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VALUE CHAINS FOR NUTRITION IN SOUTH ASIA: WHO DELIVERS, HOW, AND TO WHOM?

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Food Distribution Value Chains under the Integrated Child Development Services*

Bhavani RV and Rohit Parasar

Abstract Globally, social provisioning of food is recognised as an important means to reduce the prevalence of malnutrition. Government food distribution programmes have potential for impact at scale in this context. This article examines the food distribution value chain of the Supplementary Nutrition Programme (SNP) under the Integrated Child Development Services (ICDS) scheme of the Government of India, targeted at pregnant and lactating women and children below six years of age. Following the conceptual framework outlined in Maestre, Poole, and Henson (2017), the article examines two different models in operation under the SNP value chain in two states of India: Telangana, where a state enterprise is engaged in the manufacture of fortified premix for distribution, and Tamil Nadu, which follows a public-private partnership (PPP) model. The article highlights the challenges and opportunities associated with the two models and attempts to provide insights for designing better delivery under public food distribution value chains.

Keywords: value chain, nutrition, social protection, food distribution, state enterprise, PPP, ICDS, Supplementary Nutrition Programme.

1 Introduction

Globally, one finds that public expenditure in agriculture and the role of the government is central to food safety nets (del Ninno and Mills 2015; FAO 2015a). There exist different examples of social protection programmes to promote food and nutrition security, such as school nutrition programmes, cash-for-work programmes, and nutrition-sensitive behaviour change programmes (FAO 2015b). Public distribution of food through social protection measures is an important source of nutritious food for poor people in some developing countries. Furthermore, if these food distribution programmes are targeted to key groups, such as women and children, they have the potential for impact on nutritional outcomes (GloPan 2014).

Food distribution programmes can be seen as a potential post-farmgate agri-food value chain pathway through which poor and vulnerable

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target groups can gain access to nutritious food and thereby improved dietary diversity (Maestre, Poole and Henson 2017). A number of studies over the last decade have examined the scope and effectiveness of agri-food value chains for nutrition (Allen and de Brauw 2017; Henson, Humphrey and McClafferty 2013; Gelli *et al.* 2015; Hoddinott, Gillespie and Yosef 2015; Hawkes and Ruel 2011). However, researchers agree that focus on consumers has been largely missing in value chain development (Gelli *et al.* 2015). Henson and Humphrey (2015) and Maestre *et al.* (2017) bring in this focus, by linking the agri-food value chains with the households that consume the food, using a post-farmgate or markets perspective.

Following the framework outlined in Maestre *et al.* (2017), this article examines the food distribution value chain of the Supplementary Nutrition Programme (SNP) under the Integrated Child Development Services (ICDS) scheme in India and the mode of its operation in two states of the country. The state-led SNP value chain operates at scale and has scope for public-private partnerships (PPPs) and community engagement. The aim of this article is to review the operation of the value chain of the SNP in producing and distributing nutrient-rich products to undernourished populations and understanding the policy options to make them more effective.

We review two models, the state enterprise model in Telangana and the PPP model in Tamil Nadu (TN). Section 2 discusses the methodology, followed by a description of how the SNP functions and the value chain in operation in each state; the similar and different characteristics of each approach are discussed in Section 3; the concluding section summarises the findings, focusing on insights for designing better delivery under public food distribution value chains.

2 Methodology

The methodology followed for the study comprised: (1) a desk review of literature on food distribution programmes, documents (reports, government circulars) on the ICDS scheme, secondary data on coverage under the scheme in the two states; and (2) primary data collection via key informant interviews with (i) government officials, and (ii) manufacturers of fortified food given as take home rations (THRs); and interviews with a sample of actors at the lower end of the value chain such as *anganwadi*¹ workers (AWW) at the ICDS/*anganwadi* centres (AWCs) and consumers.

First, the desk review was undertaken to collect relevant information from secondary sources, including published reports and government websites. Following this, officials at the director and deputy-director level coordinating the programme in each state were contacted for a clear understanding of the value chain. With their permission, a qualitative assessment of the value chain under SNP was undertaken through interviews with the different actors, by visiting a few ICDS centres and the manufacturing units. At the AWCs, the objective was to get broad

feedback on the programme delivery from the officials and consumers, and no sampling method was adopted to choose the centres. A checklist of questions was used to guide the qualitative interviews.

