

# Minimum Cost of a Nutritious Diet (CoD): First Results in Indonesia



## Background

Food and nutrition assessments, combined with expenditure surveys, provide information about what people eat, how much money they spend on it, and their nutritional status. Additionally, individuals' nutrient needs are known, and households are advised on how to ensure consumption of a healthy and nutritious diet. However, in contexts where food availability does not appear to be a problem, it remains unknown how much of the nutrient gap is due to economic constraints to a nutritious diet (unaffordability), a lack of knowledge on healthy eating, and food and nutrition practices. Moreover, current methodologies to assess food and nutrition security are not able to analyse households' constraints in accessing their nutrient requirements, especially for their most vulnerable members, such as children under two years.

## What is CoD?

The Minimum Cost of a Nutritious Diet (CoD) is the cost of a theoretical, simulated diet (food basket) which satisfies all nutritional requirements of a modelled family at the minimal possible cost, based on the availability, price, and nutrient content of local foods. Any other food basket at the same price will be less nutritious, and any other food basket of the same nutrient value will be more expensive. Hence, when combined with household income and expenditure data, the CoD can be used to estimate the proportion of households that can afford an adequately nutritious diet in a particular area. Therefore, the CoD is a tool to link nutrient availability with economic food access.

# How is the CoD calculated?

The CoD tool is a spread sheet using Microsoft Excel software developed by Save the Children UK (SC-UK) in 2006. The tool uses Excel's solver function to perform linear optimization. The SC-UK tool is derived from an initial idea developed by Andre Briend and Elaine Ferguson to use Excel's solver function for optimization. To run the optimization process, the model uses **2 standard databases**:

1. food composition tables
2. individual energy and nutrient requirements

and requires **3 sets of locally-specified data**:

1. a comprehensive list of all food items available and their market prices at a given point in time in the area for which the CoD is calculated,
2. typical household composition for whom the diet is required, based on sex, age, weight and activity level (user defines a model household, for example a child aged 12-23 months, a child of 7 years and a woman and a man in their mid-thirties),
3. portion sizes for each food item and minimum and maximum allowances for food items and food groups.

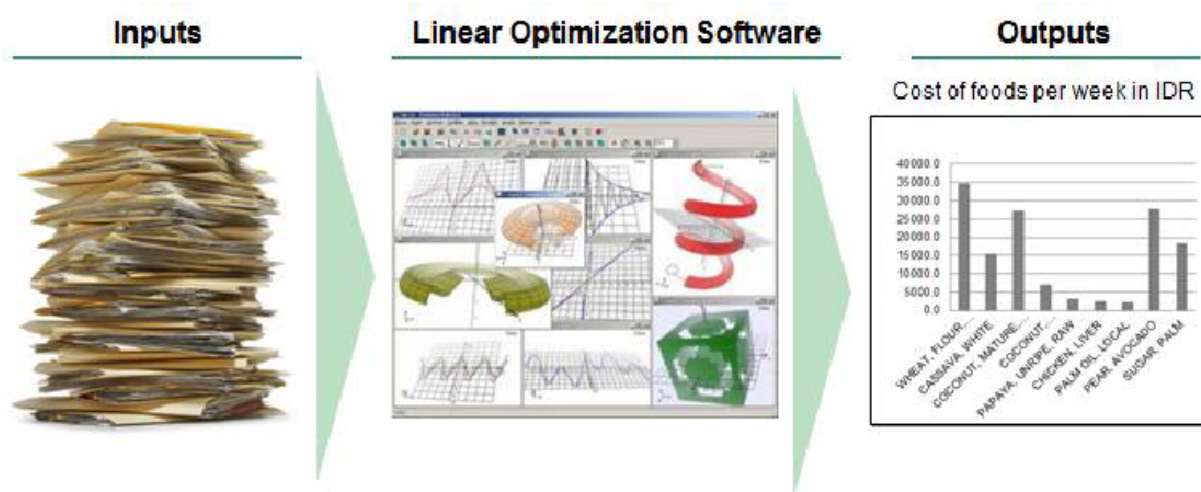


Figure 1: Overview of CoD Data Flow

Since 2006, SC-UK and WFP have used the CoD tool in several countries around the world. In 2006, SC-UK began working with the tool and has piloted it in Bangladesh, Ethiopia, Myanmar, Tanzania, and others. WFP, meanwhile, began partnering with SC-UK to use the tool in 2010 and has now worked with it in Bangladesh, Colombia, Djibouti, Indonesia, Mozambique, Philippines and Zambia

<sup>1</sup>This initial idea has evolved into various initiatives such as Nutrisurvey, developed by Juergen Erhardt (<http://www.nutrisurvey.de/lp/lp.htm>.) and Optifoods, which is still under development.

