L'Initiative pour les micronutriments

The Micronutrient Initiative

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Summary Report on the Workability of Fortification via Service Hammer Mills

DRAFT

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Executive summary

At the 2002 United Nations General Assembly Special Session on Children, world leaders pledged to protect the world's children against hunger, disease, and malnutrition. Recognizing the contribution of vitamin and mineral deficiencies to disease and malnutrition, the leaders established targets for reducing and eliminating "hidden hunger". Pledges were made to eliminate iodine deficiency disorders by 2005, to eliminate Vitamin A deficiency by 2010, to reduce iron deficiency by 2010, and to accelerate progress towards the reduction of other micronutrient deficiencies. Food fortification was named as one of the necessary methods of achieving these targets.

Fortification of staple foods is a far-reaching and sustainable strategy for addressing micronutrient malnutrition. By adding micronutrients such as iodine, iron, and Vitamin A to commonly eaten foods such as salt, cereal, flour, and oil, fortification can make a positive difference to a population's health. In most developed countries, public health has improved as a result of the addition of micronutrients to centrally processed foods.

In many Southern African countries, centralized fortification of commercially processed cereals, oils, and sugars is an affordable option that would benefit mainly the urban and peri-urban dwellers. For the rural areas, where staple foods are processed at the village or household level and where populations are often the most micronutrient deficient, a different fortification strategy is needed. To reduce micronutrient malnutrition in these areas, fortification of foods has to occur in small, decentralized, local mills.

Service hammer mills (SHMs) are decentralized small mills that provide a milling service for locally grown and consumed foods. In contrast to large and medium sized mills, SHMs do not process, package, or resell a milled product. SHMs are pervasive throughout rural Southern Africa, and they serve a large population who either grow their own cereals or purchase small unmilled quantities in the market. In many instances, consumers typically carry their grain in 20-30 kg batches (once or twice a month) to local mills, where they pay the cost of milling and return home with the milled flour or meal. In recent years it has been observed that more and more people in the peri-urban areas are also resorting to this type of small scale milling, as it is cheaper than purchasing ready-made maize meal.

Fortification of maize meal at rural (and peri-urban) service hammer mills is operationally feasible. It has the potential to provide the large rural majority of national populations with a nutritional benefit which cannot otherwise be easily or cost-effectively supplied. Intervention through the service hammer mill (SHM) channel is justified on health grounds based on the extent of nutritional deficiencies amongst 'reachable' populations. Fortification through SHMs, though holding strong potential to become a commercially viable undertaking over the long term, cannot be approached as a commercial endeavour to begin with: short to medium term subsidization will be needed. Even without considering any cost recovery, the estimated per capita cost of providing a daily 25% RDA dose of a package of mineral and vitamin nutrients through this channel appears to be highly attractive, efficacy assumed, from a health policy perspective.

This final report summarizes and briefly discusses the overarching insights and findings stemming from the three country-level studies. It is accompanied by five additional documents. An in-depth background review report presents, for each country of concern, a preliminary analysis of issues potentially important to fortification via SHMs as well as indicative poverty data. Country study reports for Malawi, Zambia and Zimbabwe each contain analyses, insights, findings and recommendations specific to the country of concern. A "Policy Analysis Guide on the Workability of Fortification via Service Hammer Mills" sets out key policy and regulatory requirements and operational performance requirements for a fortification intervention via SHMS.

Key findings common to all three country studies include:

a) *Existing commercial distribution channels for food and consumer products should be used to accomplish nationwide distribution of the premix blend (diluted premix concentrate) required for fortification at SHMs*.

Unlike public sector channels, the commercial distribution system has the bulk handling infrastructure, commodity distribution management skills and operating efficiencies that are needed to expeditiously and cost effectively ensure that premix blend is made available where and when needed. Governments generally lack the transportation, cash management and timely distribution management capacities which will be essential to success in this regard;

b) *The method and technology of the addition process is not yet mature. Despite now nearly four years of experimentation, a viable addition process has yet to emerge from the pilot projects reviewed*.

That said, it is highly probable that a blender-based method of addition will prove viable, and 'direct addition' methods not so. Further work is urgently needed: i) to develop and prove an effective yet low cost hand-powered blender; ii) to determine the economically optimal minimum dilution ratio which can be used to consistently achieve a satisfactory level of blending uniformity (of the added nutrients in the fortified maize meal);

c) A *minimum blending uniformity standard should be set for fortification via SHMs*.

Inherent variability of the manual blending process will translate into batch-to-batch variance in the degree to which the added nutrients are evenly (or not evenly) distributed in the maize meal being fortified. It is not possible for SHMs to achieve a tight uniformity standard (i.e.: within 10% of a target RDA dose)[1]. It is unlikely that a blender-based method of addition at SHMs can consistently perform to less than a 25% 'under' of 'over' dosing range around the target RDA established. However, as retention losses of the blender-based method of addition are negligible, the average level of RDA dosing actually achieved can be expected to be nearly equal to the target RDA during the period taken for a household to consume a particular batch of somewhat unevenly fortified maize meal. Nutritionists need to appreciate

[1] Personal communications with R. Pankhurst and L Umunna, Roche – South Africa indicated that even large scale commercial mills are rarely able to consistently perform at blending variances less than 20% - 25%.

the limits of the addition process, the likely degree of day-to-day actual RDA dosing variability which can be expected, consider how much variability of nutritional intake can be tolerated by a nutritionally deficient human body and, based on this, determine whether the average performance which can be expected from the technology falls within the range of variability that is permissible from a nutritional perspective;

d) *SHMs and larger scale commercial mills need to be treated differently from a policy and regulatory perspective*.

The former should be required to meet an 'addition method' standard as the key test of performance (which policy makers are not so far considering); given their access to more precise addition technologies and methods, the latter can be required to conform to a specific sample testing standard (as policy makers are already considering);

e) *The efficacy (in terms of gains to human health) of fortification via maize meal needs to be established*.

Efficacy trials should test common standards which should be adopted, including: a recommended premix composition standard (i.e.: Roche IS 254 or equivalent); the optimal physical form of iron constituent to use; and, the target RDA dose level;

f) *The prospects for achieving high levels of cost recovery and eventual commercial viability within a six to eight year period appear promising.*

Although from the health policy perspective, cost recovery is a secondary concern, the question of the costs of providing the benefit cannot be avoided. If commercial distribution channels are utilized and a policy of progressive cost recovery over a medium term period pursued, net recurrent costs of this intervention to government after a short term introductory should prove very modest and decline to an insignificant level over the long term.

g) *SHMs are currently unregulated and not accountable to any Ministerial authority*.