We met with concerned officials in the Department of Women Development and Child Welfare in Hyderabad, Telangana; visited and interacted with the functionaries and women beneficiaries at three rural/suburban AWCs; and visited and had discussions with officials at Telangana Foods (TF), the public-sector manufacturer of the weaning food. In TN, we met with officials in the Department of Social Welfare and Nutritious Meal Programme in Chennai and visited: (i) eight AWCs, two each in urban, rural, suburban, and tribal areas; (ii) two women cooperative societies manufacturing weaning food; and (iii) the manufacturing unit of the private sector company manufacturing the blend for weaning food.

The information collected was analysed using the framework discussed in Maestre *et al.* (2017) on how the value chain addresses: (i) the three desired outcomes, viz. food safety, food being nutrient-dense at point of consumption, and food being consumed in adequate amounts on a sustained basis; and (ii) the consumer- and supplier-side requirements for the desired impact on nutrition outcomes.

3 The SNP under the ICDS scheme

The ICDS scheme is a mandated national social protection measure launched by the Government of India in 1975. Targeted at women and children, it aims to provide essential services to ensure the health and nutrition outcomes of children 0–6 years of age, adolescent girls, pregnant women, and lactating mothers (GoI 2011). The programme operates through AWCs at the village level in rural areas and at the municipality level in urban areas, with prescribed norms of population per centre. The SNP is part of the ICDS scheme, and is an agri-food distribution value chain initiative to improve the nutrition status of these vulnerable groups. As of September 2016, there were 1.35 million AWCs in the country, catering to an average of 75 beneficiaries per centre under the SNP (GoI 2017a).

The AWW and the helper/cook are the key personnel responsible for all the activities at each ICDS centre. The AWW, generally a woman with education up to at least secondary school level, is responsible for managing the AWC and delivering all the services that are to be provided under the scheme, including the feeding and monthly growth monitoring of children (see Parasar and Bhavani RV (forthcoming, 2018) for details on the structure and operation of the programme).

The Ministry of Women and Child Development, Government of India (GoI) is the nodal ministry for the ICDS scheme implemented by all the states of the country.² Variations exist in the name of the nodal department across states; the programme is headed in each state by an official at director level belonging to the Indian Administrative Service

with a team under him/her spread across the districts. Each state has freedom within the mandated framework to make extra budgetary allocation and decide how to produce and distribute the food under the SNP.

3.1 Production models under the SNP in Telangana and Tamil Nadu

As mentioned, the two states under study in this article are Telangana and TN. Telangana is a young state formed in mid-2014 following bifurcation of the state of Andhra Pradesh (AP). There were 35,700 AWCs under 149 ICDS projects as of September 2017 reaching out to 2.8 million beneficiaries.³ TN has been a forerunner in social protection schemes, having been the first state in the country to pilot school meal programmes. There were 54,439 ICDS centres or AWCs under 434 projects in the state reaching out to 3.5 million beneficiaries as of October 2016.⁴

The food production and distribution strategies under the SNP in each state are discussed first in this section before examining the value chain.

3.1.1 Target consumers and food provided under the SNP

A. Women

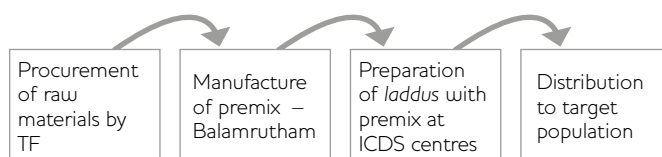
In Telangana, pregnant women and lactating mothers of infants (0–6 months) are entitled to a full meal at the centre under the Arogyalakshmi programme.⁵ The SNP meal comprises rice, pulses and vegetables, and covers 40–45 per cent of the daily calorie requirement for pregnant and lactating women. Freshly cooked food is served every day at lunchtime according to a weekly predefined menu. Spot feeding ensures that the food is consumed by the target population. Milk, a naturally nutrient-dense food often not affordable to poor households, is also provided under the programme.

In TN,⁶ pregnant women are given a fortified premix made of wheat, millet, pulses with *jaggery* (cane sugar) added for taste in prescribed ratios in the form of THR, as a supplementary food. The premix is given to the women on a fixed day every week. Previously, women had to consume the premix at the AWC itself to ensure consumption by the intended person. However, many women were unable to visit the centre every day due to potential loss of wages, and thus the process was changed. The prescribed amount to be consumed by women in the antenatal and postnatal stages is 160g of premix/day, which provides 616kcal of energy and 15.6g of protein.