<sup>2</sup>Database sourced from: *World Food Dietary Assessment System*, UN Food and Agriculture Organization; *National Nutrient Database for Standard Reference*, US Department of Agriculture; *International MiniList (IML)*, UN Food and Agriculture Organization

<sup>3</sup>Database sourced from: (for energy and protein requirements): Report of joint FAO/WHO/UNU expert consultations in 1991 and 2001; and (for micronutrient requirements): "Vitamin and Mineral Requirements in Human Nutrition," 2nd edition. World Health Organisation and UN Food and Agricultural Organisation (2004).

# CoD Tool Outputs

## a) Minimum Cost of a Nutritious (MCNUT) Diet

The CoD tool calculates the price of a theoretical nutritious diet at the minimum cost. In other words, it calculates the cheapest combination of food items and quantities to ensure that all energy and nutrient requirements are satisfied. This benchmark measure, which is based on generalized constraints for food item and food group consumption frequencies, has been termed the "MCNUT diet" (minimum cost of a nutritious diet). The output can be disaggregated by age group, in particular for children under two and for the rest of the household.

As it is an optimization, the combination of food items selected by the tool will be chosen from what is locally available, but may not be in line with cultural preferences or habits. For example, it may choose a staple food that is not the most popular, or it may select an animal source food that is not locally accepted. Therefore, the MCNUT diet is not intended to provide nutrition recommendations, nor assess the nutritional status of a given population. Rather, the MCNUT is used to assess whether households have economic access to a theoretical nutritious diet composed of locally available foods. Said differently, if household expenditure (or income) is sufficient to afford the MCNUT, we still need to understand whether the household spends that income on such a diet. However, if household income (which includes own production, gifts etc.) is insufficient to afford the MCNUT, we know the household's diet will be deficient in one or several nutrients.

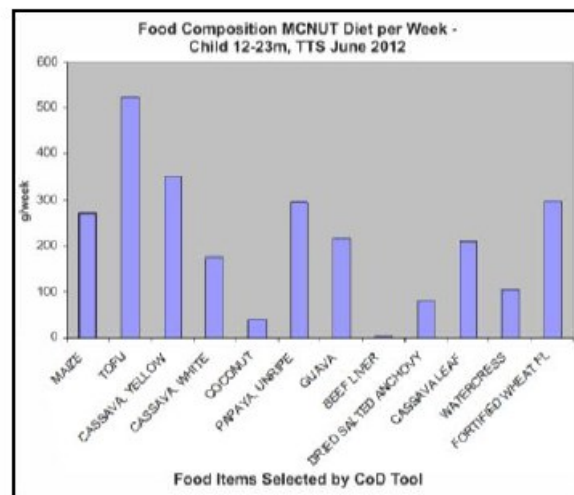
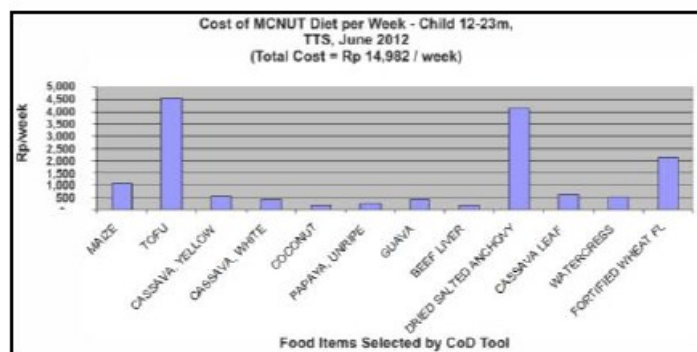


Figure 2: Example of MCNUT Cost and Composition Graphs



<sup>4</sup>Portion sizes to be entered in the tool correspond to the recommended portion sizes for children under two years available in the Cost of Diet, A practitioner's guide from SC-UK.

<sup>5</sup>The tool takes into consideration the following individual nutritional requirements: energy, proteins, fat, absorbed calcium, magnesium, zinc, absorbed iron, thiamine (B1), riboflavin (B2), niacin equivalent, vitamin B6, pantothenic acid, folic acid, vitamin B12, vitamin C and retinol equivalent.