To ensure that SHMs both offer fortification and comply with a specified addition method, it is imperative that steps be taken to bring SHMs under the jurisdiction of an appropriate health authority;

h) *A new and tailor made institutional framework is likely to be needed in each country to manage implementation of a national fortification program via SHMs.*

This institution need not be large, but should have the following abilities: to enter into and manage contract relationships with private sector companies; to regulate third parties involved in the fortification program; to broker and manage partnerships between the private sector, government and supporting donor agencies; cost control and cost recovery management capability; strong understanding of nutritional health sciences and preventative health practices including IEC practices; conversant with consumer advertising practices for food products; undertake or manage effectiveness monitoring; and have the freedom to make

timely program management decisions. This institution should be accountable to the national ministry of health which should have regulatory powers (i.e.: capacity to ensure compliance).

i) *It is unlikely that an intermediate 'dosifier' technology device would prove technically or economically workable for the purpose of fortification at SHMs.*

The reasons for this are explained later in this summary report.

Synthesis

The reader is referred to the companion document entitled "Policy Analysis Guide on the Workability of Fortification via Service Hammer Mills" for discussion of the following set of policy concerns and operational needs:

Policy issues for nutritionists	
Iron mineral form in the micronutrient contentrate: what works?	
Acceptable level of day-to-day variability of micronutrient intake?	
Policy issues for governments	
Grounds for public support for fortification	*Quality control*
'Cost recovery' and subsidies	*Sample testing*
Subsidy targeting	*Regulatory authority*
Fortification standard for service hammer mills	*Technical and operational feasibility of fortification*
A premix standard	*Landed cost of premix concentrate*
A fortification methods standard.	*Institutional framework for a national fortification program*
Fortification compliance	
Policy issues for food aid agencies and governments	
Fortification of emergency food aid	
Post-emergency capacity-building	
Fortification of maize used in supplementary feeding programs	
Policy issues for health program funding agencies	
Household capacity to pay for fortification	
Assessing fortification as a public health intervention	
Key Operational Requirements for Fortification at Service Hammer Mills	
Dilution ratio	*Commercial incentive*
Blender-based addition method	*Creating consumer demand*
On-site blending labour	*Regulation and compliance*
Training	*Monitoring*
Commercial channels to distribute and stock premix	

Aside from the topics listed above, further investigations are warranted to assist interested parties in gaining a greater understanding in the following areas of concern:

Toxicity and palatability of premix blend in relation to safety concerns

The potential risk of accidental toxic overdosing was a recurring concern expressed by health professionals during this study. The brief discussion below is not a definitive assessment but provides insight into the scale of risk and how it may be managed.

All of the constituents except for Vitamin A (Vit. A) in (Roche IS 254) concentrated premix (and thus also in partially diluted premix blend) are water soluble.[2] Unlike Vit. A, any excess consumption of water soluble constituents are flushed from the human body and do not accumulate. The toxicity risk concerns retention of excessive amounts of oil-soluble Vit. A.

The World Health Organization (WHO) recommends that up to 10000 IU (3000 RE) Vit A per day can be given safely anytime during pregnancy. This is roughly 5 times the 'Safe Level Intake' (i.e.: the daily intake required to maintain adequate body reserves) for pregnant women according to WHO guidelines. Applying the same rule of thumb to other age groups, up to a 2000 RE dose of Vit A would still be safe for children in the 1-6 year age bracket.[3]

So, is premix blend toxic? Assuming that RDA is equivalent to Safe Level Intake, the toxicity threshold is roughly '[(25% RDA * 4) * 5]' or 20 times the target 25% RDA. In other words, if the ratio of premix concentrate in the premix blend is more than 20 times the target 25% RDA it would be toxic if consumed in a meal sized quantity. For example, Roche IS 254 premix concentrate has a recommended target dose rate of 150gr/MT to achieve 25% RDA. The target dose rate is 150:1,000,000 or 0.00015 (or 1:6667). At a dilution ratio of 1:100, a 25kg bag of premix blend would contain 250gr of Roche IS 254 premix concentrate. The dose level is 250:25,000 or 0.01 or, put another way, 66 times the target 25% RDA. In fact, premix blend prepared with Roche IS 254 at any dilution ratio lower than 1:333 would be toxic. On cost and affordability grounds, the optimal dilution ratio for premix blend is a maximum of 1:100 and preferably less than this (i.e.: 1:75, etc) and would be toxic if inappropriately consumed.

It has been contended that the high levels of iron and zinc which would be present in a meal prepared with premix blend would render the meal physically unpalatable. In other words, it would be very difficult for someone to knowingly consume a meal prepared with a (toxic) premix blend.[4] It is not clear whether this would apply to a small child whose sense of taste is not yet developed.[5] This contention warrants being put to the test. If true, then the 'unpalatability' of premix blend would, excepting the special case of very young children, largely resolve the safety concern.[6]

Penetration of commercial food distribution systems and products into rural areas

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[2] This and the following statement are drawn from personal communications with Q. Johnson.

[3] Safe Level Intake (daily) for pregnant women is 600RE and 400RE for children 1-6 years. WHO guidelines.

[4] Per P. Randall during meetings at MI offices in Johannesburg.

[5] Cases of very young children sometimes mistakenly drinking paraffin thinking it to be water or other beverage are not unknown.

[6] Measures which can be adopted to further minimize risks of accidental use of premix blend when preparing a meal include use of distinctive packaging and storing packages of premix blend in secure containers. Once premix blend is added to the maize meal to be fortified, even if some addition inaccuracy occurs or if blending is just partially completed, the premix blend would be further diluted in the maize meal to a point where the chance of a toxic 'event' (a toxic meal) occurring during the two weeks or so that it may take to fully use up a particular bag of fortified maize meal is so small that it can be ignored.

In addition to rural purchasing power, the extent to which commercial food distribution systems have penetrated into rural areas is a key consideration in relation to the potential to utilize SHMs as a nutrient delivery channel (fortification of maize) in rural areas. Many factors influence rural areas' access to commercially distributed food products: agricultural sector governance practices; the impacts of trade deregulation and economic restructuring programmes; state of national and local roads infrastructures; population density; distance from central food warehousing and distribution centres; transportation cost structures (i.e.: per MT per klm); seasonality of road conditions (i.e.: flooding); and consumer product retailers' perceptions of rural purchasing power are some examples.

The three brief country studies indicated that consumer products distribution reaches to at least the district administrative level in most areas. This means that the task of getting premix blend distributed to and stored at district level points of supply can, generally speaking, be accomplished cost effectively.

