Global Mapping of Management Information Systems for Fortification Monitoring
Table of Contents

Acknowledgement .................................................................................................................. 3
Executive Summary ................................................................................................................ 3
Table1: Summary of Pros and Cons of MIS in different countries ........................................ 5
Findings.................................................................................................................................. 7
Recommendations.................................................................................................................... 8
List of Abbreviations ............................................................................................................. 10
Introduction............................................................................................................................. 11
Objectives .............................................................................................................................. 12
Methodology.......................................................................................................................... 12
Kenya .................................................................................................................................. 13
Structure of Web based System ............................................................................................ 14
Fig 1: Screenshot image of the web based system................................................................. 16
Limitations of system use ....................................................................................................... 17
Tanzania ................................................................................................................................. 18
Structure of the Web based system ....................................................................................... 19
Fig 2: Screenshot image of the data entry form .................................................................. 20
Limitations of System Use .................................................................................................. 20
Malawi ................................................................................................................................. 20
Structure of the System ........................................................................................................ 21
Limitation of Fort MIS ......................................................................................................... 22
Zimbabwe ............................................................................................................................. 22
Limitation of DHIS for Fortification Monitoring ................................................................. 23
South Africa ......................................................................................................................... 24
Jordan ................................................................................................................................... 25
India ..................................................................................................................................... 26
Structure of the Web based system ..................................................................................... 28
Egypt .................................................................................................................................... 28
Structure of the Web based system ..................................................................................... 30
Bangladesh .......................................................................................................................... 30
Acknowledgement

I express my sincere appreciation to all who contributed, in any way, to the successful and timely completion of this monitoring information systems mapping exercise. I specifically highlight the following, whose contributions were cardinal if not critical: Global Alliance for Improved Nutrition and Project Healthy Children for entrusting the mapping exercise to me and providing all the support needed to facilitate the exercise. All the different stakeholders in Kenya, Tanzania, Malawi, Zimbabwe, South Africa, Canada, Bangladesh, Egypt, India, Jordan and Senegal whose contribution made it possible to have a write up.

Executive Summary

Different countries globally have fortification regulations for condiments or food. In Kenya mandatory fortification applies to: maize flour, wheat flour, salt and edible fats and oils. In Tanzania regulations require wheat flour, maize flour, salt and edible oils to be fortified. In Malawi, mandatory fortification applies to salt, sugar, maize flour, wheat flour and edible fats and oils. Zimbabwe’s statutory instrument has made it compulsory to fortify cooking oil, sugar, wheat flour and maize meal with vitamins and minerals while in South Africa salt, maize products, wheat products and pan baked products are fortified despite having fortification regulations in the process of being finalized by the Department of Health. Mandatory fortification in Canada applies to margarine, wheat and salt. In Jordan fortification is mandatory for wheat and salt. Fortification in Egypt is mandatory for wheat and salt and voluntary for
vegetable oil. In Senegal fortification is compulsory for wheat, vegetable oil and salt. In India, a mandatory national salt fortification program exists while wheat and vegetable oil in some states (Madhya, Pradesh and Rajasthan is voluntary. Fortification in Bangladesh is mandatory for salt, vegetable oil and voluntary for wheat and rice.

The objective of this exercise is to review and document management information systems used for fortification monitoring in order to draw lessons that could identify constraints and weaknesses and develop recommendations for changes that will improve the efficiency, effectiveness and sustainable systems globally. The review was carried out by a consultant. It consisted of a desk review of available documents on the regulatory monitoring systems. The desk review was followed by interviews. The main stakeholders in the eleven countries in the ECSA and outside the ECSA region included all relevant departments in the Ministries of Health, Government inspectors, production facilities and regulatory bodies which included Government laboratories where samples are tested.
Table 1: Summary of Pros and Cons of MIS in different countries