# CoD Tool Outputs



## b) Locally Adapted Cost Optimized Nutritious (LACON) Diet

In order to make the CoD tool more sensitive to the local situation where it is being utilized, in terms of food preferences and consumption behaviours, the model can be adjusted. Based on focus group discussions with local communities in the target CoD area, information on food preference patterns can be collected to inform the adjustment of minimum and maximum constraints of food items and food groups. Based on this information, a locally adapted, cost optimized, nutritious diet can be generated, mostly reflecting staple preferences of the local population. This LACON diet constrains the ability of the tool to optimize. The cost is, therefore, typically higher than the MCNUT.

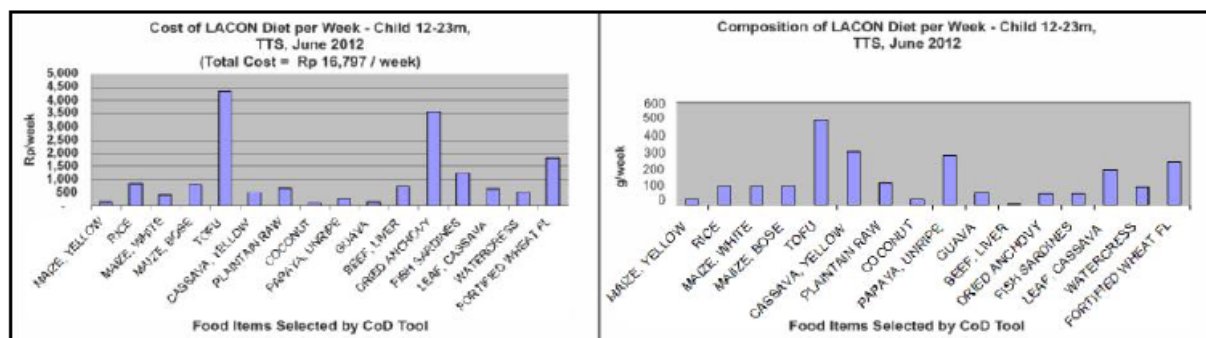


Figure 3: Example of LACON Cost and Composition Graphs

## Limiting Nutrients

When the CoD tool is run, one of the outputs which can be analysed is the list displaying the extent to which the needs for vitamins, energy, fat and other nutrients were satisfied in the simulated diet. By identifying those nutrients whose requirements were met at just 100% of the requirement (i.e. the minimal amount), whether for the household or for the child under two, it is possible to know which nutrient requirement of the diet the tool found most difficult and expensive to meet. This can give useful insight into which nutrients can be considered limiting factors of a nutritious diet. When contextualized with information on micronutrient deficiencies, this can be useful to add to the body of knowledge for comprehensive nutrition analysis and decision making on nutrition interventions.



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# Types of Analyses Which Can Be Performed with the CoD Tool

## a) **Affordability Analysis**

Based on income and expenditure data, the percentage of households who can afford the minimum cost of a nutritious diet, or its locally adjusted version, LACON, can be calculated to show the extent to which economic access limits the potential ability to fulfil the nutrient requirements of a family within a certain area, as compared to other areas.

## b) **Cost-effectiveness Analysis through Modelling**

The basis for the CoD tool is the list of locally available foods and their respective prices. However, a dynamic aspect of the tool is the ability to incorporate fortified food, such as fortified rice, or complementary food supplements for children 6-24 months and other vulnerable groups. By entering these items into the food list – either at a zero cost, if freely distributed through social safety net programmes, or at subsidized or regular market prices – it is possible to model new scenarios that incorporate various interventions and gauge their impact on the cost of a nutritious diet for a particular age group or for the household. This change in cost comparison also allows the user to assess the cost-effectiveness of interventions relative to one another.