The pattern of product distribution from the main commercial trading town in a district administration to outlying areas within a district - 'the last mile' – varies widely. In Zimbabwe, the existence of village level general trading shops and good roads means that even the remotest settlements can be reached using commercial channels. In Malawi, the high cost of local transportation between outlying villages and the nearest trading point poses the main 'last mile' challenge. The most challenging environment to work in is Zambia where long distances must be negotiated over poorly maintained roads to reach the least travelled and remoter areas of population settlement. However, in all three countries, anecdotal evidence indicated that some form of cost effective local 'last mile' solution can probably be found to ship premix blend to SHMs from the nearest district level point of supply. It would be most efficient if SHMs were made responsible for finding the best 'last mile' transport solution rather than for a central agency to attempt to manage this directly.

From a preventative nutritional health perspective, introduction of nutrients into centrally processed commercially packaged food products is very attractive: the potential to achieve widespread nutritional gains at little incremental cost. It is thus important for health policy makers to acquire a strong understanding of the extent of market penetration as well as consumption patterns, and factors influencing these, of prospective commercially packaged food carriers: presuppositions about the efficacy of a particular food type need to be identified and tested. For example, commercially packaged sugar may be widely available throughout most of a given country. However, it is also a luxury good which poorer households tend to forego when lacking cash (seasonal cash shortages? ultra-poor households?). In Malawi, small children do not customarily consume coffee or tea (in which sugar might be added) and poorer households which eat a single maize-based meal per day may prepare a soup-based condiment rather than a breakfast porridge to which sugar would ordinarily be added. In Zambia, rural households situated a long distance from main roads and subsisting on own-grown foods may rarely buy commercially prepared foods either due to lack of access or lack of income; and, in the months immediately following harvests, sales of commercially packaged maize meal plummet because urban consumers prefer to buy whole maize and take this for service milling both to save money and for taste preference reasons. In Zimbabwe, despite the existence of good roads, a sophisticated food distribution system and general dealer food shops in most villages, rural households' currently lack access to commercially packaged foods: rampant inflation has meant that village general dealers lack sufficient working capital to purchase

stocks and rural households lack purchasing power. Thus, nutritional health policy makers need to understand how the pattern of access and consumption habits concerning commercially packaged foods varies across the country to better gauge how best to reach specific target households and individuals with nutritional benefits through food fortification.

Survey of number, distribution and characteristics of SHMs

As SHMS are not regulated any of the three countries surveyed, there is a paucity of current data concerning the scale and distribution of SHMs nationally. The available data is presented in each of the country study reports: this data is not sufficient or reliable enough to serve as the basis for taking a decision to utilize SHMs as a channel for fortification. Although it seems to be widely viewed in all three countries that SHMs are pervasive, the only 'recent' survey data in existence dates back to 1991 (Zambia). However, views offered on this issue consistently supported the notion of SHMs being high in number and pervasive in terms of distribution nationally but sample survey work should be carried out to establish a true current picture.

Major salient observations made during the three country studies and which will need to be explored further include the following:

a) non-availability of spare parts: a plethora of imported makes of SHM machinery exists in all three countries, but changing economic conditions, business closures and, in Zambia, an inappropriate women's economic empowerment scheme which has set up a large number of SHMs in remote areas and other factors suggest that a significant proportion of the total stock of SHMs are no longer operating. Firm data on this will be needed. It may turn out to be appropriate to consider including a spare parts distribution element in a national SHM maize fortification program.

b) in all three countries, SHM machinery operates on either diesel generator or electricity, with the rural bias being towards diesel plants due to lack of access to the national power grid. The economics of diesel powered SHMs is substantially less profitable than for electrically-powered units. The result of this is that SHM service milling fees are generally higher in rural areas (where household disposable incomes are generally lower). It will be important to take the two levels of operating profitability into account when designing a national SHM fortification scheme and setting fortification fees.

c) in all three countries, the premises of most SHMs visited were only just large enough to house the milling machinery: in a majority of cases, extension of the built structure will be needed to create the space needed to accommodate blender-based fortification. While the cost of adding any extra space required may be modest, it may be necessary to assist SHM owners to defray the associated costs as part of a national SHM fortification scheme.

Blender technology development

In all three pilot projects reviewed, there is a clear need for an effective and inexpensive blending technology. The reasons for this are straight forward: the direct addition method is highly unlikely to prove either technically sound or a cost effective alternative to blender-based methods of addition; the latter has been shown to work in Zambia, although

using a blender technology that is not satisfactory; little and inadequate attention has been given to blender technology development to date; and, with a modest level of funding and effort it should be quite simple to develop an appropriate standardized hand-blender device which will suit most operating situations.[7] At present, none of the pilot projects has funding which can be used for blender technology development. The drawbacks of the Odjob blender used by NISIR in Zambia and of the locally fabricated steel case ribbon blender previously used by CARE in Zimbabwe are summarized in the corresponding country study reports.

Blender technology development tasks include: identification of specific operating performance requirements (discussed in the country study reports); prototyping; testing of prototypes under controlled conditions; testing of prototypes under SHM operating conditions; and, funding of a limited production run for wider scale testing. Critical technology development objectives are: a) to keep the total duration of the blending task to less than the time required for milling the same quantity of maize (i.e.: to avoid customer line ups for fortification during peak operating periods); b) to maximize the ergonomics and operating convenience of the device; c) to minimize the cost of the technology without unduly compromising durability; and d) to minimize the need for replacement parts (i.e.: rubber gaskets which might break) and ensure that repairs can be carried out on site by the owner.

Plastic rotation moulding technology offers a potentially low cost way to fabricate a lightweight and consistent blender drum casing using high density polyethylene. The casing design could include internal ribs to enhance mixing of the premix with the maize meal.[8] Mounting the plastic casing on a steel shaft and rotating the entire unit means that only one pair of bearings are needed, and less costly flange bearings may be sufficient. The shape of the casing would need to be sufficiently curved to ensure that the maize meal flows easily out of an opening into the customer's bag (i.e.: below). An in-feed hopper, fitted with a sliding gate, could be provided directly above the casing to funnel the maize and premix into the casing (i.e.: through the small opening also used for emptying the blender). Another funnel, fitted with clips to hold the 25kg maize meal bag customers' typically use, could be fitted immediately below the casing to ensure seamless emptying of the fortified maize meal into the customer's bag.[9] An angle iron frame similar to that of existing blender units could be used. It is quite likely that some form of simple steel blade may need to be fitted to the steel shaft inside the casing to ensure lateral flow of the premix and maize meal as the casing is turned, but this should not be a difficult or too complex a challenge.[10] Durability is a significant consideration. However, if properly mounted and secured to the steel shaft, the only area of wear and tear on the plastic casing itself will be on the mechanism used to open and close the

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[7] With modest additional technology development investment, it should also be possible to add an electric motor drive option to a hand-powered unit.

[8] Similar to the internal ribs in the Objob blender used in Zambia.