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>PROS</th>
<th>CONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>Producers can input production volumes directly into the system.</td>
<td>Alerts are not generated by the system to facilitate corrective action. Inability of the system to recognize future expiry dates makes it hard to analyze samples</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Number of samples that comply is captured by the system.</td>
<td>The system does not generate alerts to facilitate corrective action.</td>
</tr>
<tr>
<td>Malawi</td>
<td>Auto generation of charts and trends.</td>
<td>The manual data entry is very laborious and time consuming.</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Data validation is possible by flagging out outliers, Geographic visualization of sample origin by compliance status. Generation of weekly and monthly data.</td>
<td>Lack of information to build up the drop box to avoid misspelling. Limited resources at point of entry hinder compliance monitoring for imports.</td>
</tr>
<tr>
<td>South Africa</td>
<td>Production volumes of fortified products is available</td>
<td>There is no linkage between data captured from millers and SABS</td>
</tr>
<tr>
<td>Jordan</td>
<td>The system is very basic and does not require any log in credentials</td>
<td>No linkage between information sent to the departments responsible for fortification</td>
</tr>
<tr>
<td>Egypt</td>
<td>Audio alert generated and sent by email to responsible persons for corrective action.</td>
<td>The system is not in use due to lack of functioning hardware and servers.</td>
</tr>
<tr>
<td>Country</td>
<td>Description</td>
<td>Challenges</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>India</td>
<td>Real time data review. Multidimensional data extraction for building future/ongoing strategic map for the salt department. Integrated system which offers all services provided in the salt department.</td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>Data from the refineries is recorded into registered and transferred into excel sheets where analysis to compare proportion of fortified edible oil against total production.</td>
<td>Retrieval of information is challenging as it is recorded in registers.</td>
</tr>
<tr>
<td>Canada</td>
<td>Utilizes Hazard Analysis Critical Control Points approach where biological, physical and chemical are identified and corrected.</td>
<td>Information is confidential making it difficult to access production volumes</td>
</tr>
<tr>
<td>Senegal</td>
<td>Management information system is missing but there exists an excel track sheet where production volumes of iodized salt are recorded.</td>
<td>The excel sheet does help to monitor compliance in industrial fortification and salt iodization</td>
</tr>
</tbody>
</table>

Findings
System Platform and Use

- Data capture systems for compliance monitoring exist in almost all the 11 countries.
- Kenya, Tanzania, India, and Egypt have an online monitoring tool with multiple data entry points and one central processing point, Zimbabwe has incorporated monitoring indicators into DHIS2 while South Africa has a data capture system which is not well defined, and Malawi has an offline excel reporting tool.
- Zimbabwe’s management information system for fortification monitoring is able to flag out outliers to facilitate corrective correction. Management systems for fortification monitoring in the other countries are able to recognize data entry errors.

System Users, Data Usage and System Effectiveness

- System audits have been performed in very few countries India being an example as the system is still in its infancy stage in the other countries.
- Management information systems for fortification monitoring in use in Malawi, Tanzania, Zimbabwe, India and Egypt generate charts and graphs automatically.

Implementation

- A management information system for fortification monitoring was positively received by government officials, however, most production companies were reluctant to use the system as they thought production volumes will be available to their competitors.
• Stakeholders were in agreement that development of a standardized global system will be very important in benchmarking and uniform reporting globally.

• Relevant training was done for the persons responsible for data entry. Staff have the appropriate skills needed to operate the system in all the eleven countries.

• There is need to enforce fortification regulations in all of the four countries where fortification is mandatory so as to enhance compliance in food fortification.

• Monitoring is an important component in fortification programs and requires financial, personnel and laboratory resources, which are underestimated and under prioritized.

• Government inspectors need refresher training on compliance monitoring in food fortification.

Recommendations

• The development of global standardized system was recommended by all of the stakeholders; however data security needs to be guaranteed to the users.

• Autonomy needs to be given to the users so that they are able to use the system without having to seek permission from the administrators.

• More inspectors need to be trained because the few that are trained are overburdened.

• Recognition for the countries or companies who report on time and that are within the acceptable range of compliance.

