REPORT ON ANALYSIS OF ECONOMIC LOSSES DUE TO IRON & FOLIC ACID DEFICIENCIES IN AFGHANISTAN

FOOD FORTIFICATION AS A COST-EFFECTIVE STRATEGY FOR ECONOMIC GROWTH

Cost Benefit Analysis and Report

June 2017

DISCLAIMER

This report is made possible by the support of the American people through the United States Agency for International Development (USAID). The contents are the sole responsibility of the author and do not necessarily reflect the views of USAID or the United States Government.

ACKNOWLEDGEMENT

GAIN would like to thank all those experts who provided their valuable inputs for this analysis especially Mr. Kalim Ghauri, Mr. Jack Bagriansky for providing the base structure of the analysis model; subject experts Mr. Philip Randall, Mr. Quentin Johnson and Dr. Susan E. Horton for their technical inputs related to key assumptions used, and Mrs. Dora Panagides, Dr. Mohibullah Wahdati, Mr. Sayed Jamaluddin Sediqi and Ms. Caroline Manus of GAIN for their contribution in providing country specific information and coordination, and Ms. Joyce Greene of GAIN for editing this report.

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EXECUTIVE SUMMARY

Micronutrient malnutrition is a major public health problem in Afghanistan, with devastating, often lifelong consequences for the health, mental development, and productivity of its people, as well as the economic progress of the nation. Women and children are especially vulnerable. It is estimated that undernutrition costs the economy millions of US dollars annually[1].

Children with micronutrient malnutrition are more susceptible to illnesses that prevent them from regularly attending school. They find it more difficult to learn, with deficits equivalent to a 2 to 3-year loss in education[2]. As adults, they are more likely to be overweight and in danger of contracting diseases such heart problems and diabetes[3]. In the workforce, they will earn as much as 22 per cent less[4], causing challenges in raising and feeding their own families, perpetuating a cycle of poverty.

Poor maternal and infant nutrition affects the well-being of communities and countries' economic performance across generations[5]. Losses due to lower productivity, poor cognitive development, reduced schooling and the heavy burden on already stretched health care systems, hamper a nation's economic advancement through reductions of as much as 1 per cent in GDP[6]. Making sure children and women of reproductive age have the vitamins and minerals they need for life, learning and health can break the cycle of poverty, enriching their lives, their communities, and ultimately their nations.

Tackling the problem of micronutrient malnutrition is one of the best investments a nation can make. The Copenhagen Consensus, a group of economists who calculate the most cost-efficient ways of improving the lives of populations, has said that even in very poor countries, using very conservative assumptions, each dollar spent reducing chronic malnutrition has at least a USD 12.46 payoff, and that delivering micronutrients through fortification of food staples is a top public health priority.

Data from this cost benefit analysis (CBA) show that **failing to tackle the problem will lead to economic losses of USD 2,284 million over the next decade.**

Consequences of Vitamin and Mineral Deficiency	USD million
Neural tube defects	13.228
Neonatal deaths	337.648
Maternal Mortality	66.559
Iron Deficiency Anemia in children	181.307
Iron Deficiency Anemia in adults	1,685.381
Accumulated economic loss over 10 years	**2,284.125**

[1] Horton, S., Alderman, H. and J.A Rivera. Copenhagen Consensus 2008 Challenge Paper - Hunger and Malnutrition. March 6, 2008. Copenhagen Consensus Center

[2] Hoddinott J, Maluccio JA, Behrman JR, Flores R, Martorell R. Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. Lancet. 2008;371:411–16. doi:10.1016/S0140- 6736(08)60205-6.

[3] Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al.; the Maternal and Child Nutrition Study Group. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet 2013;371:243–60. doi:10.1016/S0140-6736(13)60937-X

[4] Victora C., et al. 2008. Maternal and Child Undernutrition: Consequences for Adult Health and Human Capital. The Lancet 2008 (Maternal and Child Undernutrition Series).

[5] Walker, S. P., T. D. Wachs, S. Grantham-McGregor, et al., 2011, "Inequality in early childhood: risk and protective factors for early child development," *The Lancet* - 8 October, 378(9799): 1325-1338.

[6] Repositioning nutrition as central to development: a strategy for largescale action. Washington DC: The World Bank; 2006 (http://siteresources. worldbank.org/NUTRITION/Resources/281846-1131636806329/ NutritionStrategy.pdf, accessed 21 October 2014).

The CBA looked at the cost-effectiveness of **a single intervention**, wheat flour fortification, in addressing micronutrient malnutrition. Analysis revealed that over a ten-year period, a successful fortification program would reduce these losses by USD664.69 million.