B. Children

The SNP targets reduction of undernutrition in children below six years of age through provision of therapeutic food and freshly cooked meals.

In Telangana, 'Balamrutham',⁷ a therapeutic food made from roasted wheat, chickpea, skimmed milk powder, sugar and oil, and fortified with eight micronutrients, is given to mothers as THR to feed children aged below three years; the recommended daily intake of 100g (0.22lb) of Balamrutham ensures 50 per cent of the recommended dietary intake (RDI) required by children of this age. In addition, 16 eggs a month

Figure 1 Supply chain of premix under SNP in Telangana

Source Authors' own, based on qualitative assessment.¹²

are given as THRs. Children aged between three and six years come to the AWC and are fed the same meal that is given to women under the Arogyalakshmi programme. They are also fed a ready-to-eat extruded snack⁸ manufactured by TF with wheat and maize flour, chickpea, and fortified with micronutrients.

In TN, children (6–36 months) are given 130g/day of the same fortified premix that is provided to women, accounting for 500kcal of energy and 12.67g of protein. Children aged between one and two years also get a boiled egg every Wednesday. Children aged between two and three years are entitled to a boiled egg three times a week and a full meal at the centre; however, given their very young age, not many have meals at the AWC. Children aged between three and six years are provided with hot cooked meals and the menu is a variety of rice and pulses/boiled egg.⁹ Salt fortified with iron and iodine is used.

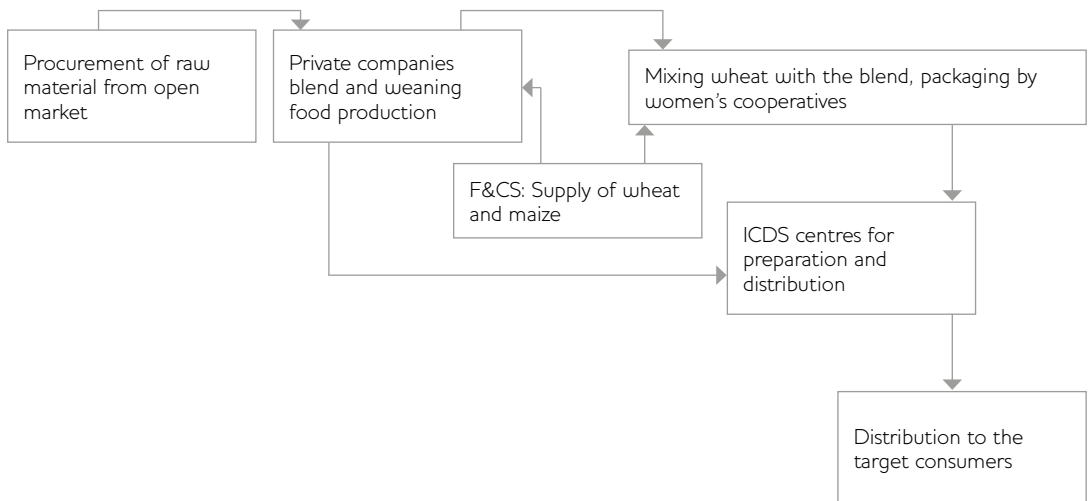
In both states, children classified as 'severely malnourished' during monthly growth monitoring are provided extra nutrition until their status improves.

3.2 The SNP value chain

The cereals and pulses required for cooking at the AWCs are procured centrally from the Food & Civil Supplies (F&CS) department of the government. The AWW is responsible for the purchase of condiments, spices, and vegetables. The vegetables are usually purchased from the local market and the quantity of vegetables varies according to the market price, in order to manage within the available budget. Children are encouraged to bring vegetables from their homes to encourage community contribution and engagement. However, this practice is not very popular, as explained in Section 4.

The value chain for the manufacture of fortified premix is, as expected, more elaborate. In Telangana, the state owns Telangana Foods (TF), an ISO-certified state government enterprise that manufactures Balamrutham and other extruded snacks for SNP. The company, originally AP Foods, was established by the government of undivided Andhra Pradesh (AP) in 1974 with support from the central government, UNICEF, and the international humanitarian agency CARE, specifically for producing and supplying nutritious foods to malnourished schoolgoing and pre-school children, pregnant women, and lactating mothers. It is governed by the Essential Services Maintenance Act.¹⁰

Figure 2 Supply chain of premix under SNP in Tamil Nadu



Source Authors' own, based on qualitative assessment.