• Adjusting Quality Control/Quality Assurance protocol to include compulsory reporting using the system.
• Adequate resource allocation for the food fortification program.
• Hiring / recruiting of a competent person to help in reconciliation and interpretation of data.
**List of Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>BSTI</td>
<td>Bangladesh Standards and Testing Institutions</td>
</tr>
<tr>
<td>CLM</td>
<td>Cellule de Lutte Contre la Malnutrition (Senegal)</td>
</tr>
<tr>
<td>DHIS</td>
<td>District Health Information System</td>
</tr>
<tr>
<td>DOH</td>
<td>Department of Health (RSA)</td>
</tr>
<tr>
<td>DON</td>
<td>Division of Nutrition (Kenya)</td>
</tr>
<tr>
<td>ECSA</td>
<td>East, Central, and Southern Africa</td>
</tr>
<tr>
<td>EHP</td>
<td>Environmental Health Practitioners</td>
</tr>
<tr>
<td>GAIN</td>
<td>Global Alliance for Improved Nutrition</td>
</tr>
<tr>
<td>GAL</td>
<td>Government Analyst Laboratory (Zimbabwe)</td>
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<tr>
<td>GIS</td>
<td>Geographic Information System</td>
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<tr>
<td>GMP</td>
<td>Good Manufacturing Practice</td>
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<tr>
<td>HACCP</td>
<td>Hazard Analysis and Critical Control Point</td>
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<tr>
<td>HKI</td>
<td>Helen Keller International</td>
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<tr>
<td>KEBS</td>
<td>Kenya Bureau of Standards</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring and Evaluation</td>
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<tr>
<td>MIS</td>
<td>Management Information System</td>
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<tr>
<td>MIT</td>
<td>Ministry of Industry and Trade (Jordan)</td>
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<tr>
<td>MOH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>MoSIT</td>
<td>Ministry of Supply and Internal Trade (Egypt)</td>
</tr>
<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>MT</td>
<td>Metric Tons</td>
</tr>
<tr>
<td>PHC</td>
<td>Project Healthy Children</td>
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<tr>
<td>PMU</td>
<td>Project Monitoring Unit (Bangladesh)</td>
</tr>
<tr>
<td>SABS</td>
<td>South African Bureau of Standards</td>
</tr>
<tr>
<td>SAGIS</td>
<td>South African Grain Information System</td>
</tr>
<tr>
<td>TFNC</td>
<td>Tanzania Food and Nutrition Centre</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children's Fund</td>
</tr>
<tr>
<td>WFP</td>
<td>World Food Programme</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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</table>
Introduction
The World Health Organization (WHO) considers that more than 2 billion people worldwide suffer from vitamin and mineral deficiencies, primarily iodine, iron, vitamin A and zinc, with important health consequences. There are various strategies in place to control micronutrient deficiencies and they include but are not limited to: increasing diversity of consumed food, food fortification, and supplementation. In developing countries, food fortification is increasingly recognized as an effective medium- to long-term approach to improving the micronutrient status of large populations. Globally, countries have made tremendous progress in designing, resourcing, and implementing programs that focus on making fortified foods widely available within recommended standards. However, the success of programs to promote the production and distribution of fortified foods relies on the establishment of mechanisms that guarantee safety and quality by the food industries, continuous monitoring of compliance and enforcement of standards by government authorities of food control, and the assessment of consumption and program performance by research institutions in public health. There remains a need to strengthen human resources in these areas throughout the countries of the East, Central, and Southern Africa (ECSA) Region and globally.

There exist few data management systems that can capture and inform food control agencies and government personnel about compliance issues and implementation challenges. As a result of this lack, a review of management information systems (MIS) for fortification monitoring in food fortification was necessary so to be able to identify the countries that have mechanisms for data capture and review lessons learned for future application to other countries. The review was done globally: Kenya, Tanzania, Malawi, Zimbabwe South Africa, Canada, Bangladesh, Egypt, India, Jordan and Senegal.
Objectives

1. Reviewing various models that have been implemented or attempted globally.

2. Learning good practices, identifying gaps and defining common elements with an aim of developing an adaptable regulatory framework and online reporting tool.