The CBA estimated the cost of such a ten-year wheat flour fortification program in Afghanistan at USD 53.34 million, with the potential to generate 12.46 times more benefit than cost. The minimal direct cost to the consumer would be just 1.06 % of the current average retail price of wheat flour in Afghanistan– an increase of 13.93 Af on a 50kg bag (using exchange rate of 66 Afghani per USD). Now, there is a clear economic case for moving forward to fortify flour in Afghanistan with essential micronutrients.

IRON AND FOLIC ACID DEFICIENCY IN AFGHANISTAN

Iron deficiency anemia is a major cause of maternal deaths and of cognitive deficits in young children. It can permanently affect school performance and has a negative impact on the economic well-being of individuals, families and national economies. In adults, anemia also affects productivity. In Afghanistan, anemia affects an estimated 40.4% of women of reproductive age and 44.9% of children under the age of five.[7] In 2014, according to the Ministry of Public Health, anemia prevalence in pregnant women was 44.4% and in non-pregnant women was 39%.

Folate is a vitamin that is essential for development of the brain, spinal cord and skull. Ensuring sufficient levels of folate in women prior to conception can reduce neural tube defects. An estimated 214[8] children in Afghanistan are born each year with neural tube defects like spina bifida.

Large-scale food fortification, the addition of small amounts of vitamins and minerals to staple foods and condiments, is one strategy for improving diet quality. In Afghanistan, wheat flour is an ideal vehicle for fortification with iron and folic acid. More than 25-30 percent of Afghan households purchase wheat flour. In urban areas, that figure rises to almost 90 percent. Afghanistan has one of the largest per capita, per month consumption of wheat flour in the world. Commercial flour imported into Afghanistan is not fortified. Bread is consumed by most in Afghanistan, usually at every meal, with an estimated per capita consumption of 430 grams per day[9]. GAIN, with financial support from USAID, has been working with the Government of Afghanistan, private sector partners, and others, to build an enabling environment for fortification. Prior to further adopting wheat flour fortification as an intervention to tackle micronutrient deficiencies, a robust analysis of flour fortification needed to be conducted to determine its cost effectiveness in addressing iron and folic acid deficiencies.

METHODOLOGY

The CBA has three major components: assumption data sets; a spreadsheet based model, and an analysis of results. Data sets (Annex A) were discussed in detail and agreed upon with key public, private and development sector stakeholders. Economic consequences are measured via four distinct pathways:

[7] As per data provided by Ministry of Public Health, Afghanistan
[8] Calculated, based on assumptions using the number of live birth rate
[9] ANSA flour fortification standard, 2013

1. Mortality and disability in children and consequent forgone income from future employment;
2. Economic deficits due to poorer child cognition, inferior school performance and depressed future productivity;
3. Depressed productivity in working but anemic adults; and
4. Additional health care costs due to micronutrient malnutrition.

Monetizing health risks and deficits is based on a range of national demographic, labor and health statistics, as well as some key assumptions in cases where data is not available. The general algorithm (coefficients of loss) for projecting the magnitude of economic losses is set out in the diagram below.

GENERAL ALGORITHM FOR PROJECTION OF ECONOMIC LOSSES

Risk Group Population		**Prevalence of Condition**		**Population with Deficit**		**Economically Active Population**[10]		**Average Annual Wage**[11]		**Coefficient Of Deficit or Loss**		**Lost Productive Activity**
National statistics	X	% from National Survey	=	By Indicator and Risk Group	X	48% 79% Male 35% Female	X	USD 901 Per Year	X	% Relative Risk[12]	=	USD/year

Since deficits are applied only to individuals projected to be economically active, with Afghanistan's low employment rate, participation rate impacts of iron and folic acid deficiencies is only applied to about half of working age men and about a quarter of females. Childhood productivity deficits are not felt until children enter the workforce, as much as 15 years in the future, and earnings stretch out for another 40-50 years. Therefore, a Net Present Value (NPV) of future economic losses is calculated based on a 1.5% discount rate to account for the time the child is not in the workforce.

Converting indicators of malnutrition to economic activity and attaching a monetary value to that economic activity involves many factors beyond simply human potential and performance. Workplace incentives, technology and opportunity all affect how increased potential translates into actual improved productivity and earnings. Additionally, the effects of iron and folic acid deficiency extend beyond the workplace to a range of activities, including parenting, household work, education, entrepreneurial pursuits and community participation.

