stocks reached the affected regions close to a year after the disaster. Coordination, proper governance and trust issues across national borders often complicate implementation and effectiveness of regional food reserve mechanisms.

IRRI, Creative Commons

18 Op. cit., Timmer, 2010

19 Op. cit., Gilbert, 2011

Way Forward

Stockpiling has been considered as one of the important components of national food policies. Experience has shown that public stockpiles can help shield domestic markets in times of production shortfalls or global prices hikes, in the short-term. In pursuing public food stockpiling policies, governments should ensure greater stability of physical food availability by adopting a system that allows them to monitor public and private stockpiling of food. In this regard, it is important that governments fully understand the long-term implications of stockpiling on food security, as well as be fully aware of the regional and global implications of their domestic stockpiling decisions.

Moving forward, key recommendations are outlined below in order to improve the implementation of stockpiling policies.

Public stockpiling for food security purposes

- **Avoid large fiscal burden and opportunity costs by giving more weight to efficiency and effectiveness of food stockpiling.** Elimination of politics from policy is impossible. However, policy makers can minimize the risk of actions that are politically motivated and rent seeking in stockpiling practices by having greater transparency in the management of national food reserve systems.

- **Introduce robustness in stockpiling by encouraging public-private partnership (PPP).** A strategy which actively includes the private sector in terms of procurement, storage and distribution of stocks is recommended to avert the negative impacts of stockpiling on domestic markets. This strategy can help the government (i) ensure efficiency in stockpiling (ii) avoid monopolising in terms of food procurement and sale, and (iii) prevent dis-incentivising and crowding out the private sector. A PPP model would also help in terms of greater transparency in the financing of stockpiling programs. Importing countries can learn from the case of Singapore's Rice Stockpile Scheme where governments can achieve their food stockpiling objectives in an efficient manner without discouraging the private sector.[20] In Indonesia, wheat stockpiling by the private sector over the last few decades has proven to be effective without creating fiscal burdens.

- **Improve management of humanitarian/ emergency stocks.** This can be done by setting a minimum quantity of stocks based on the actual size of vulnerable populations and the nature of logistical infrastructure and geographical characteristics of the region. However, the strength of such a stockpiling policy is dependent on a credible disaster warning system.

Public stockpiling for trade

- **Proactively share stockpile data from public and private sectors in producing countries to help stabilize food prices.** Our field research suggests that some Southeast Asian governments still rely on international trade statistics (e.g. data from United States Department of Agriculture or USDA) to build their national food supply projection. For example, Vietnam's Annual Rice Outlook is often based on USDA data rather than on its own food data. Asymmetric information problems due to the lack of public data can be costly for both importing and exporting countries. Without robust information systems, food producers and exporters may not be able to benefit from higher food prices in international markets, as was seen in Southeast Asia during the 2007/08 food crisis. Furthermore, sharing of information and data is vital in avoiding potential volatility in international markets and will help build trust not only with importing countries but also with the other competitors.

Multilateral stockpiling

- **Shift regional food reserve from merely virtual stocks into one which also incorporates physical stocks.** Timely intervention is key for any emergency food reserve to be effective. Hence direct control and maintenance of at least some physical stock by the appointed regional body should be considered. This would allow for timely disbursement and distribution of food in affected countries and regions. However, the cost associated with control and operation of physical stocks should also be considered and assessed.

20 See Rice Stockpile Scheme (RSS) https://rice.iesingapore.gov.sg/Home/RiceStockpileScheme.aspx

About the Authors

Mely Caballero-Anthony is Associate Professor and Head of the Centre for Non-Traditional Security (NTS) Studies at the S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University, Singapore. She previously served as the Director of External Relations at the ASEAN Secretariat and currently serves in the UN Secretary-General's Advisory Board on Disarmament Matters and Security. She is also Secretary-General of the Consortium of Non-Traditional Security Studies in Asia (NTS-Asia) and is a member of the World Economic Forum (WEF) Global Agenda Council on Conflict Prevention.