[9] The design of the exit fitting of the cyclone on the Tan Tan hammer mill unit provides a useful example for this.

[10] The casing would have a single opening in the centre on one side to admit maize meal and premix when the opening is situated in the 'up' or 'top' position directly under the in-feed hopper. If the premix ends up being added to the top of the maize in the in-feed hopper, when it flows into the casing, it will tend to run down the sides of the cone of maize meal which has entered before it and accumulate at the ends of the casing rather than being distributed evenly along its length. Angled blades inducing lateral flow to redistribute these materials during mixing may be needed. Partial mixing by hand of the premix in the maize meal whilst it is in the in-feed hopper (as is done in Malawi) would be another remedy.

single opening which is used to admit/expel the maize meal. With thoughtful design of this mechanism, durability ought not to be a concern.[11] The unit can be designed for hand turning and, at additional cost, be geared so that it may be driven by electric motor.

Outside of South Africa, Harare has the only significant industrial product engineering and innovation capacity. This technology development challenge was reviewed with Mega Plastics in Harare and it appears that it would prove technically feasible and cost effective.[12] Unlike injection moulding which requires costly machined steel moulds, rotation moulding technology uses simple and inexpensively fabricated sheet metal moulds. National SHM fortification schemes in the region would require up to 20,000 units or more.

Dosifiers for SHMs

Dosifier technologies have been tried in Venezuela and South East Asia. In Malawi, WVI abandoned efforts to develop a local dosifier when the engineering firm it worked with encountered financial difficulties. The principal attraction of using a dosifier lies in the promise it holds to mechanize the addition of premix (or partially diluted premix blend) to the maize as it is milled at a rate which yields consistently even distribution of the premix (blend) in the milled maize flour to, in turn, eliminate the variations (in distribution) which are associated with existing direct addition and blender-based methods.

Though an examination of dosifier technology possibilities was beyond the terms of reference for this study, a number of factors were identified which indicate that it is unlikely that a 'mechanical direct addition' option will prove workable. These factors include:

a) SHM operators regulate the rate at which whole maize is admitted to the mill by hand to manage the strain placed on the mill – thus, in practice, whole maize enters the mill at varying and unpredictable rates which probably cannot be matched by a mechanical device;

b) up to a dozen different makes and physical configurations of SHM machinery available are in use in each country thus making it difficult – and potentially costly – to develop a dosifier technology that fits most makes;

c) the costs of retrofitting and calibrating upwards of 5000 existing hammer mills in each country are likely to prove prohibitive;

d) excessive vibration, use of differing sieve sizes and other factors may necessitate frequent recalibration of dosifiers: calibration may prove too difficult for SHM operators do perform without assistance, and the only means of confirming the accuracy of such recalibrations is sample testing which, in all three countries, would require a substantial parallel investment in establishing sample testing facilities capable of quickly processing thousands of samples originating from SHMs across the country; and,

e) fortification is unlikely to yield significant profits for SHMs and, this being so, persuading SHM owners to invest in dosifier technology would prove challenging.

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[11] Note that hammer mill owners are already accustomed to periodically refitting their hammer mills with new sets of 'beaters' and to periodically overhauling their electric motors or diesel engines. Should the plastic blender casing need replacement every four or five years, this should not be a problem notwithstanding cost issues.

[12] Contact: Mr John Fotheringham, Technical Director, Mega Plastics, Ruwa, Zimbabwe.

Thus, the prospects for coming up with a 'magic bullet' dosifier appear unlikely.

Discussion of 'success factor' conditions

The 'success factor' conditions required for the future success of a country-level SHM fortification intervention were identified at the outset of this study. The summary findings from the three country studies are presented and discussed in detail in Appendix A of this report and in specific detail in each of the three country study reports.

Short Term Program Framework

The recommendations contained in this summary report support intervention to promote and support fortification through SHM channels. This portion of the report discussing the features of a short term investigative program of work to:

a) determine the efficacy of this method of nutritional intervention, and, if so,
b) invite international agencies to endorse it and
c) assist interested African governments to develop fundable proposals to initiate SHM fortification programs.

Appendix B contains a results-based management (RBM) matrix for the program.

Objectives

The objectives of a short term (i.e.: three year) program of support should focus on:
a) Developing the blender technology;
b) Establishing nutrition related standards for SHM fortification;
c) Determining efficacy under sound experimental conditions;
d) Improving national understanding of SHM policy and operational issues;
e) Securing international donor and debt financing agency support for SHM fortification; and,
g) Supporting design of national fortification schemes

Key design features and structure

MI and its partners should position this program as a focal point for international agencies and national policy makers and health system managers' access to technical assistance and information concerning SHM fortification to guide policy thinking and operational design. The program should give high priority to sharing of new knowledge as it is acquired (i.e.: through MI-sponsored activities, for example) to build country-level understanding and the capacity of key champions to investigate and, should it prove efficacious, promote SHM fortification at the country-level. Measures should include support for peer-to-peer networking and exchange of experience and perspectives (i.e.: across countries). The program should adopt a regional approach for two main reasons: a) to ensure that country-level policy decisions (concerning SHM fortification and general nutrition strategy formulation) are informed in a timely manner by 'state of the art' SHM fortification experience and knowledge available in other countries; and b), to achieve cost economies and

avoid needless duplication of effort (i.e.: by establishing a single blender technology standard, common nutrition-related standards, and ensuring a consistent approach to efficacy testing).

Key success factors

Foremost, a clear commitment by partners to a multi-year program of action is warranted. Second, operational staff competencies should include solid understanding of the mechanics of involving and working with private sector to deliver a subsidized public good. Refer to section 4.13 in the Policy Analysis Guide companion document for a list of specific expertise which operational staff will need to have on board to play an effective technical assistance role.

Inputs, Outputs, Outcomes

Refer to Appendix B for details.

Implementing partners

It is important to involve key international agencies wielding influence over national nutritional health policy and norms of practice at an early stage in this program to generate their awareness, interest and willingness to collaborate. Such agencies include major multilateral health agencies, MI, WFP, UNICEF, the WB and key bilateral donors with major development programming commitments in the countries of interest. This may be achieved by engaging such audiences in the program in observation, reference group or steering roles.