[10] Labor Force
[11] IBID
[12] From global literature

ECONOMIC IMPACTS OF ANEMIA AND FOLIC ACID DEFICIENCY

ANEMIA IN CHILDREN

ANNUAL NPV OF FUTURE EARNINGS LOSS FROM IDA IN CHILDREN

Children w/ IDA		Average Annual Wage		Labor Force Participation Rate		Coefficient of Loss		NPV 39 years' earnings after 12.5-year delay[13]		NPV economic loss (12.5 years to workforce entry)
0.315 million	X	USD901	X	47.8%	X	2.5%	X	1.5%	=	USD17.726m

Data confirmed in National Nutrition Survey (NNS) of 2013 show that some 26.1% of children under 5 years of age suffer from iron deficiency. A range of evidence links iron status in children to cognitive development and future productivity deficits as adults. A *Journal of Nutrition* review documents the positive impact of iron intervention on cognitive scores, ranging from 0.5 to 1 Standard Deviation (SD) and concludes that "available evidence satisfies all of the conditions needed to conclude that iron deficiency causes cognitive deficits and developmental delays."[14]

A recent review of child psychology, nutrition and economic knowledge concluded that developmental problems related to iron status in children under 5 years is associated with a 4% reduction in lifetime earnings.[15] This led us to correct the 4% deficit by a factor of 0.62 to arrive at a 2.5% decrease in lifetime earnings for children under five who are iron deficient.[16] Our estimates are based on a 39-year work life, with a 1.5% discount rate to account for the time the child is not in the workforce.

At this current anemia prevalence, more than 0.315 million children in Afghanistan under 5 years of age will not live up to their full cognitive potential, will perform less well in school and will suffer associated earnings deficits as adults. Even with modest 2.5% productivity deficits estimated at USD 901 per child per year, this accumulated loss will have a significant impact on national GDP. The NPV of Afghanistan's lost earnings totals USD 17.726 million per year. Adding an annual birth growth rate of 0.5%, increases that figure to about USD 181.3 million over a 10-year period.

ANEMIA IN ADULT WORKERS

ANNUAL ECONOMIC LOSSES IN ADULT MANUAL LABOR AS A CONSEQUENCE OF IDA

IDA prevalence Adults 15-65		Manual labor wage		10% Manual Labor Deficit		12% Loss Heavy Labor[17]		Annual Loss
Women: 19.9%x2.413m	X	USD406/yr	X	USD39.055	+	7.029 m	=	USD46.085m/yr
Men: 8.1%x6.613m		USD676/yr		USD72.825		32.771 m		USD105.596m/yr

[13] Average number of years before entering workforce
[14] Haas, J. and Brownlie T., Iron Deficiency and Reduced Work Capacity: A Critical Review of the Research *Journal of Nutrition.* 2001;131
[15] Horton & Ross The Economics of Iron Deficiency Food Policy 28 (2003) 51–75
[16] Horton & Ross The Economics of Iron Deficiency Food Policy 28 (2003) 51–75
[17] Estimated at 12% (From Horton et al 2003)

Weakness, fatigue and lethargy due to anemia in adults results in productivity losses across the manual labor sector, including agriculture, manufacturing, construction, mining and defense. There is substantial documented evidence on the negative impact of anemia on indicators of work performance.

The table summarizes the projection for an annual productivity deficit of almost **USD151.6** million. Separate calculations for male and female workers have been made to account for significant variances in anemia prevalence, wage levels and labor participation. Productivity deficits are applied only to those engaged in manual labor where aerobic capacity, endurance and strength affect work performance. While anemia has consequences in non-manual "white collar jobs", the 10% work deficit is not applied to education and social sectors where women represent a significant share of the workforce.

PERINATAL AND MATERNAL MORTALITY DUE TO MOTHER'S ANEMIA

ANNUAL MATERNAL DEATHS DUE TO ANEMIA

Calculated Deficit in Mean Hb	X	Relative Risk Mortality	=	Population Attributable Risk	X	Annual Maternal Deaths (live births x MMR)	=	Annual Maternal Deaths
1.11 g/dL		0.75		27%		4974		1355

ESTIMATE FOR NPV OF LOST WAGES DUE TO MATERNAL DEATH

Attributed Deaths	X	Average Annual Wage(All Sectors)	X	Labor Participation Rate	X	Average Years in Workforce	X	Discount Rate for NPV[18]	=	Lost Productive Activity
1355		USD541/yr		35%		33		1.5%		USD 6.507 million

During pregnancy, iron requirements increase significantly and the risk of anemia rises in parallel, threatening the health and survival of mother and child. Afghanistan's Ministry of Public Health rates the prevalence of maternal anemia at 44%. While the human loss is immeasurable, in economic terms these 1355 annual deaths simply represent the NPV of a lost future workforce, valued at about USD6.507 million/yr.