Following the bifurcation of AP in 2014, the company located in Hyderabad in Telangana was renamed Telangana Foods (TF).

Figure 1 outlines the value chain for the preparation of premix by TF. Wheat is procured from the Food Corporation of India.¹¹ The sourcing of other food materials is through a process of competitive bidding for suppliers under a tender call by TF.

The packaging of the product is aligned with the guidelines of the Indian Institute of Packaging; the institute suggests the parameters for labelling, packaging material, and other biological and chemical parameters. An official informed the authors that the company sells all disposable and scrap material every year, the proceeds of which – amounting to approximately ₹1 million in some years – are added to the company's corpus fund, which is used for capital investments.

In Telangana, the public enterprise model ensures some of the essential requirements for adequate nutritional intake, including of micronutrients and high energy food by children, with due attention to quality and food safety aspects. The model is cost-effective as pricing is done in consultation with the government departments and is as per the allocation available under the relevant programme. The company had embarked on capacity expansion with support from the Global Alliance for Improved Nutrition (GAIN) prior to state bifurcation; it is, however, currently catering only to Telangana state instead of the whole of AP¹³ and therefore has underutilised capacity.

TN follows two different PPP models for production of the premix: (i) tripartite partnership with state-promoted cooperatives of women from low-income households and a private sector manufacturer; and

Table 1 Cost and nutrient norms of the SNP under the ICDS scheme

| Target group | Cost norms (per beneficiary/day) INR | Cost norms (per beneficiary/day) £ | Calories (kcal) | Protein (grams) |
|--|--------------------------------------|------------------------------------|-----------------|-----------------|
| (i) Children (6–72 months) | 6.00 | 0.07 | 500 | 12–15 |
| (ii) Severely underweight children (6–72 months) | 9.00 | 0.11 | 800 | 20–25 |
| (iii) Pregnant and lactating women | 7.00 | 0.08 | 600 | 18–20 |

Note 1 gram: 0.002 pounds; INR/£: 0.01135.

Source Government of India, Ministry of Women and Child Development.¹⁷

(ii) partnership only with a private sector manufacturer. In the first model, the private enterprise manufactures a premix blend with chickpea, malted finger millet, *jaggery*, and the micronutrient fortificant. The women's cooperatives are responsible for sourcing, roasting and milling wheat into flour, mixing it with the blend in the prescribed ratio, and packing and supplying it to the AWCs. In the second model, the entire process from production to delivery is handled by the private company. Twenty-five women cooperatives engage in the manufacture and supply of weaning food to AWCs across 25 districts and cater to about 75 per cent of the premix requirement. On average, a cooperative member earns around INR17,000 (£193) a month from this activity.

Figure 2 gives a diagrammatic representation of the value chain under the two models.

The blend manufacturers are contracted by the government through a competitive bidding process; currently, there are two private sector players: Rasi Nutri Foods (RNF)¹⁴ and Christy Friedgram Industry (CFI).¹⁵ RNF manufactures and directly supplies the premix to centres in ten districts; CFI directly supplies premix in four districts and the blend to the 25 women cooperatives for the manufacture of the premix.

4 Comparing the two SNP models: Telangana and Tamil Nadu

The SNP under the ICDS scheme reaffirms the states' commitment to improving the nutritional status of children and their mothers. There is scope for active engagement of private business and civil society for effective delivery under these initiatives; this section throws some light on this by comparing the models in Telangana and TN.

4.1 Analysis of expenditure on SNP

The costs of the programme as per the national norm are shared equally by the centre and states; extra allocations, if any, are to be met from the budgets of respective states. Both TN and Telangana states are currently spending more under the SNP than the budget allocation norms set by the Government of India, summarised in Table 1.¹⁶

The cost, for instance, of the hot meal under the Arogyalakshmi programme in Telangana at INR21 (£0.24)/woman/day is three times

Table 2 An estimate of cost to exchequer for providing hot cooked meals to women under the ICDS scheme

| State | No. of women | Cost per day per head (INR) | Estimated total annual expenditure (million INR) | GSDP current prices 2015–16 (million INR) | Percentage of GSDP |
|------------|--------------|-----------------------------|--|---|--------------------|
| Telangana | 531,310 | 21 (₹0.24) | 3,458.8 (₹40) | 5,831,172.5 (₹66,170) | 0.059 |
| Tamil Nadu | 649,249 | 21 (₹0.24) | 4,226.6 (₹48) | 12,126,679.9 (₹137,610) | 0.035 |

Note Exchange rate as of 26 September 2017: INR/₹: 0.01135).