Approximate implementation time line

The program of work indicated in Appendix B will require approximately three years once partners have made a commitment to move forward. Appendix B lists program objectives in order of priority (from top to bottom): a satisfactory blender technology and setting of nutrition related standards for SHM fortification are prerequisites for efficacy testing; and a positive result from the latter a precondition for acting upon subsequent program objectives. An approximate task completion time line appears below:

	Year 1				2				3			
Objective	q1	2	3	4	5	6	7	8	9	10	11	12
Develop blender technology												
Establish nutrition related standards for SHM fortification												
Determine efficacy under sound experimental conditions												
Improve national understanding of SHM policy and operational issues												
Secure international health donor and debt financing agency support for SHM fortification												
Support design of national fortification schemes												

Estimated program intervention costs

A ballpark budget estimate assumes that work would be supported in approximately three countries. It should be noted that if the initial efficacy studies firmly indicate that this method of nutritional intervention is not effective, then the balance – roughly half – of program costs would not be incurred. The cost of determining that SHM fortification is, or is not, efficacious would be on the order of C$500,000 over a period of 1.5 years (plus incremental in-house program management costs). Assuming efficacy, approximately C$400,000 in additional funding would be needed to achieve country-level understandings, secure international donor support and generate three fundable country SHM fortification program plans. Program support costs are on the order of C$100,000 annually.

Appendix A

Summary of prospects for successful fortification of maize meal through service hammer mills (SHMs)	
SUCCESS FACTOR	FINDINGS FROM FIELD INVESTIGATIONS
1 SHMs positioned as major & critical supplier to retailers & consumers	Characterization: SHMs are the only provider of whole maize milling services to a majority of households in rural areas and nationally in all three countries. Small scale commercial mills may engage in what is known as 'toll milling', that is, providing a milling service for a specific client (in addition to their more usual 'buy, mill, package and wholesale' business practices). But, in such cases, the order quantity toll milled is large and for an intermediary institution which on-distributes the product. Though small scale commercial mills do not offer toll milling services for 'household quantities' of maize, some such mills are thought to sell maize meal directly to households in order to capture a portion of the retail margin which would otherwise accrue to food retail establishments. The extent of this practice is not known. Generally, consumption of commercially-milled maize meal appears to be largely limited to urban markets (including small towns) and to the upper middle income households and above. In all three countries: a) taking whole maize to SHMs for milling is generally the only option for rural households to obtain milled maize; b) commercially processed and packaged maize meal, if retailed at all in rural areas, is generally limited to the larger 'small rural town' markets. In Malawi and Zambia, in peri-urban and high-density urban areas, SHMs operate alongside retailers, street vendors and wholesalers of commercially milled maize meal products. In this instance, SHMs are serving two market segments: a) households which grow maize and wish to mill it for own consumption, and b) households which buy whole maize and mill it as an alternative to paying the higher retail cost of commercially milled products.[13] In Zambia, in high-density urban areas, street vendors were found to be retailing commercially milled maize meal to local residents in 'single meal' and 'sufficient for one day only' quantities. Implications for fortification: Fortification via SHMs can be expected to reach the majority of households, mainly rural and including a share of poor urban households, which would not be reached by fortification via larger scale milling establishments.
2	Characterization: Maize is the main staple food grown and consumed by the large majority of households in all three countries. In limited regions

[13] Peri-uran and high density urban markets in Zimbabwe were not investigated due to time constraints.

Availability & reliability of un-milled cereal inputs	(i.e.: northern portions of Zambia), cassava is the dominant staple food. Sorghum and millet crops provide a comparatively small proportion of total staple food intake. [14] Availability of whole maize depends on many factors. In normal harvest years, Malawi and Zambia still have what are referred to as the 'hungry months', the 2 to 3 months preceding the next harvest. In normal political times, Zimbabwe has been a net exporter of whole maize to such countries as Malawi and Zambia. Under drought conditions, availability of whole maize depends on the effectiveness of national food reserve strategies and on how quickly international emergency food aid agencies respond to appeals for assistance. In Malawi, small average sizes of farm land available to households means that most households have to supplement own-production of maize by generating off-farm income and buying whole maize to meet annual household consumption needs. There is much concern in Zambia that the impact of HIV/AIDS is undermining household capacity to grow maize sufficient for annual needs. In Zimbabwe, political turmoil has all but closed down commercial maize farming, whilst small farm households crop growing decisions appear to be most directly influenced by drought concerns (i.e.: the political situation is driving households to try and grow their own food as a way to cope with loss of wage earnings, etc). All three countries have whole maize markets and storage depots. In Malawi and Zimbabwe, this capacity is under government control in the form of marketing boards, the system in Malawi functioning well, that in Zimbabwe barely active due to political interference in maize pricing and lack of cash flow to effect purchases of maize. Zambia privatized its maize marketing system years ago. This resulted in closure of a majority of maize market and storage depots leaving large parts of the country without access to the national whole maize market. Maize brokers and commercial maize mills have entered the maize distribution market to replace the former public maize marketing system. <u>Implications for fortification</u>: SHMs operate flexibly in relation to local consumer demand for service milling. SHMs fixed costs are negligible and so they can afford to close down when demand is low and reopen as needed. The main issues pertaining to fortification through SHMs are: a) legislation requiring only commercially processed maize meal to be fortified would not benefit the large majority of low income households which patronize SHMs, b) opportunities exist to use local SHMs to mill and fortify emergency and supplementary maize food aid.
3 Availability of premix blend for use	<u>Characterization</u>: The critical factors pertaining to preparation of premix blend are: a) consistency of the product; b) cost of the product; and c) the cost of distributing the product from where it may be produced to where it is used. Generally speaking, in all three countries the existing commercial distribution, warehousing, wholesale and retail food and consumer product systems are well suited to handling distribution, storage, monitoring and selling inventories of premix blend. It is highly unlikely that government and NGO infrastructures are capable of providing comparable capacity, national coverage and cost effectiveness but might be utilized to

[14] Cassava, sorghum and millet can be fortified using the same premix blend used for fortifying maize meal. Sorghum requires different dehulling equipment than that used for maize and so is not processed at SHMs.

at SHMs	supply premix blend in locations where the commercial sector is not present (and to carry out complementary IEC and monitoring activities). The quality of the premix blend is a critical matter: each batch of premix blend produced should meet a blend composition standard which needs to be established (i.e.: by government). This should not be a problem for larger commercial mills. Small commercial mills (i.e.: mission mills in Malawi), which use small batch sizes and more labour intensive production methods, may find it more challenging to consistently meet a blend composition standard: assessment of their capabilities appears to be warranted. <u>Implications for fortification</u>: Estimates of the cost of preparing and packaging premix blend were obtained from large scale commercial milling companies in all three countries, from the small scale DOMASI mission-run commercial mill in Malawi and from a medium scale commercial mill in Zimbabwe. Estimates provided by large scale mills in Zambia and Zimbabwe proved comparable and very cost effective. Estimates provided by the large mills in Malawi were exorbitant when compared against those from equivalent sized mills in Zambia and Zimbabwe and this needs further study to identify why Malawian costs appear to be vastly higher.[15] In general, the smaller mills are not price competitive. However, their higher cost structures may, in some cases, be offset by location advantages. This needs further investigation. The cost of distributing, handling and stocking premix blend is estimated to be a very small percentage of total product costs (i.e.: delivered to SHMs) in Malawi and Zimbabwe.[16] Thus, in these countries, the cost implications of where the premix blend is produced will have a negligible impact on total costs. In Zambia, with the largest distances to cover over a roads network in a poor stare of repair, the costs of distributing food and consumer products are much higher. It is likely that preparation of premix will need to be decentralized in Zambia to reduce distribution costs. Fortunately, a medium or large scale commercial mill operates in every provincial capital city, so this should be workable.
4 Availability of fortification	<u>Characterization</u>: For SHMs, two fortification methods exist: the 'direct addition' method in which no new technology is now in use, per se; and the blender-based method of addition which uses a hand-powered blending device. The direct addition method of fortification used in Malawi and Zimbabwe is unlikely to prove satisfactory in terms of the level of blending uniformity achieved. In theory, the dilution ratio of the premix blend could be increased to the point where satisfactory blending uniformity is achieved, but even