PROJECTION OF PERINATAL DEATHS DUE TO MOTHERS' IDA

IDA prevalence in pregnant women	X	Decreased Relative Risk Mortality	=	Population Attributable Risk	X	Annual Deaths infants<1month	=	Child Deaths attributed to IDA in Mother
35%		1.45		**13.6%**		45,216		6,153

Due to a 35% prevalence of IDA in pregnant women (as per Ministry of Public Health, Afghanistan) and a relative mortality risk of mortality 1.45, the population attributable to risk is 13.6%. As per national statistics the annual deaths of infants of less than 1 month of age is 45,216 (Ministry of Public Health, Afghanistan). Accordingly, the estimated number of child deaths attributed to IDA in mothers is 6,153.

ESTIMATE OF LOST WAGES DUE TO PERINATAL DEATH

[18] After a 15 years delay

Attributed Deaths		Average Annual Wage		Labor Participation Rate		Average Years in Workforce		Discount Rate For NPV	=	NPV Lost Productive Activity[19]
6,153	X	USD901/ year	X	47.8%	X	33	X	1.5%		USD33.011 million/year

Presuming 30 years of age is the average age of maternal death, suggesting 22 years of additional work lost, we estimate an NPV of average USD33.011 million.

FOLIC ACID-RELATED NEURAL BIRTH DEFECTS

PROJECTED NTD-ASSOCIATED MORTALITY

Annual Births		Average Annual NTD Rate/1000 Births x Folic Acid Associated/Preventable NTDs	=	Projected Annual Folic Acid Associated NTDs	X	Assumed Mortality Rate	=	Total Projected Folic Acid Associated Deaths from NTDs
1.256 million	X	0.20x85%=0.17		214	X	90%		192

Neural Tube Defects (NTDs), spina bifida and anencephaly, are a significant cause of death and disability throughout the world. With no nationally representative figures available for the incidence of spina bifida and anencephaly in Afghanistan, we used The March of Dimes Global Report which estimates almost eleven thousand cases annually – a rate of 2/1,000 births, about the global average.[20] For the sake of analysis we make the conservative assumptions: that the annual NTD rate per 1000 births is 0.20 out of which around 85% are Folic Acid Associated/Preventable NTDs. Accordingly, if we apply this assumption to total births of 1,256,007 annual births, the approximate annual folic acid associated NTDs are in the range of 192.

PROJECTION OF ECONOMIC LOSSES FROM NTD MORTALITY

Attributed Deaths		Average Annual Wage		Labor Participation Rate		Average Years in Workforce		Discount Rate For NPV after 15 years delay	=	NPV of Annual Economic Loss[21]
192	X	USD901/yr	X	48%	X	33	X	1.5%		USD0.838 m/yr

[19] Assuming 15 years to workforce entry
[20] March of Dimes Global Report on Birth Defects, Appendix B, 2011
[21] Assuming 15 years to workforce entry

PROJECTION OF NPV OF LOST PRODUCTIVITY DUE TO NTD CASES

Number of Survivors		Average Annual Wage		Labor Participation Rate		Average Years in Workforce		Discount Rate For NPV after 15 years' delay		NPV Annual Lost Productivity[22]
Severe Disability 1	X	USD901/yr	X	48%	X	33	X	1.5%	=	100% Loss USD0.015m/yr
Moderate Disability 2		USD901/yr		48%		33		1.5%		50% Loss USD0.030m/yr

The projected annual children born with folic acid associated NTDs face a lifetime of moderate or severe disability. Infants born with NTDs require surgery at birth and will require specialist care throughout life. The associated lost productivity and health care costs are estimated very roughly as follows:

- Presuming appropriate level of facilities are available in 1/5 of birth cases and the cost of surgery is USD 15,000 this suggests about USD320,287 costs to the health system – both public and private.
- USD6,500 per year for rehabilitation and medicines along with USD4,500 estimated Annual Cost per Case of Ongoing Rehabilitation and Care for individuals with Moderately Disabled NTDs.

[22] Assuming 15 years to workforce entry

SUMMARY OF ANNUAL NATIONAL ECONOMIC LOSSES

TABLE 1: SUMMARY ECONOMIC CONSEQUENCES FOR ALL INDICATORS

The best available global evidence applied to national health, labor and demographic data suggests depressed national economic activity of nearly 2,284 million dollars over a ten-year period which could be attributed to current rates of IDA and folic acid related NTDs.