Assoc Prof Caballero-Anthony's research interests include regionalism and regional security in the Asia Pacific, multilateral security cooperation, politics and international relations in ASEAN, conflict prevention and management, as well as human security. She has published extensively in peer-reviewed journals on a broad range of security issues in the Asia Pacific. Her latest publications, both single-authored and co-edited, include: "Community Security: Human Security at 21" (*Contemporary Politics*, 2015), "Understanding ASEAN Centrality" (*Pacific Review,* 2014), "Human Security in ASEAN: 20 Years On" (*Asian Journal of Peacebuilding*, 2014), *Non-Traditional Security in Asia: Issues, Challenges and Framework for Action* (ISEAS, 2013), *Human Security and Climate Change in Southeast Asia: Managing Risk and Resilience* (Routledge, 2013), "The Responsibility to Protect in Southeast Asia: Opening Up Spaces for Advancing Human Security" (*Pacific Review*, 2012), *Energy and Non-Traditional Security (NTS) in Asia* (Springer, 2012), and *Rethinking Energy Security in Asia: A Non-Traditional View of Human Security* (Springer, 2012).

Paul P. S. Teng is Principal Officer at the National Institute of Education (NIE); and Senior Fellow (Food Security) at the Centre for Non-Traditional Security Studies, S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University. Prof Teng received his PhD from the University of Canterbury, New Zealand. He did post-doctoral work at the Agricultural University, Wageningen, The Netherlands, under a Visiting Fellowship awarded by the Netherlands Government and has attended many short courses on management development and science communication. He has served as Dean, Office of Graduate Studies & Professional Learning from 1 November 2006 to 2014 and was also Head, Natural Sciences and Science Education (NSSE) Academic Group from 2004 to 2006.

Professor Teng has over 20 years of experience on food security issues, having held positions at the WorldFish Center, Malaysia; the International Rice Research Institute (IRRI); and Monsanto Company. He has extensively researched the role of plant diseases in causing epidemics and crop losses in several continents, working cooperatively with a network of national programme scientists. The work has led to over 250 journal papers, eight books and numerous conference papers, and recognition by peer organisations. His pioneering work on using system analysis and computer modelling techniques to quantify and predict biological phenomena, and conduct risk assessments, is still having impact today in the USA and Asian rice growing countries. More recently, he has devoted his time to researching science communication and science entrepreneurship, under the umbrella of "Innovation and Enterprise" and to meet the needs of new economies. Prof Teng has won awards such as the Jakob Eriksson Prize in Plant Pathology in 1987, given by the Royal Swedish Academy of Sciences every five years to a scientist who has made significant contributions to solving plant disease problems affecting developing countries. He is a Fellow of the Third World Academy of Sciences and the American Phytopathological Society, and was co-recipient of the 2001 CGIAR Excellence in Science Award for Outstanding Scientific Article. He has also been cited in the 1996-1997 'Marquis Who's Who' in Science and Engineering.

Maxim Shrestha is Associate Research Fellow with the Centre for Non-Traditional Security (NTS) Studies, S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University (NTU), Singapore. His research centres on food and agriculture policies in Asia and global food security issues. Maxim holds an MSc in International Political Economy from RSIS, NTU and a Bachelor's Degree in History from the National University of Singapore (NUS). Prior to joining the NTS Centre, Maxim has worked in the field of academic publishing and journalism.

Tamara Nair is Research Fellow at the Centre for Non-Traditional Security (NTS) Studies, S. Rajaratanam School of International Studies (RSIS), Nanyang Technological Univeristy (NTU), Singapore, where she works primarily on food security but is also involved in migration, gender and development issues in the region. With a background in Political Science and Geography from the National University of Singapore, she also has a Graduate Diploma in Education from the National Institute of Education in Singapore. Tamara has a Masters in Environmental Management, a Graduate Diploma in Arts Research and a PhD in Development Studies from the University of New South Wales in Sydney, Australia. Before joining the Centre for NTS Studies, she was involved in an international project looking at climate change and 'cultures of resilience' focussing on major waterways and communities (in Asia, Australia and the U.S.) in relation to their adaptation mechanisms in the face of climate change. She also served as co-editor for a proposed special edition volume of the *International Journal of Water Governance*. Tamara has taught in private and government schools in Singapore prior to her postgraduate studies.