Sources No. of women covered by the SNP under the ICDS scheme: <http://wdcw.tg.nic.in/index.html#>;

http://icds.tn.nic.in/all_categories.html;

Reported per head/day cost: http://wdcw.tg.nic.in/Arogya_Lakshmi.html;

Nominal GSDP: NITI Aayog State Statistics: <http://niti.gov.in/state-statistics>.

the national norm of INR7 (£0.08)/day for pregnant and lactating women, i.e. Telangana state spends INR17.5 (£0.22) per woman instead of its prescribed share of INR3.5 (£0.03). The cost per head of a hot meal and snack for children aged between three and six years at INR7.26 (£0.08)/day is also higher than the norm of INR6 (£0.07)/day.

In TN, where the women are given premix instead of a hot cooked meal, the cost per head at INR10.22 (£0.12)/day is higher than the norm, and the state spends an additional INR6.72 (£0.08)/woman/day. The cost per head for children aged 6–36 months is also higher at INR8.3 (£0.09)/day.

Going a little further, the cost of providing hot cooked meals under the Arogyalakshmi programme in Telangana for 310 days in a year was examined. Calculating on the basis of coverage and the given per head cost, it is seen that the total expenditure even without considering central contribution amounts to only 0.06 per cent of the gross state domestic product (GSDP) of the state (see Table 2). Although a hot cooked meal is not provided to pregnant women in TN, the estimated cost, if provided, was worked out using the same per head cost as in Telangana, to further examine this aspect. Taking the number of women reported to be covered under the scheme in TN, the cost worked out to a little under 0.04 per cent of the state's GSDP.

This cost is only that of providing the hot cooked meal to pregnant and lactating women, and not the premix. The analysis reveals that it will account for only a small share of government expenditure if any other state in India were to consider providing a hot cooked meal towards targeted nutrition for pregnant and lactating women from poor households.

It was further examined whether the additional amount spent has any association with the prevalence of undernutrition in children, using state-level data for nutrition outcome indicators. The analysis showed a significant negative association of per capita expenditure on the SNP with a prevalence of undernutrition, i.e. higher state spending on the SNP is associated with a lesser proportion of child undernutrition

Table 3 Child nutrition and health indicators: Telangana, Tamil Nadu, and all India

| | Stunting (%) | IMR (per 1,000) | U5MR (per 1,000) |
|------------|--------------|-----------------|------------------|
| Telangana | 28.1 | 28 | 32 |
| Tamil Nadu | 27.1 | 21 | 27 |
| India | 38.4 | 41 | 50 |

Note IMR: infant mortality rate; U5MR: under-5 mortality rate.

Source Gol 2017b.

(Parasar and Bhavani RV forthcoming, 2018). Both Telangana and TN are also found to have better child mortality and nutrition rates compared to the national average (see Table 3).

The literature suggests that early childhood development initiatives directed towards the poorest children can have significant returns on investment for economic growth in the long term (Lake 2011; UNICEF 2012). The SNP focuses on improving nutritional intake by providing both 'spot feeding' at the ICDS centres through hot cooked meals and THRs in the form of fortified premix to provide supplementary nutrition to the targeted households. Studies show less prevalence of undernutrition in children in areas with significant coverage of ICDS centres and among children registered with the centres versus others (Kapil and Pradhan 1999; Saxena and Srivastava 2009).

4.2 Assessment of the value chain

Following the three requirements for desired impact, viz. food must be 'safe to eat', 'nutrient-dense at the point of consumption', and 'consumed in adequate amounts on a sustained basis' (Maestre *et al.* 2017), the hot cooked meal programme that targets children >3 years in both states and also women in Telangana, addresses the issues of both ensuring consumption and fulfilment of the three desired outcomes. It is an important and non-substitutable part of the programme; the menus take into account different food groups and the prescribed serving for different age groups address the issues of being nutritious and adequate. The AWW and cook are trained to keep the centres clean, and to cook and serve in a hygienic environment. In the case of THRs, however, it is difficult to ensure sufficient consumption, although targeted consumers are oriented on the quantity to be consumed and the importance of consuming it.