	Baseline Loss	GDP	Loss as % of GDP
	USD millions		
2017	210	20,038	1.05%
2018	214	20,639	1.04%
2019	218	21,259	1.03%
2020	222	21,896	1.01%
2021	226	22,553	1.00%
2022	230	23,230	0.99%
2023	234	23,927	0.98%
2024	239	24,644	0.97%
2025	243	25,384	0.96%
2026	248	26,145	0.95%
Total	**2,284**		

COST OF LARGE SCALE WHEAT FLOUR FORTIFICATION

This calculation covers costs associated with fortification of wheat flour produced by mills in Afghanistan, as well as in Pakistan and Kazakhstan for export to Afghanistan. The volume of wheat flour produced by large mills, both locally and imported, is calculated using data from recent regional wheat flour supply chain studies[23]. The cost of fortification calculated as part of this analysis includes costs to be incurred in Afghanistan, Pakistan and Kazakhstan on fortification of wheat flour. Fortification cost is expected to be passed on to the consumer under a standard market pricing mechanism. The tables below present premix, industry and government costs along with related assumptions over a period of ten years starting from 2017. Initiating a large-scale wheat flour fortification program for Afghanistan will cost USD 0.053 billion over 10 years.

TABLE 2: COSTOF LARGE SCALE WHEAT FLOUR FORTIFICATION OVER A 10-YEAR PERIOD

	Premix	Industrial	Government	Total	Total $ billion
	USD millions				
2017	871,387	1,028,886	3,087,500	4,974,185	0.005
2018	1,135,083	328,585	237,500	1,683,467	0.002
2019	2,464,293	423,397	437,500	3,286,762	0.003
2020	3,120,859	474,316	2,887,500	6,434,009	0.006
2021	3,871,695	531,655	437,500	4,780,474	0.005
2022	4,202,775	561,703	487,500	5,186,439	0.005
2023	4,562,166	593,857	3,087,500	8,172,381	0.008
2024	4,952,290	628,285	237,500	5,740,849	0.006
2025	5,375,774	665,167	437,500	6,394,611	0.006
2026	5,835,472	704,697	237,500	6,686,670	0.007

[23]Trade flow analysis (wheat grain, wheat flour& edible oil), Altai report, 2015

	36,391,795	5,940,548	11,575,000	53,339,847	0.053

TABLE 3: PREMIX COST

Premix costs are projected using population growth rate and proportion of premium and first grade white flour, as only these are required to be fortified. Per capita consumption of wheat flour and associated products, and is

	Total Population	Consumption kg/yr	Population Proportion Consuming Flour	% Flour Fortified	Target/Scale Fortified Production MT/	Cost of Premix USD billions
	A	B	C	D	E	
2017	9,769,303	110	100.0%	25%	267,435	0.001
2018	10,295,829	110	100.0%	30%	338,218	0.001
2019	10,850,733	110	100.0%	60%	712,893	0.002
2020	11,435,544	110	100.0%	70%	876,534	0.003
2021	12,051,874	110	100.0%	80%	1,055,744	0.004
2022	12,701,422	110	100.0%	80%	1,112,645	0.004
2023	13,385,978	110	100.0%	80%	1,172,612	0.005
2024	14,107,428	110	100.0%	80%	1,235,811	0.005
2025	14,867,762	110	100.0%	80%	1,302,416	0.005
2026	15,669,075	110	100.0%	80%	1,372,611	0.006
					9,446,918	0.036

assumed at 0.5% per year compared to other food items. The columns are multiplied to give the cost of premix.

TABLE 4: INDUSTRIAL COST

Industrial costs include the provision of micro feeders and the establishment of 5 new labs for quality assurance in and outside Afghanistan. Equipment maintenance includes costs associated with labor, maintenance and quality assurance spot testing. Other operational costs are 5% of the premix cost.

	Equipment - Capex (1)	Equipment Maintenance (2)	Operational Costs (3)	Total	Total USD billions
2017	725,000	246,728	57,158	1,028,886	0.001
2018	-	254,130	74,455	328,585	0.000
2019	-	261,754	161,643	423,397	0.000
2020	-	269,607	204,710	474,316	0.000
2021	-	277,695	253,960	531,655	0.001
2022	-	286,026	275,677	561,703	0.001
2023	-	294,606	299,251	593,857	0.001
2024	-	303,445	324,841	628,285	0.001
2025	-	312,548	352,619	665,167	0.001
2026	-	321,924	382,772	704,697	0.001
	725,000	**2,828,462**	**2,387,086**	**5,940,548**	**0.006**

TABLE 5: GOVERNMENTCOST

Government costs represent two flour mill inspections a year per mill; cost of lab tests per inspection; project costs associated with external monitoring engagements, and one-time capacity building and social advocacy.