[15] Refer to the Malawi country study report for cost details.

[16] A very geographically compact country, food and consumer products can be cost-effectively distributed, with minor seasonal exceptions, throughout Malawi. The main distribution challenge in Malawi relates to transporting the premix blend from a nearby point of supply at the sub-district level over the 'last miles' to each SHM. Zimbabwe, though a larger country, has an extensive roads infrastructure which is well maintained throughout the country and food and consumer products distribution systems are equally well established throughout the country.

technologies	current dilution ratio levels of 1:167 (used in recent direct addition trials in Zambia) and 1:200 (in Malawi) are uneconomic. Mechanical dosifiers for direct addition are unlikely to prove effective even if the basic technology can be devised.[17] Thus, the direct addition method is judged as non-viable. The dilution ratio needs to be reduced to 1:100 or lower to bring the cost of fortification down to an affordable level. The blender technologies in use in Zambia and previously used in Zimbabwe are also not satisfactory. Little effort has been devoted to 'technology innovation'. No thought has been given to what might be termed the 'performance requirements' of what would be a satisfactory blender technology. The key shortcomings of existing blender technologies are: inadequate batch size capacity (Zambia); poor user-ergonomics (Zambia and Zimbabwe); cost of producing new units is too high (Zimbabwe); need to improve mixing efficiency (both). The economic aspects of fortification require that the dilution ratio of the premix blend be minimized. The offsetting factor is the duration of blending: reducing the dilution ratio will require increasing the duration of blending. The degree of this increase will be partially determined by the mixing efficiency of the blender. Not all SHMs are the same: some operate a single milling unit on a low demand basis; others located in high demand areas may operate several machines. Some SHMs operate using diesel engines, others using electricity. In short, one blender technology is not likely to be suited to all SHM operating environments. A single hand-powered blender may suit the majority of SHMs, but others may want – for example – an electric motor powered blender. Adding dosifier capabilities in small and medium scale commercial milling operating environments is likely to prove costly and technically challenging. Such mills may also need to be prepared to modify their current operating practices to incorporate fortification. Such modifications may serve to also improve the operating efficiency and commercial viability of the smaller mills, but this needs investigation. <u>Implications for fortification</u>: a) Modest new investment in blender technology development, prototyping and testing is imperative. It should not prove too difficult to devise a satisfactory blender. b) It will be prudent to 'standardize' the blender-based addition method on a specific blender technology rather than to have a situation where each country ends up pursuing different blender designs: it is easier to improve the performance of a single standard technology over time through design innovations and easier to establish performance standards for SHMs when blender technology is standardized. c) Additional, but modest investment in developing several variations of the standard blender design may be warranted: a model which can be powered off existing diesel engine belt drive systems; a model which can be powered by electric motor. d) Assessment of the technological and process implications of adding fortification capacity in small and medium scale

[17] The reasons for this are explained elsewhere in this summary report.

	commercial milling environments is needed before such mills are required by legislation to fortify their maize meal products. The task and cost of adding fortification capacity is likely to prove substantial for such mills. Some form of financial support may be warranted to assist such mills to defray the costs of complying with fortification requirements.
5 Economics and risks associated with adding fortification by SHMs are favourable	Characterization: The fortification addition method needs to be 'engineered' for simplicity and ease of execution to help ensure that SHM owners will be willing to accept responsibility for ensuring that fortification is offered and effectively provided by their businesses. Milling operations are, generally speaking, highly profitable irrespective of the volume of demand. It is possible to structure fortification fee pricing to ensure that mill owners earn a profit on fortification (even under subsidy conditions). Fortification will, at best, yield low additional profits for mill owners due to limited consumer capacity to pay premium pricing. But, if the addition method is simply to carry out and easily managed, the additional profits, though low, should prove attractive to most mill owners. In addition to the capital cost of obtaining the needed blending equipment, in many cases, it will be necessary for the SHM owner to extend the existing milling building to accommodate a blender and suitable and secure storage space for premix blend. The incremental costs of such construction should be modest. Implications for fortification: a) Premix blend should be made available at a point of supply as near as possible to each SHM to simplify procurement and minimize the transport costs of premix blend by the SHM. b) Dedicated labour is recommended to carry out the fortification task for customers both to provide a suitable degree of customer convenience and to minimize the impact on existing milling operations of introducing fortification. c) Pricing of the fortification service should be set by and monitored by government. Two pricing options exist – include the fortification fee in the service milling fee, or set a separate fee for fortification. Whichever option is preferred, there are advantages to ensuring that the customer knows that s/he is paying a fee for the fortification service: it increases the likelihood that the customer will monitor the actions of the mill to ensure that they receive the fortification benefit that they are paying for. The initial fortification fee level charged to customers should be set sufficiently high to cover the mill owners' dedicated labour costs, costs of collecting premix blend from the nearest point of supply, and profit. d) SHMs should be required to provide fortification on condition that premix blend is available at a designated nearby point of supply (i.e.: if premix blend is not available locally, then the SHM would not be obliged to provide fortification). Regulation should include provisions for penalizing SHMs which fail to provide fortification when premix blend is locally available. e) Initial subsidy requirements are estimated to be very high as a proportion of the total direct costs of fortification. However, SHMs themselves do not need to be operationally subsidized and will only require access to premix blend at subsidized prices. f) Capital grant support may be warranted to assist SHMs to partially defray the cost of buying blending equipment and extending their premises to accommodate fortification processes.
6	Characterization: In the current pilot projects, SHMs, generally speaking, appear more than capable of implementing the fortification technique