On further examining the five consumer requirements of *signalling*, *availability*, *affordability*, *awareness*, and *acceptability* discussed in Maestre *et al.* (2017), one finds that the first three requirements do not strictly apply here: as this is a state-mandated food distribution programme, the prescribed menu addresses nutritional requirements and is made available to those who are registered with and come to the centres; food is available throughout the year at the centres as a buffer stock of food grains and other necessary logistic support are well managed

by the relevant government department. Price fluctuations, however, have implications for the availability of vegetables which have to be procured from the market. Encouraging households to donate vegetables to the centres is not popular: 'People ask why we should donate when government is providing allocation for buying vegetables' (response of AWW in Vasanapatti, Thinnanur Panchayat, TN).¹⁸

The target consumers are oriented and made aware on the importance of consuming nutritious food, addressing the requirement of *awareness*. In both states, consumers were aware about the importance of hot cooked meals and fortified food provided at the centres. Consumers perceived the food to be nutritious as it is distributed by the government to address undernutrition, pointing to its credibility:

I like the taste. Even if I dislike it, I would consume it... it is good for my health. (Response of a woman in her eighth month of pregnancy, AWC in Taramani, Chennai, when asked about the taste of the premix¹⁹)

Yes. Tastes good, Healthy... It is good for both the mother [pregnant woman] and her child [foetus]. There is some weight gain... As she is not having food properly, we feel this [THR] will help her. (Response of above respondent's mother, AWC, Taramani, Chennai²⁰)

Labelling the produce with nutritional information reinforces the credibility of the fortified premix. In TN, the bulk packets supplied to the AWCs have the necessary labelling, but the premix is distributed in loose packets to the target population. This can undermine the assurance of food safety and needs attention.

The last requirement, '*acceptability*', is important for ensuring consumption and was found to have influenced the food served. For instance, in Telangana, officials mentioned that people did not like the ready-to-cook food served earlier because its palatability was reduced once the food became cold. Pregnant women and lactating mothers at the three centres visited were appreciative of the hot meals they were getting now at the centres. The AWWs we spoke to also felt that the women appreciated the Arogyalakshmi programme and came to the centre for the meal. However, it is not possible to make a generalised statement about their regularity, based on this limited assessment. In TN, the practice of consuming the premix at the centre was changed to THRs as some working women were not able to come daily to the centre; hence the model was changed to be *acceptable* for the women, as mentioned in Section 3.1.

Maestre *et al.* (2017) also outline five supply-side requirements, to ensure that the value chain is stable and reliable, viz. 'capturing value', 'distribution of incentives along the value chain', 'coordination and governance', 'managing costs, risk and uncertainty', and 'appropriate institutional environment'.

It is difficult to assess the element of *'capturing value'* under a state-mandated programme; it would require an assessment of the cost versus impact; however, we may assume that the private players in TN are capturing some of the value as they remain suppliers of the state. Within the PPP, the *'distribution of incentives'* and *'coordination and governance'* aspects are addressed, as observed in the case of both the women cooperatives and private player in TN; this is not, however, relevant in the case of the state enterprise model in Telangana. The staple cereals provided under the SNP are procured and supplied by the government, thereby ensuring *'management of costs, risk and uncertainty'* for this part of the agri-food value chain. But in the case of vegetables that have to be procured from the market, the serving amount and/or quality is likely to vary with volatility in prices, in order to manage within the cost allocated; this will affect the consumer requirement of *availability* of nutrient-dense food. Vegetable markets in India are not always efficient (Gandhi and Namboodiri 2002), so sourcing vegetables from these markets with a fixed budget allocation can be a challenge. Linking local vegetable growers with the AWCs could be a possible approach to address both the supplier and consumer requirements in this case. Examples in this line are women's groups growing and supplying vegetables for the school nutrition programme in Bangladesh (Islam and Ul-Kabir forthcoming, 2018) and procurement directly from family farmers under Brazil's Food Acquisition Programme (PAA) for distribution to vulnerable groups covered by social assistance, cited in Hawkes and Ruel (2011).

In the case of the manufacture of premix, bringing in a private partner in TN helped with better *management of costs, risk, and uncertainty* by the women's cooperatives. The private company is better equipped to source raw materials that have to be procured from the market, and would ideally have built in the costs for this when applying for the bid.