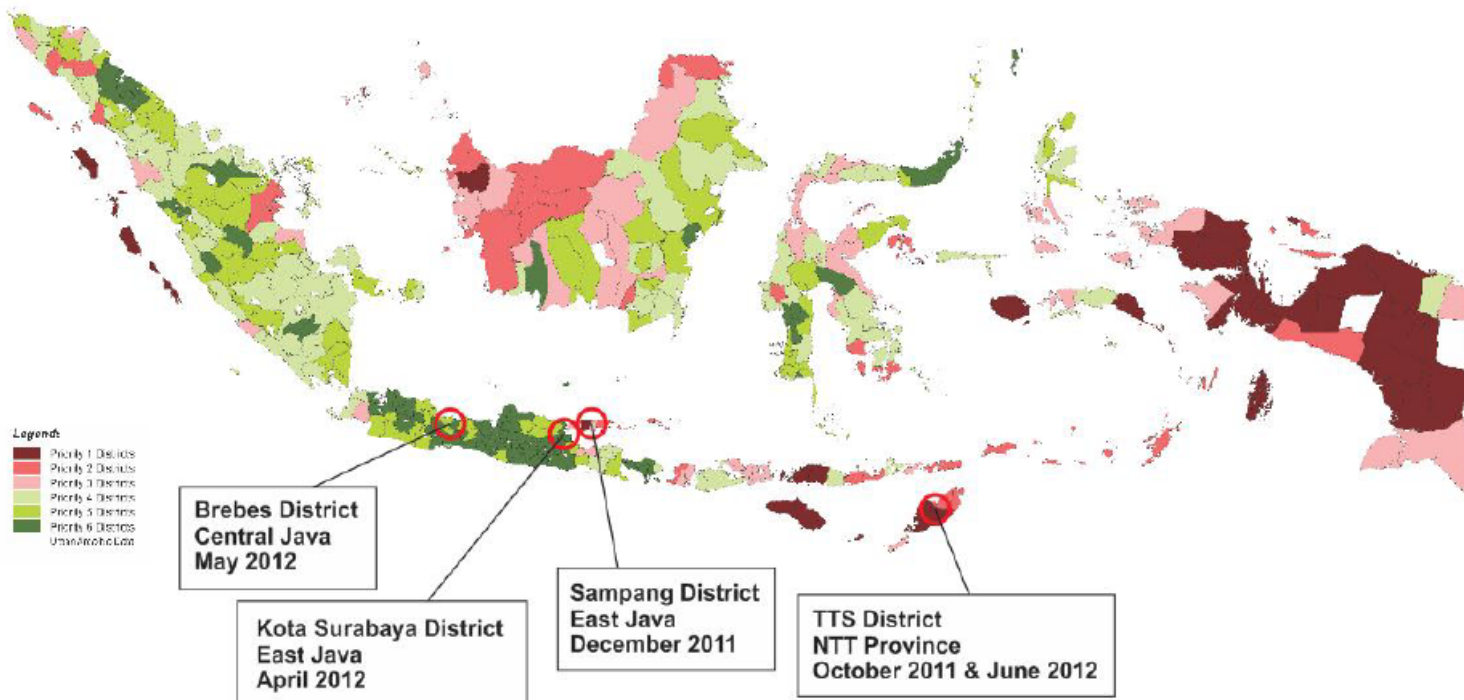
In order to assess the cost effectiveness of one intervention (e.g. Taburia), the cost reduction for a particular age group within the household (e.g. child under 2) can be compared to the programming cost of delivering the commodity through a social safety net programme, as well as to distribute the same product through the market. An example of this can later be seen in Figure 10.



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# The CoD in Indonesia at a Glance



Source: "Food Security and Vulnerability Atlas," Indonesian Food Security Agency and UNWFP, 2009

Figure 4: Locations and Dates of Data Collection and Priority Areas

In Indonesia, the CoD was conducted in four districts – Timor Tengah Selatan (TTS), Sampang, Surabaya, and Brebes – from October 2011 to June 2012, as shown in Figure 4. Data collection and initial analysis were carried out by WFP in collaboration with Ministry of Health teams at national, provincial and district level, Food Security Office (in NTT), researchers from SEAMEO RECFON and DSM volunteers. In TTS, data collection took place at two different points in time, allowing for seasonal comparison.



# Summary of Key Findings

## Diet Cost and Affordability

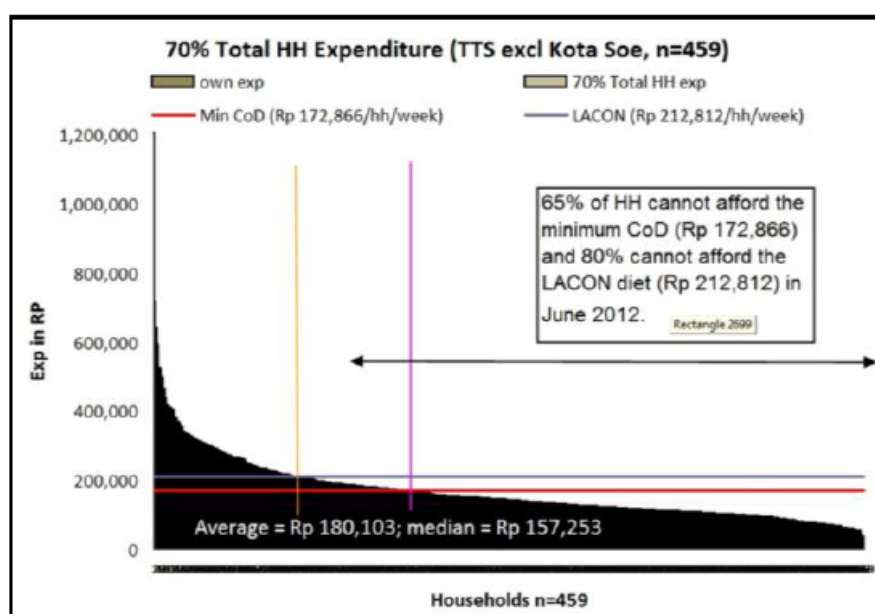
Figure 5 shows the percentage of households that could afford the locally adapted, cost optimized nutritious diet (LACON). There are stark differences among the four CoD areas: in TTS only 1 out of 4 households could afford to meet 100% of their nutrient requirements through locally available food, while in urban Surabaya 8 out of 10 could. If we look at the prevalence of underweight and stunting among children under 5 in the four areas, we see a strong inverse correlation with the proportion of households that could afford a nutritious diet (Figure 8).