	Ongoing Food Control (1)	Additional Monitoring (2)	One time startup cost (3)	Total	Total USD billions
		USD millions			
2017	237,500	200,000	2,650,000	3,087,500	0.003
2018	237,500	-	-	237,500	0.000
2019	237,500	200,000	-	437,500	0.000
2020	237,500	-	2,650,000	2,887,500	0.003
2021	237,500	200,000	-	437,500	0.000

2022	237,500	250,000	-	487,500	0.000
2023	237,500	200,000	2,650,000	3,087,500	0.003
2024	237,500	-	-	237,500	0.000
2025	237,500	200,000	-	437,500	0.000
2026	237,500	-	-	237,500	0.000
	2,375,000	**1,250,000**	**7,950,000**	**11,575,000**	**0.012**

PROJECTING THE BENEFITS OF FORTIFICATION

Large scale wheat flour fortification could generate material economic value through the reduction in economic loss due to malnutrition to the extent of $2,284.125 million over a period of ten years. For the purpose of calculating economic benefit, coverage used is of fortification of flour produced by mills in Afghanistan and the effectiveness of this intervention in the context of five areas of economic loss from international studies. This benefit analysis is only for a wheat flour fortification-related intervention

TABLE 6: SUMMARY CALCULATIONS OF INTERVENTION BENEFITS

	Neo Natal	Maternal Mortality	NTD	IDA Kids	IDA Adults	Total	Coverage (1)
			Base Economic Loss in USD billions				
2017	0.033	0.007	0.001	0.018	0.152	0.210	25%
2018	0.033	0.007	0.001	0.018	0.155	0.214	30%
2019	0.033	0.007	0.001	0.018	0.159	0.218	60%
2020	0.034	0.007	0.001	0.018	0.162	0.222	70%
2021	0.034	0.007	0.001	0.018	0.166	0.226	80%
2022	0.034	0.007	0.001	0.018	0.170	0.230	80%
2023	0.034	0.007	0.001	0.018	0.174	0.234	80%
2024	0.034	0.007	0.001	0.018	0.178	0.239	80%
2025	0.034	0.007	0.001	0.018	0.182	0.243	80%
2026	0.035	0.007	0.001	0.019	0.186	0.248	80%
Total	0.338	0.067	0.013	0.181	1.685	2.284	
EFFECTIVENESS (2)	**15%**	**15%**	**70%**	**40%**	**50%**[24]		
2015	0.001	0.000	0.000	0.002	0.019	0.022	
2016	0.001	0.000	0.000	0.002	0.023	0.027	
2017	0.003	0.001	0.001	0.004	0.048	0.056	
2018	0.004	0.001	0.001	0.005	0.057	0.067	
2019	0.004	0.001	0.001	0.006	0.067	0.078	
2020	0.004	0.001	0.001	0.006	0.068	0.079	
2021	0.004	0.001	0.001	0.006	0.070	0.081	
2022	0.004	0.001	0.001	0.006	0.071	0.083	
2023	0.004	0.001	0.001	0.006	0.073	0.084	
2024	0.004	0.001	0.001	0.006	0.075	0.086	
Total	**0.034**	**0.007**	**0.006**	**0.048**	**0.570**	**0.665**	

1. As per level of fortification stipulated as part of Wheat Flour fortification intervention.
2. As per international studies

COST AND BENEFIT RATIO FOR FLOUR FORTIFICATION

A CBA for a large-scale food fortification program is presented above. By spending $65.26 million over a ten-year period, economic benefits equal to $664.69 million could be generated, 10.19 times the costs expected to be incurred in the implementation of a large-scale wheat flour fortification program in Afghanistan.

[24] calculated using expected consumption of Iron and folic acid through program intervention among target population and proportionate positive impact in related economic terms.

TABLE 7: COST AND BENEFIT RATIO FOR FLOUR FORTIFICATION (USD MILLIONS)

	Cost	Benefit	Cost Benefit Ratio
2017	0.001	$22.44	4.51
2018	0.001	$27.48	16.32
2019	0.002	$56.08	17.06
2020	0.003	$66.76	10.38
2021	0.004	$77.87	16.29
2022	0.004	$79.47	15.32
2023	0.005	$81.10	9.92
2024	0.005	$82.77	14.42
2025	0.005	$84.48	13.21
2026	0.006	$86.23	12.90
	0.036	$664.69	12.46

RETAIL PRICE IMPACT OF WHEAT FLOUR FORTIFICATION

The CBA shows that the overall percentage of marginal fortification cost of current average retail price of all wheat flour is 1.35%. Accordingly, we are looking at a potential increase of 17.42 Afghani on 49kg bag or 356 Afghani 1MT of wheat flour based on current average current retail price of wheat flour. It is apparent from the analysis that the impact of cost of fortification on the end user retail price is minimal. In the following table over a ten-year period the cost of fortification with respect to its impact on retail price of wheat price is presented.