SHMs able to apply fortification techniques correctly and reliably	according to the method prescribed by the implementing NGO institution. Two minor sources of variation were observed: a) in Zambia, the duration of the blending varied according to how busy the mill operator(s) were at any given time; b) in Zimbabwe, the manner in which the sachet of premix blend was opened and distributed across the whole maize awaiting milling varied slightly from one mill to the next. Aside from such variability, the other main risk is the risk of an SHM running out of stocks of premix blend and being unable to fortify until new stocks are obtained. Packaging of premix blend should be visually distinctive to prevent it from being inadvertently confused with a bag of maize meal for food safety reasons. <u>Implications for fortification</u>: The accuracy with which SHMs apply a prescribed fortification method depends on three things: a) How precisely the prescribed method is described. The efficacy of the addition method <u>may</u> be significantly affected by minor variations in how a prescribed method is actually applied by SHMs. As the actual effects have not been quantified, it seems prudent to investigate this issue to either rule out the significance of minor variations, or to confirm that adherence to a precisely defined method is needed. b) Training. SHM owners and hired labour will require training (and testing by observation) to ensure that they can both carry out the prescribed addition method properly and understand why it is important to refrain from varying the method. It may be prudent to institute short term between researchers and SHM owners and operators to jointly determine the optimal variants of a general addition method (i.e.: akin to farmer-centred agricultural research and extension practices). c) Effective monitoring. Human nature being what it is, the actual addition practices of SHMs will need to be monitored periodically to ensure compliance. The most cost effective way to achieve this is likely to be to train existing field-level government personnel (i.e.: food safety inspectors, community health workers, environmental health officers, etc) in the correct addition methods and arrange for them to periodically visit each SHM to review their practices. Customers might also be enlisted to play a monitoring role in this regard. d) Premix blend will have to be packaged in bulk – 25kg bags, or thereabouts – for cost reasons. Although premix blend is considered to be unpalatable and poses a low risk of accidental consumption, precautions should be taken even to counter even low risks of accidental misuse. Distinctive packaging and clear labelling is advised and can be achieved at negligible or no added cost.
7 Regulatory environment supports fortification	<u>Characterization</u>: Generally speaking, in all three countries visited SHMs are currently not regulated. SHMs are only rarely required to register their existence or pay annual business licences. Effective monitoring of their premises from a health and safety perspective is non-existent (although SHMs will soon be covered under a wider food safety monitoring initiative now being established in Zambia). Where maize fortification regulation has been introduced (Malawi) and is under consideration (Zambia), only commercial mills are covered and SHMs (rightly) are exempted. Thus, at present, there is no regulatory based means to monitor or govern the activities of SHMs at all. Fortification via SHMs cannot be effective under such a vacuum.

	Implications for fortification: a) Regulation will be required to make SHMs formally accountable to the health ministry for complying with a fortification requirement. b) SHMs will require a separate fortification standard and set of obligations than that warranted for larger scale commercial mills: compliance with a specified fortification method rather than compliance against a standard for maize meal nutrient composition. The prescribed standard to be achieved by SHMs should be based on thorough understanding of what level of performance can routinely be anticipated from available fortification technology. c) A compliance requirement for SHMs will need to be introduced in tandem with the availability of premix blend. As it is likely that premix blend will (for logistical reasons)initially be available in some areas and not others, regulation needs to be crafted to account for local availability (or unavailability). d) Regulation should further include penalty provisions for non-compliance. This may mean that other new regulatory requirements need also to be introduced to create the basis for issuing penalties (i.e.: business licensing and the threat of losing such operating licence; empowering food safety inspectors to shut down an SHM if it consistently fails to meet the minimum fortification standards on repeated inspection).
8 Decision influencers support & advocate fortification	Characterization: At the time of study, national nutritional health spokespersons interviewed were all in favour of maize fortification via SHMs in principle. In Malawi and Zambia, considerable progress has been more broadly made to introduce and achieve fortification of other food commodities, notably salt, sugar and oil. The key challenges at the national decision influencing level include: a) how to weigh the benefits of a national maize fortification scheme via SHMs against the estimated costs; b) how to compare the net value of this intervention with other health interventions and to persuade health economists, national financial planners and debt funding institutions that this intervention is a good investment; and c) how to handle the tension between justifying this intervention as a 'poverty reduction' measure whilst also expecting to achieve full cost recovery over the medium to long term (i.e.: some decision influencers may not be receptive to a progressive cost recovery strategy but it is difficult to turn away from this when the opportunity exists to eventually achieve sustainability of the intervention). At the sub-national level, the key need is to identify actors who can positively influence household fortification acceptance rates. Pilot projects have generally done a good job of identifying these actors and devising effective IEC activities and have achieved high levels of household acceptance (albeit of a free fortification benefit). There will be a need to tap additional sources of positive influence on households in a full fortification intervention (see below). The food and consumer products industry is well acquainted with the most effective consumer advertising methods. Implications for fortification (national): a) Efficacy trials are needed as soon as possible. b) The opinions and cost analysis methods of health economists need to be engaged and assessment from a health economics perspective carried out as soon as possible.

	c) Limited trial distribution of premix blend following the format of a national intervention model should be undertaken to verify direct costs and identify any thus far unforeseen distribution impediments to enable a firm assessment of supply side viability based on actual experience to be made n the short term. d) National decision influencers are interested in 'what works'. To the extent that MI and partners can facilitate knowledge sharing across countries of what works, this should be supported to accelerate country learning curves. Options include: provision of advisory technical assistance; publication of policy briefs discussing pertinent issues in depth, best practice guides and recommended standards; support for peer exchange visits; direct funding of multi-country activities (i.e.: efficacy trials, blender technology development and testing). <u>Implications for fortification</u> (sub-national): a) The participating commercial sector needs to be engaged to champion fortification, assist in the design of a fortification advertising campaign and with distribution of fortification educational materials (i.e.: point-of-sale advertising; leaflets, posters, etc). b) The national media, local community radio, newsprint, 'mobile billboards' (i.e.: on the sides of buses) need to be utilized to quickly stimulate and build broad public awareness and demand for fortification. c) Introduction of a fortification logo in English and vernacular languages should be considered.
9 Consumer acceptability & demand for fortified cereals exists	<u>Characterization</u>: Except for the well education urban consumer sector and in pilot maize fortification project areas there is little or no current demand for fortification or other nutrition products in all three countries. Awareness levels of nutritional needs are generally thought, by key informants, to be quite low amongst rural and poorly educated populations. The IEC activities of current pilot fortification projects have been highly successful in overcoming this gap, and so it should not prove difficult to leverage this experience to achieve similarly high levels of consumer acceptability in a national intervention. In Zimbabwe, nearby communities not included in the pilot project have learned about fortification and have been asking to be included in the project. Also in Zimbabwe, there is some evidence (Makonde Industries) of emergence of consumer demand in small towns for moderately priced nutritionally enriched processed staple foods. In all three countries, field-level civil servants and NGO workers are familiar with IEC programs and activities and local communities have typically been previously exposed to some form of IEC intervention and thus all key actors are likely to be receptive to IEC interventions concerning fortification. <u>Implications for fortification</u>: a) Benefits of fortification need to be expressed in locally meaningful ways in IEC materials rather than in technical terms. b) Engaging local IEC campaigners on a temporary basis during the initial introduction of fortification in each community may help to accelerate consumer acceptance. c) The timing of local IEC activities and a wider advertising campaign should be coordinated with the availability of premix blend and the capacity of local SHMs to carry out fortification. d) One would expect that, with increasing incomes, households which become nutritionally aware through maize fortification