LACON – Rp/Week/Age Group	TTS	Sampang	Surabaya	Brebes
Child 12-23 months	16,796	10,446	13,587	11,550
Other Family Members (3)	196,015	126,071	141,430	131,264
Total LACON Cost	212,812	136,518	155,017	142,814

LACON Affordability for Households, by Area	TTS	Sampang	Surabaya	Brebes
% of Households That Could Afford – Based on Total Food Expenditure	25	59	80	69
% of Households That Could Afford – Based on Using 70% of Total Household Expenditure on Food Purchases	20	63	92	73

Figure 5: Minimum Cost of Locally-Adapted Nutritious Diet in the Four Areas and the Proportion of Households that Could Afford to Buy Such a Diet, by Age Group

Affordability for the households is calculated both based on food expenditure and on 70% of total household expenditure. Detailed zone analysis is further illustrated with the example of Timor Tengah Selatan (TTS) below.



Figures 6: Diet Affordability for Households in TTS, June 2012

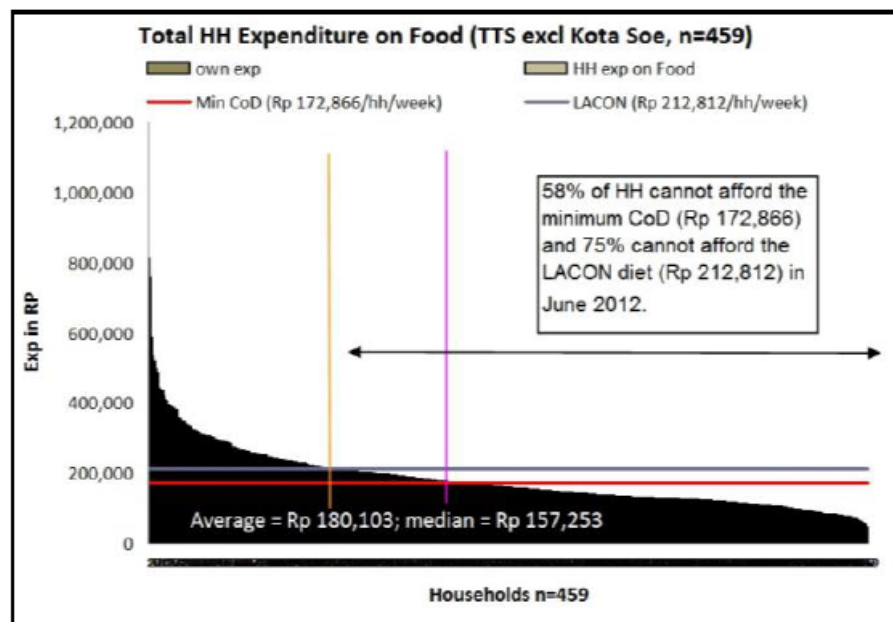
<sup>7</sup> If households behaviours were only determined by economic constraints

<sup>8</sup> 70% is a commonly-used benchmark for food expenditure in poorer households, and provides insight into how much these households are actually spending.

<sup>9</sup> Both data sources are the same for all four areas: SUSENAS 2010.