TABLE 8: POTENTIAL IMPACT OF FORTIFICATION ON RETAIL WHEAT FLOUR PRICE (USD)

Current average per kg price of Wheat Flour in USD	0.400
Projected average per kg price of Fortified Wheat Flour in USD	0.454

	Premix Cost	Industrial Cost -Recurring	Industrial Cost -Capital Cost Allocated	Industrial Cost - Total	Total	Expected Production of Fortified Wheat Flour (MT)
2015	871,387	246,728	72,500	319,228	1,190,615	267,435
2016	1,135,083	254,130	72,500	326,630	1,461,713	338,218
2017	2,464,293	261,754	72,500	334,254	2,798,547	712,893
2018	3,120,859	269,607	72,500	342,107	3,462,966	876,534
2019	3,871,695	277,695	72,500	350,195	4,221,890	1,055,744
2020	4,202,775	286,026	72,500	358,526	4,561,300	1,112,645
2021	4,562,166	294,606	72,500	367,106	4,929,272	1,172,612
2022	4,952,290	303,445	72,500	375,945	5,328,234	1,235,811
2023	871,387	312,548	72,500	385,048	5,760,822	1,302,416
2024	1,135,083	321,924	72,500	394,424	6,229,897	1,372,611
	2,464,293				39,945,257	
		2,828,462	725,000	3,553,462		9,446,918

	Fortification Cost Per MT	Fortification Cost Per KG	% of Current Retail Price
2015	4.45	0.0045	1.11%
2016	4.32	0.0043	1.08%
2017	3.93	0.0039	0.98%
2018	3.95	0.0040	0.99%
2019	4.00	0.0040	1.00%
2020	4.10	0.0041	1.02%
2021	4.20	0.0042	1.05%
2022	4.31	0.0043	1.08%
2023	4.42	0.0044	1.11%
2024	4.54	0.0045	1.13%
	Overall Average		1.13%

CONCLUSION

To move the food fortification agenda forward in Afghanistan and create a supportive environment for action, stakeholders need to understand the impact of fortification, both in terms of health benefits and economic costs.

This analysis shows us that failing to tackle the problem of micronutrient malnutrition will lead to economic losses of USD 2,284.125 million over the next decade in Afghanistan. We know that over a ten-year period, one single intervention, a successful wheat flour fortification program, would reduce these losses by USD 664.69 million. We also know that the cost of this fortification program is USD 53.34 million, with the potential to generate 12.46 times more benefit than cost.

Now, there is a clear economic case for moving forward to fortify flour in Afghanistan, as well as to ensure that imported flour into Afghanistan is fortified. This is particularly critical as Afghanistan imports approximately 1.1m MT of industrial wheat flour, from Kazakhstan and Pakistan. Regional efforts to increase the imports of fortified wheat flour into Afghanistan are under way. Efforts have focused on the adoption of a regional harmonized standard for wheat flour and for Afghanistan to adopt mandatory legislation for all wheat flour , both domestic and imported productions, to be fortified.

Importantly and a major signal that Afghanistan is committed to bringing fortified wheat flour is that the Ministry of Finance advocated for the reduction in tax duties for all premixes. In early 2017, the tax duties on all premixes have been reduced from 32.5% to 1%.

It is a common myth that cost of fortification is the key hurdle in sustainability of food fortification. This CBA shows that the cost of fortification as compared to current retail price of wheat flour in Afghanistan could easily be absorbed in the retail price of the final fortified product under good price control processes.

Beyond that, this wheat flour fortification program can be the cornerstone upon which other nutrition interventions can be built, with positive consequences for the health and wealth of the people of Afghanistan and the future of its children.