Jonatan A. Lassa is Research Fellow with the Centre for Non-Traditional Security (NTS) Studies, S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University (NTU), Singapore, where he researches on climate change, food security and (environmental) risk governance issues. Jonatan holds a PhD from the Faculty of Agriculture at the University of Bonn, Germany, and has studied Social Science and Interdisciplinarity at the Center for Development Research (ZEF) at the Univeristy of Bonn. He also has an MSc in environment and International Development from the University of East Anglia, U.K. Prior to joining the Centre for NTS Studies, Jonatan was senior research fellow with the Institute of Resource Governance and Social Change (IRGSC). He has also previously served as a PhD researcher with the United Nations University Institute for Environment and Human Security in Bonn (2007-2010) and as an Indonesian post-doctoral fellow at Ash Center, Harvard Kennedy School (2011). In his professional career, he has also worked with the UN, international NGOs and the private sector.

About the Centre for Non-Traditional Security Studies

The **RSIS Centre for Non-Traditional Security (NTS) Studies** conducts research and produces policy-relevant analyses aimed at furthering awareness and building capacity to address NTS issues and challenges in the Asia-Pacific region and beyond.

To fulfil this mission, the Centre aims to:

- Advance the understanding of NTS issues and challenges in the Asia-Pacific by highlighting gaps in knowledge and policy, and identifying best practices among state and non-state actors in responding to these challenges.
- Provide a platform for scholars and policymakers within and outside Asia to discuss and analyse NTS issues in the region.
- Network with institutions and organisations worldwide to exchange information, insights and experiences in the area of NTS.
- Engage policymakers on the importance of NTS in guiding political responses to NTS emergencies and develop strategies to mitigate the risks to state and human security.
- Contribute to building the institutional capacity of governments, and regional and international organisations to respond to NTS challenges.

Our Research

The key programmes at the RSIS' Centre for NTS Studies include:

1) Sustainable Development, Climate Change, Environment and Resilience
2) Energy Security
3) Food Security
4) Health Security
5) Peace, Human Security and Development
6) Humanitarian Assistance and Disaster Relief

Our Output

Policy Relevant Publications

The **RSIS Centre for NTS Studies** produces a range of output such as research reports, books, monographs, policy briefs and conference proceedings.

Training

Based in RSIS, which has an excellent record of post-graduate teaching, an international faculty, and an extensive network of policy institutes worldwide, the Centre is well-placed to develop robust research capabilities, conduct training courses and facilitate advanced education on NTS. These are aimed at, but not limited to, academics, analysts, policymakers and non-governmental organisations (NGOs).

Networking and Outreach

The Centre serves as a networking hub for researchers, policy analysts, policymakers, NGOs and media from across Asia and farther afield interested in NTS issues and challenges.

The Centre is the Coordinator of the ASEAN-Canada Research Partnership (2012–2015) supported by the International Development Research Centre (IDRC), Canada. It also serves as the Secretariat of the initiative.

In 2009, the Centre was chosen by the MacArthur Foundation as a lead institution for its three-year Asia Security Initiative (2009–2012), to develop policy research capacity and recommend policies on the critical security challenges facing the Asia-Pacific.

It is also a founding member and the Secretariat for the Consortium of Non-Traditional Security (NTS) Studies in Asia (NTS-Asia).

More information on our Centre is available at www.rsis.edu.sg/research/nts.

About the S. Rajaratnam School of International Studies

The **S. Rajaratnam School of International Studies (RSIS)** is a professional graduate school of international affairs at the Nanyang Technological University, Singapore. RSIS' mission is to develop a community of scholars and policy analysts at the forefront of security studies and international affairs. Its core functions are research, graduate education and networking. It produces cutting-edge research on Asia Pacific Security, Multilateralism and Regionalism, Conflict Studies, Non-Traditional Security, International Political Economy, and Country and Region Studies. RSIS' activities are aimed at assisting policymakers to develop comprehensive approaches to strategic thinking on issues related to security and stability in the Asia Pacific.

For more information about RSIS, please visit www.rsis.edu.sg.

RSiS
Nanyang Technological University
S. RAJARATNAM SCHOOL OF INTERNATIONAL STUDIES

Nanyang Technological University
Block S4, Level B4, 50 Nanyang Avenue, Singapore 639798
Tel: +65 6790 6982 | Fax: +65 6794 0617 | www.rsis.edu.sg