# Summary of Key Findings



Figures 7: Diet Affordability for Households in TTS, June 2012

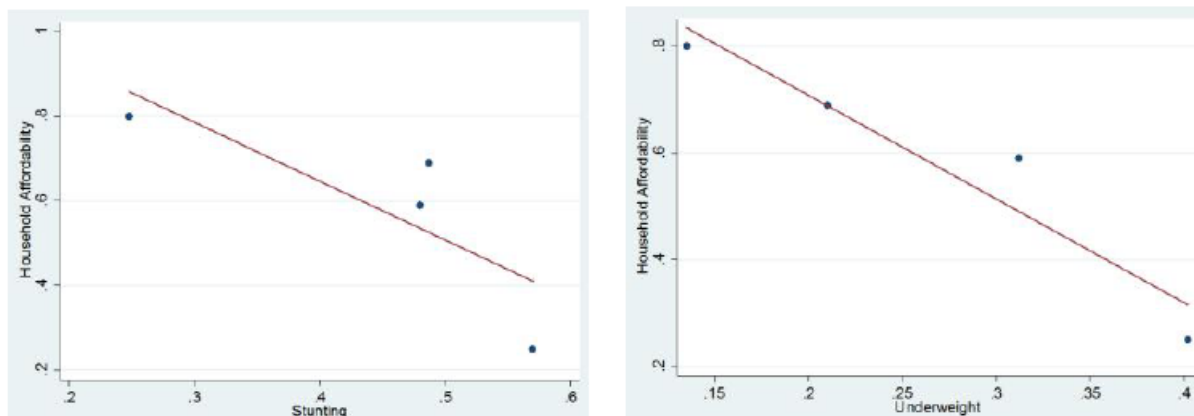


Figure 8: Correlation between Prevalence of Undernutrition (underweight and stunting) and Proportion of Households that Could Afford the Locally Adapted Cost Optimized Nutritious Diet.



# Summary of Key Findings

## Intervention Modelling (for TTS, through the market and Social Safety Nets)

Different types of fortified food transfers to the household, targeted at the child 6-24 months or at the entire family, are modelled to assess the reduced weekly cost of a nutritious diet for the household and the child. The introduction of the same fortified products through the market is also modelled.

Three types of products are modelled in this simulation:

- Fortified blended food for child 6-24 months (MP-ASI)
- Micronutrient Powder for child 6-24 months (Taburia)
- Fortified rice for the household

Intervention Options, Child 6-24 mo	LACON Child, IDR/Week	Selected by the Tool (for Commercial Options)
No Fortified Items	16,797	
MP-ASI, 60 g/d, Free	7,354	
Taburia, 3/week, Free	13,354	
MP-ASI, Commercial	16,611	600 Rp/20 g, 33 g/week
Taburia, Commercial	15,045	/1 g, 2 g/week

Figure 9: Effect of Child Interventions on Child Diet Cost in TTS (June 2012)



As shown in Figure 9, the highest reduction in the cost of the child's diet is observed with the provision of MP-ASI through Social Safety Nets (SSN), as fortified foods provide both micronutrients and energy, while Taburia only provides micronutrients (1 RNI). However, the diet cost of the child is small compared to that of the rest of the family (approximately 8% of the total cost), so that the overall cost reduction for the household is limited.

Furthermore, the CoD assumes that households will purchase the combination of foods which ensures meeting the nutrient requirements for the child, which may not reflect household behavior. Therefore, nutrition education and Behavior Change Communication (BCC) strategies are very important to ensure adequate complementary feeding practices.

<sup>10</sup> Return

Investment (ROI) is defined as (Amount Gained – Amount Invested) / Amount Invested. For example, if we look at the ROI for private sector distribution, the amount gained is the \$.13/sachet in savings, while the amount invested is \$.11/sachet. So, the ROI is calculated as  $(.13-.11)/.11 = 15\%$ , which shows that every \$.11 invested yields a return of \$.13.

# Summary of Key Findings

If we analyze the provision of Taburia from a cost-effectiveness perspective, we can see from Figure 10 that whether the product is provided through Government Social Safety Nets (SSN) or through the market, the reduction of expenses for the household outweighs the intervention costs. Furthermore, the return on investment is high both for the distribution through SSN (32%) and through the market (15%).

	IDR/sachet	USD/sachet	Return on Investment (%)
Cost Reduction LACON (child)	1,148	0.13	
Production Cost	270	0.03	325
Programming Cost (Government)	600	0.07	48
Total Government Cost	870	0.10	32
Private Sector Distribution	1,000*	0.11	15

Figure 10: Cost-Effectiveness of Taburia in TTS, 1 Sachet/Day, 3x/Week

Intervention Options, Household	LACON Household, IDR/Week	% Households who Could Afford - Based on Total Food Expenditure	Grams/Week Selected by Tool
No Fortified Items	212,812	25	1,752
Raskin	201,649	29	3,346
Fortified Rice, Commercial	161,351	48	3,514
Fortified Raskin	132,533	65	5,551

Figure 11: Effect of Fortified Rice on Household Diet Cost and Affordability, TTS, June 2012

As shown in Figure 11, rice fortification (either through SSN or through the market) greatly improves affordability at the household level. In the TTS example, the percentage of households who can afford the LACON diet increases from 25 to 65%, if fortified rice is available through the Raskin programme, and to 48% when it is available in the market.