ANNEX A: LIST OF DATA SETS

Data Class 1	Data Title	Value Set	Values[25]
Demographic / Health	Total Population	No.	32,564,342
Demographic / Health	Proportion of Male	%	52%
Demographic / Health	Proportion of Female	%	48%
Demographic / Health	Population Working Age Adults 15-65	No.	18,229,498
Demographic / Health	Population Working Age Male Adults 15-65	No.	9,266,889
Demographic / Health	Population Working Age Female Adults 15-65	No.	8,962,609
Demographic / Health	Population Children < 15 years	No.	13,505,801
Demographic / Health	Population Children < 5 years	No.	1,210,610
Demographic / Health	Birth Rate	No. per 1000	39
Demographic / Health	Annual Population Growth	%	2.32%
Demographic / Health	Annual Birth Rate Growth	%	0.50%
Demographic / Health	Under 5 Mortality/1000	No. per 1000	91
Demographic / Health	Infant Mortality/1000	No. per 1000	115
Demographic / Health	Neonatal < 1 month/1000	No. per 1000	36
Demographic / Health	Maternal Mortality/100000	No. per 100,000	396
Demographic / Health	Estimated ID in Children 6-59 months	%	**26.1%**
Demographic / Health	Anemia in Pregnant Women	%	**44.4%**
Demographic / Health	IDA in Pregnant Women	%	35%
Demographic / Health	Anemia Adult Women	%	40.4%
Demographic / Health	IDA Adult Women	%	19.9%
Demographic / Health	Anemia Adult Men	%	28%
Economics	Start year of Model	Year	2017
Demographic / Health	Adult Labor Participation Rate (Male and Female Combined)	%	47.8.0%
Demographic / Health	Adult Male Labor Participation Rate	%	79.3%
Demographic / Health	Adult Female Labor Participation rate	%	35%
Demographic / Health	Healthy Life Expectancy	Age in years	51
Demographic / Health	Healthy Life Expectancy, Male	Age in years	50
Demographic / Health	Healthy Life Expectancy, Female	Age in years	52
Demographic / Health	Average Maternal Age at Birth of First Child	Age in years	20
Demographic / Health	Age at Work Force Entry		18
Economics	GDP (current US$)	USD	$20,038,215,159
Economics	Individual Wage/Labor Share GDP	%	70%
Economics	Per Capita Manual Wage as % Average Wages	%	75%
Economics	Female Manual Wage as % Male Manual Wage	%	60%
Economics	Discount Rate	%	1.50%
Demographic / Health	Relative Risk of Neonatal Death Due IDA in Mother		1.45
Demographic / Health	Average Annual NTD Rate/1000 Births	No. / 1000	0.20
Demographic / Health	Folic Acid Associated/Preventable NTDs	%	85%
Demographic / Health	Proportion of Survivors with Severe Disability	%	33%
Demographic / Health	Proportion of Survivors with Moderate Disability	%	67%
Demographic / Health	% Births with Access to Special Care or Pediatric Surgery for NTD Cases	%	10%
Demographic / Health	Estimate of Cost per Case for Pediatric Surgery for NTD Cases	$	$15,000
Demographic / Health	Estimated Annual Cost per Case of Ongoing Rehabilitation and Care for Severely Disabled	$	$6,500
Demographic / Health	Estimated Annual Cost per Case of Ongoing Rehabilitation and Care for Moderately Disabled	$	$4,500
Demographic / Health	Annual Social Security, Welfare or Other Special Programs	$	$1,200
Demographic / Health	RR of Maternal Mortality Associated with a 1 g/dL Increase in Hemoglobin:		0.75

[25] Agreed during the workshop

Data Class 1	Data Title	Value Set	Values
Demographic / Health	Reduction in Future Productivity in All Sectors due to Anemia	%	4.50%
Cost of Fortification	Feeders and Start-Up	Total units	50
Cost of Fortification	Cost per unit of Micro feeder	$	$7,500
Cost of Fortification	Feeders for Expansion into Private Sector	$	$3,500
Cost of Fortification	Installation and Training	Per Unit $	$2,500
Cost of Fortification	Lab and Other Capital Improvement Costs	No. Units	2
Cost of Fortification	Lab and Other Capital Improvement Costs per unit cost	$	$300,000
Cost of Fortification	Per Capita Consumption in kg/yr Among Consumers	Kgs	109.50
Cost of Fortification	Current Percent Population Consuming Flour	%	100%
Cost of Fortification	Growth Population Rate	%	2.3%
Cost of Fortification	Growth in Population of Consumers	%	0.0%
Cost of Fortification	Growth in Average per Person Flour Consumption	%	0.0%
Cost of Fortification	% of WF from Flour Mills	%	30%
Cost of Fortification	% of Growth in consumption to WF from flour mills	%	3%
Cost of Fortification	Training Food Control Agency	$ for 3 years	$300,000
Cost of Fortification	Training Program Monitors	$ for 3 years	$100,000
Cost of Fortification	Advocacy/Social Marketing	$ for 3 years	$1,000,000
Cost of Fortification	Capital Improvement	$ for 3 years	$250,000
Cost of Fortification	Inspections/Yr	No. of inspections per year	3
Cost of Fortification	Estimated Total Cost/Inspection	$	$1,500
Cost of Fortification	Lab Costs/Inspection-per Sample	$	$50
Cost of Fortification	Lump Sum Bi Annual	$	$200,000