	will also begin to demand other nutritionally enriched food products.
10 SHM sector is competitive relative to packaged milled cereal products marketed by large scale commercial milling sector	Characterization: The combination of low income levels of the households served by SHMs and the fact that they provide a milling service rather than a milled product means that SHMs and commercial maize mills serve essentially different segments of the consumer market. If anything, commercial mills are seasonally adversely affected (during the annual post-harvest period) by a tendency for their normal customer base to stop buying commercially processed maize meal until their own stocks of whole maize are exhausted. SHMs are the primary beneficiaries of this seasonal swing in urban household habits. When (and it seems to be a matter of 'when' rather than 'if') fortification of commercially processed maize meal becomes a legislated requirement, such will represent an 'entry barrier' for any SHMs which aspire to become suppliers of commercially processed maize meal. In theory, such SHMs would have to meet the same fortification standard that is legislated for larger scale commercial mills so as to preserve an equal competitive playing field. SHMs are unlikely to be able to do so. This may be a significant concern if adding value to rural productivity is a national policy priority. Implications for fortification: a) If SHMs can routinely fortify maize meal to at least the minimum standard accepted by nutritionists (see above), then, in principle, there is no reason why SHMs should not be permitted to supply fortified maize meal products in packaged form into the same markets served by larger milling companies. Were this to be acceptable from a policy perspective, legislated standards regulating SHMs and commercial mills will need to be harmonized to ensure consistent and equal treatment. b) Large scale commercial mills can expect to benefit from fortification via SHMs in terms of increasing consumer awareness of fortification benefits and thus, with improving income levels, increasing demand for commercially processed maize meal products (which the commercial mills produce).
11 Partnerships	Characterisation: At the operational level, achievement of fortification through SHMs on a large scale will involve a blend of actions by the health system and the commercial sector. The key constraints on the health system side include: a) unfamiliarity with the basic idea of implementing a preventative health measure through commercial channels; b) lack of capacity to directly manage a fortification intervention which needs to be sensitive to commercial operations; and c) lack of capacity to manage the increasing volume of cash revenues which would be generated through a fortification scheme based on cost recovery. For its part, the commercial sector does not understand public health and nutrition challenges but will do whatever it is contracted to do provided its costs are adequately covered: it cannot be expected to 'trouble shoot' any effectiveness problems which may arise during the intervention. NGOs can play a valuable role in the initial 'roll out' stages of an intervention by a) handling IEC activities, b) training SHMS, and c) coordinating roll out at localized levels in partnership with government. As noted above, some form of 'bridging' institutional mechanism is warranted to provide overall coordination, leadership and carry out other key tasks (such as contracting, monitoring and compliance, payments, trouble shooting, etc).

	At a policy level (nutrition, child welfare, poverty reduction practice, etc), donor agencies and various national institutions of government will take a keen interest in fortification via SHMs. It may be appropriate to convene a fortification forum through which pertinent issues can be raised and considered by the accountable health ministry for its final decision. Given the influence and large scale of program interventions of WFP, UNICEF, UNDP and possibly other large donors, it may be prudent to ensure that these role players fully understand and subscribe to the preferred fortification strategy prior to its implementation. <u>Implications for fortification</u>: a) MI and partner agencies should begin engaging the major donor agencies at the national level on pertinent issues before national policy makers reach the point of taking intervention design decisions. Issues papers and 'options for action' briefs might be circulated, a section on MI and partner's website dedicated to fortification through SHMS, etc.to support such dialogue. b) MI and partners should consider taking steps to ensure that national policy makers and planners fully understand the operational dimensions of this kind of intervention to inform their views, basis of judgement and decisions regarding how best to manage fortification through SHMs.

Appendix B

Draft RBM matrix for short term SHM fortification support program					
	OPERATIONAL RESULTS		DEVELOPMENTAL RESULTS		
Objectives	*Inputs*	*Activities*	*Outputs*	*Outcomes*	*Impacts*
Develop blender technology	$, expert guidance	Specify design performance needs; Design, cost, build and test prototypes	Design specs; Prototype blenders; Production costings	Satisfactory standard blender technology exists	Fortification at SHMs operationally workable, cost effective, affordable
Establish nutrition related standards for SHM fortification	$, facilitation	Literature reviews; Expert consultations	Recommended form of iron in premix; Recommended blending uniformity standard for SHMs	Common standards accepted by national policy makers; Performance benchmarks set for SHM fortification programs	Paves the way for consistent approach to analysis, testing and planning for fortification via SHMs
Establish efficacy	$, expert guidance, nutrition standards	Literature reviews, Experiment design, fortification via SHMs and testing of iron, retinol levels under experimental conditions in two or three countries	Statistical analyses correlating dietary intake, fortification levels, iron and retinol levels	Efficacy of fortification at SHMs is indicated	A positive outcome would sustain momentum towards initiating national SHM fortification schemes
Improve national understanding of SHM policy and operational issues	$, expert guidance, facilitation	Publishing and dissemination of new knowledge in accessible formats; country workshops and meetings; peer study visits	Key national health planners and policy makers, nutritionists better understand what is required to achieve fortification via SHMs	National consensus on short term action agenda aimed at verifying costs and operational feasibility of SHM fortification	National role players on path towards launching SHM fortification program

(continued)	OPERATIONAL RESULTS		DEVELOPMENTAL RESULTS		
Objectives	*Inputs*	*Activities*	*Outputs*	*Outcomes*	*Impacts*
Secure international health donor and debt financing agency support for SHM fortification	Peer consultations	Knowledge dissemination; Presentations at international and regional forums	Key influencing agencies well informed about SHM fortification issues and prospects	Key influencing agencies act to support SHM fortification as valid health intervention	Financial support for national SHM fortification schemes is forthcoming
Support design of national fortification schemes	$, expert technical assistance	Project development and stakeholder consultations	Proposals to launch and roll out national SHM fortification program completed.	National consensus on SHM fortification plan; plan used to secure funding resources	Launch of national SHM fortification program ready to go

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