Considering that the production cost of fortified rice is approximately 3-5% higher than normal rice, the potential impact of this large scale fortification intervention is huge and cost-effective.



<sup>21</sup> For 100 grams, fortification provides an additional: 361kcal energy, 6.7g protein, 0.6g fat, 0.5mg absorbed calcium, 0.64mg thiamine (B1), 36mg magnesium, 0.06mg riboflavin (B2), 3mg zinc, 2.4mg niacin equivalent, 0.4mg absorbed iron, 0.14mg vitamin B6, 1mcg vitamin B12, 1.14mg pantothenic acid, 200mcg folic acid.

# Conclusions

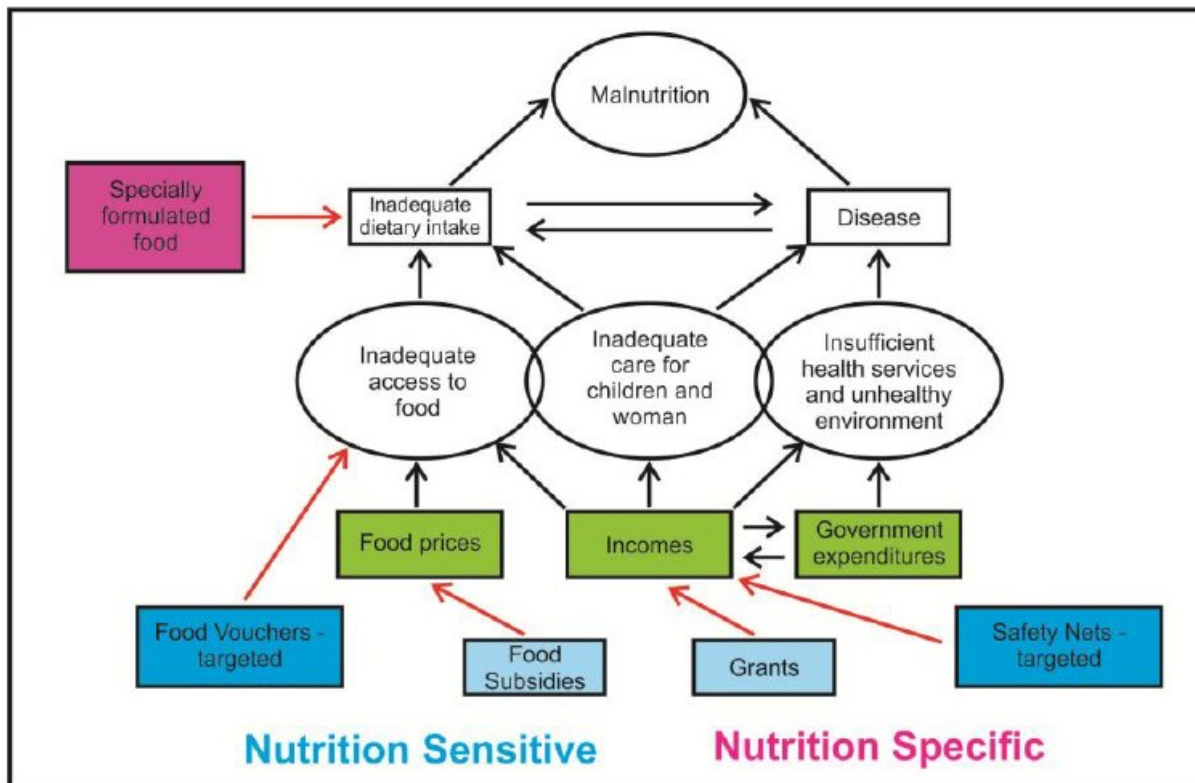


Figure 12: Policy Options to Address Malnutrition

The CoD analysis allows performing useful evaluation on household affordability and cost-effectiveness, modelling different fortified foods, nutritious specialised products, and various intervention types. The tool provides an important benchmark for any nutrition policy discussion, as it illustrates the cost of accessing a nutritious diet, both for children under 2 years and the rest of the household. Although economic access to nutritious food is not the sole determinant of under-nutrition, it is an important prerequisite to fulfil. Being able to measure this dimension is therefore a necessary first step to inform policy decision making.