The state-led programme also determines the *'institutional environment'* of operation for businesses that engage with it under the PPP framework. The private business partners in TN come through a process of competitive bidding and operate on a commercial basis; their operations are not restricted to catering only to the SNP. Such engagement under state-led food distribution programmes can be an effective way of involving business in reaching nutrient-rich foods to poor and vulnerable populations. Robinson and Humphrey (2014) make a similar observation based on their study in Nigeria. Including women cooperatives in the value chain is part of the state's approach to nurture such initiatives. In Telangana, the situation of underutilised capacity calls for state action to ensure operation of the state enterprise at full capacity.

Gender is a key focus in the SNP value chain with women in a vulnerable phase of their lifecycle being a core target group, not only providing food, but also nutrition awareness for future generations; the value chain also provides employment opportunities to women as AWWs and helpers. Further, in TN, the women's cooperative in the value chain enables women from economically deprived households to gain an assured income.

5 Conclusion

Studies have shown that developing countries have low dietary quality with dominance of starch and carbohydrate in diets (Ruel 2003). This makes the SNP an important vehicle for increasing the consumption of balanced and micronutrient-fortified foods by women and children in poor households at crucial phases in their lifecycle, viz. pregnancy, lactation, and infancy.

As a targeted value chain backed by the state, the programme has the potential to generate impacts on nutritional outcomes at scale. Both Telangana and TN states are spending over and above the central government allocation under the programme, highlighting their commitment to addressing the problem of undernutrition among vulnerable sections of the population. The scope for PPPs and role for private business engagement in improving nutrition outcomes are innovative dimensions. The two models of the state enterprise-linked food distribution value chain in Telangana and public-private-cooperative sector partnership in the value chain in TN for the manufacture of fortified premix suggest innovative pathways for consideration (see Box 1). Each has lessons to offer for other states in India to emulate and adopt for delivery under the nationally mandated food distribution programme.

As stated previously, TF has enhanced but underutilised capacity, posing a question of cost to the exchequer. Given that the company is a state enterprise that was established with the support of the central government, ideally measures should be taken for the company to cater to the requirements of more states and ensure full capacity utilisation. TN has enhanced its production capabilities with innovations in the value chain. The private sector players, besides partnering in the SNP supply chain, also operate in commercial markets and are free to diversify their production base. The large-scale production of food blend ensures value creation for the private players, despite uncertainty due to price fluctuations in its components. Assurance of demand for the blend and premix ensures that both the private sector player and the cooperative avoid the risk of overproduction/excess supply.

A company set up exclusively to cater to the requirements of government food distribution programmes is a unique model that reinforces the state's capacity and willingness to promote and sustain the value chain targeting women and children from economically poor households. However, there is the danger of inefficiency if the production capacity is not fully utilised as is currently the case. This is less likely to happen under a PPP model, where operational viability would be a key concern for private players to sustain operations.

It may be said that the programme in operation in both Telangana and TN is equipped to deliver the three outcomes for food value chain pathways to improve nutrition listed in Maestre *et al.* (2017), viz.: (i) sustained and safe, (ii) nutrient-dense, and (iii) adequate food, to

women and children from poor households. There is, however, potential for further improvement. The issue of safety regarding the premix at the point of consumption is dealt with well until it reaches the target consumer. In TN, however, the women are not provided premix in sealed packets, and hygiene and food safety could be an issue though the existing infrastructure was found to be well maintained. The adequacy of consumption of THRs is also uncertain, when unobserved.

Box 1 Value chains for nutritious premix under the SNP in Telangana and Tamil Nadu

Some salient aspects and differences

Reach: Telangana Foods (TF) is a centralised production system with distribution through the ICDS scheme. The women's cooperatives are spread across the state in TN and production of premix is decentralised.

Risk for public investment: Manufacturing of fortified premix at scale requires large production capacity and investment. TF is catering only to Telangana after the state's bifurcation from erstwhile AP and operating below full capacity, raising questions on the viability of the enterprise. Public investments face such risks in an uncertain policy environment.

The state's level of economic development: A state with lower economic prosperity or with high policy uncertainty may find it difficult to attract private investment for a public food distribution initiative. The number of private players is also likely to be limited in less developed economies, leading to a call for a stronger state role. The state-owned enterprise fulfils an important role in developing the necessary production capacity.