While the affordability analysis is very powerful to illustrate the extent of economic constraints to food access in a particular area, the cost-effectiveness analysis can add to the information available for decision making at the local level. In particular, an important perspective can be provided for Social Safety Nets (SSNs) and other transfer-based programmes, be it food, in-kind, or cash, including vouchers.

# Conclusions

The CoD analysis is a useful entry point for discussion on the type and combination of delivery channels to best achieve nutritional outcomes, both through government Social Safety Nets and market solutions. Moreover, it provides information on the role and potential impact of nutrition specific interventions targeting the first 1,000 days. Furthermore, it sheds light on the importance of nutrition sensitive interventions, such as fortification strategies targeting households. For the most vulnerable households, the initial CoD analysis highlights that both nutrition specific and sensitive interventions would be required to meet their nutrient gap.

Finally, the tool has a great potential to support decentralised policy decision making, as decisions on the above described interventions (implementation modalities and budget allocation) are increasingly taken at district and provincial levels.



## Our Partners (many thanks to all of them)

- **TTS** – Ministry of Health, NTT Provincial Health Office, TTS District Health Office, TTS District Food Security Office, DSM
- **Surabaya** – Ministry of Health, East Java Provincial Health Office, Surabaya District Health Office
- **Brebes** – Ministry of Health, Central Java Provincial Health Office, Brebes District Health Office, DSM
- **Sampang** – Ministry of Health, Sampang District Health Office, DSM
- **Analysis** – Ministry of Health, Southeast Asian Ministers of Education Organizations – Regional Centre for Food and Nutrition (SEAMEO – RECFON), DSM

# Conclusions

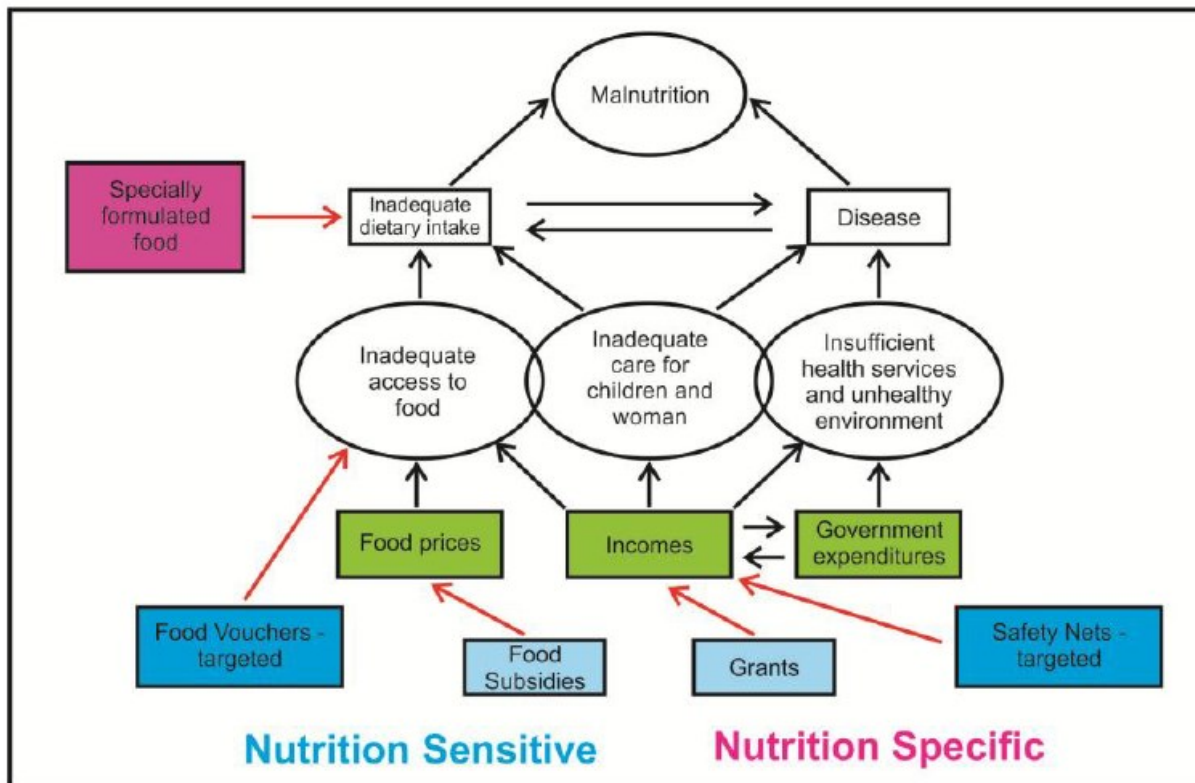


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