Cooperative and social welfare: Besides being a player in the food distribution chain, the women's cooperative in TN also supports the economic development of cooperative members, who come from socioeconomically deprived backgrounds; women members interviewed expressed satisfaction with their work and earnings. The state initiative to include the women's cooperatives in the value chain brings in a larger social welfare perspective.

The importance of innovation and a mixed value chain: TN initially had only the women's cooperatives and no private players. The limited economies of scale of each cooperative made operation difficult and their earnings remained low. The inclusion of private business has made the value chain more efficient and also enabled women's cooperatives to gain increased earnings.

Source Authors' own assessment.

This article examined the value chain model under the SNP in operation in two states. Other models are also found to be in operation. For instance, non-governmental organisations (NGOs) are a part of the value chain in the state of Delhi; self-help groups (SHGs) are involved in Odisha state. The participation of the private sector can be in different forms (companies, farmers' groups, cooperatives). States may choose between different models based on their capabilities, willingness, and local milieu. The two different models examined in this study can help in identifying opportunities and bottlenecks, and with the design of a better production and delivery system for other states in India, as well as offering insights for other countries in the region.

From the perspective of the conceptual framework against which we have examined the two value chains, one finds that all the consumer choice requirements and also producer requirements are not strictly applicable in the case of a targeted food distribution programme such as the SNP. The issues of capturing value and incentives also do not apply to a state-led programme. Incentives come to play only where there is a PPP model. Although there is danger of inefficiency in cost management in state-funded food distribution programmes, there is also scope for innovation and larger welfare benefits as seen in the engagement of women's cooperatives in TN. The SNP under the ICDS scheme is unique in using a life cycle approach to reach some of the most vulnerable population groups, viz. children, pregnant, and lactating women. Such public food distribution value chains are important in the context of developing economies with large undernourished populations. An alternative framework that addresses the requirements of these value chains will be useful. Clear objectives and alignment of actors' motives with them, the level of trade-off between efficiency and social welfare in the organisation of the production system, and sustained funding are some of the supply-side requirements; from the consumer perspective, in the absence of signalling, a mechanism for grievance redressal will help promote better delivery. Proper monitoring processes and evaluation are other requirements.

Notes

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1 *Anganwadi* literally means courtyard shelter. The *Anganwadi* centres operate under the Integrated Child Development Services (ICDS) scheme as pre-school, nutrition and immunisation centres for children under six years old; they also provide pregnant women with supplementary nutrition.

2 <http://icds-wcd.nic.in/icds/>.

- 3 <http://wcdw.tg.nic.in/> and <http://nhts.telangana.gov.in/#/categoryreport>.
- 4 <http://icds.tn.nic.in/files/awcs.pdf> and http://icds.tn.nic.in/all_categories.html.
- 5 *Arogya* means healthy; Lakshmi is the goddess of fortune and prosperity and is a term used to refer to women; http://wcdw.tg.nic.in/Arogya_Lakshmi.html.
- 6 http://icds.tn.nic.in/weaning_food.html.
- 7 <http://wcdw.tg.nic.in/Balamrutham.html>.
- 8 The snack is manufactured using extrusion technology: https://en.wikipedia.org/wiki/Food_extrusion and <http://apfoods.ap.nic.in/html/snackfood.htm>.
- 9 http://icds.tn.nic.in/noon_meal.html.
- 10 'The Act provides for maintenance of certain essential services for normal life of the community': www.doccentre.net/docsweb/LABOURLAWS/bare-acts/essential_service_Act.htm.
- 11 Set up under a national Act, the Food Corporation of India procures and distributes food grains under national programmes: <http://fci.gov.in/aboutUs.php?view=268>.
- 12 *Laddu* is a ball-shaped sweetmeat. The premix is made into *laddus* at the ICDS centres and distributed.
- 13 www.thehindu.com/news/national/telangana/%E2%80%98Balamrutam%E2%80%99-programme-caught-in-bifurcation-tangle/article14004406.ece.
- 14 www.rasifoods.com/index.html.
- 15 www.christyfoods.in/.
- 16 The Government of India has recently revised the cost norms for the SNP, as reported in the press in September 2017. Details of implementation are not yet available; www.business-standard.com/article/pti-stories/cost-norms-revised-for-nutrition-provided-at-anganwadi-centres-117092000930_1.html.
- 17 <http://icds-wcd.nic.in/icds/icdsimg/snrules2017.pdf>.
- 18 Interview, January 2016.
- 19 Interview, January 2016.
- 20 Interview, January 2016.

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