Methodology

A desk review was done to look into management information systems that are in use. This would help to identify questions to be included in the questionnaire. A key informant questionnaire was designed factoring in recommendations from partners. The questionnaire was designed to elicit responses from 5 segments, which included:

- System platform and structure
- Users and data usage/security
- Implementation process
- Maintenance
- Performance and effectiveness

A list of key informants was generated and necessary arrangements were made to facilitate participation in the exercise either through one on one interviews, Skype interviews, telephonic interviews and electronic sharing of the questionnaire. Most of the interviews were telephonic interviews. A total of 21 stakeholders were interviewed, 3 stakeholders did not participate in the exercise.
Kenya

Micronutrient deficiency is one of the critical nutrition challenges in Kenya and is one of the contributing factors to the unacceptable stunting rates in Kenya making it one of the developing countries where mandatory food fortification for staples is being practiced. Kenya is the leading food manufacturer in the East African region and various local and international investors are actively involved in the production and distribution of the fortified foods. Mandatory basis started with salt iodization in 1978 and later in June 2012 with wheat flour, maize meal and edible fats and oils. Currently, margarine and sugar fortification is on voluntary basis. To ensure success of the program, there is need to monitor it at specific intervals so as to guarantee proper fortification of the product against the regulation and standards. To facilitate regulatory monitoring of fortified foods, a web based system was designed and implemented by the Ministry of Health, Division of Nutrition (DON), champions of the fortification agenda in Kenya.

The system was designed by a Strathmore University and rolled out by the Division of Nutrition. Implementation process was a phased approach. There was in-house training at the production facilities first, followed by government stakeholders. The training completed covered an introduction to the web for the persons who were not “tech savvy” and the creation of email accounts. The system is in the process of an upgrade to ensure its optimum use. The system was well received by the government stakeholders but the production companies were reluctant to use it mainly because they thought that production volumes would be made available to their competitors.

Advocacy and training was done to inform them of the benefits and importance of system use and they were convinced that data confidentiality will be upheld and only the system administrators have rights to access data from all the production facilities. The roll out process was
led by the Division of Nutrition and the local university due to their initial involvement in the
development of the system. A total of 34 production companies and 5 premix suppliers were
originally trained on use of the system but now 48 production companies are directly reporting to
the Division of Nutrition as more companies were brought on board on the system use. Two
regulatory bodies were also enrolled but have not used the system since its implementation due to
technical challenges and lack of interest. However the results of the analysis conducted are readily
available on their internal reporting systems.

Data collection effectiveness before and after the implementation of the system has not been
done, however the implementation of the system has facilitated easy access to information. Prior to
implementation of the MIS, collation and analysis was done after monthly submission of production
forms and most of the time information was not readily available due to poor archival systems. This
systems approach for compliance monitoring was somewhat successful because most of the
production companies and premix suppliers are submitting their monthly returns but the
reconciliation of the data at the DON is poorly done. This is because there is no dedicated person
who looks into the system to reconcile the data and follow up with the producers who have not
submitted their returns.

**Structure of Web based System**

The system uses forms that were customized to the various needs of the users. Monthly
returns are submitted to the Division of Nutrition. There are multiple data entry points and one
processing point (DON). In the production facility, the production clerk is responsible for data
entry while the quality assurance manager in the government laboratories is responsible for
inputting data. The system is designed so as to capture monitoring results at the industry, import and commercial level. However, import and commercial level are not using the system.

Reasons given for the non use of the system at the import site is because the government inspectors are overburdened as they check compliance for all imports with the required regulations either through laboratory analysis or through import declaration forms and certificates of conformity and they are therefore unable to report on a monthly basis.

Compliance monitoring data from Kenya Bureau of Standards (KEBS) who are responsible for industry and import monitoring is available on an as needed basis as the information is already available through their internal database. Non use of the system at the commercial level by the National Public Health Laboratory is due to technical challenges with the system where they have been unable to input the laboratory analysis results due to the design of the form used to capture information in the laboratory. Currently, the system is unable to generate alerts in case of outliers to facilitate corrective action but it recognizes data entry errors. The system does not automatically generate charts and graphs; however summaries used during monitoring and evaluation meetings can be derived by the system administrators (DON).

There are two requirements needed to access the system and they include: an email account, where the system sends a link automatically to enable access since it is hidden from the public domain, and a password. The system can be used for different fortification vehicles namely but not limited to: wheat, maize, cooking oil, and salt.

The image below captures the homepage of the system, which shows the breakdown of how information in the system is captured.
There are different indicators captured by different users. Main users of the system include: production facilities (milling factories), premix suppliers and market data that are mainly the two laboratories responsible for conducting quantitative analysis on samples from production sites and market shelves.

Indicators captured at the production facilities are specific to the vehicle type and include: Opening balance (kg), Quantity of premix delivered, Supplier/manufacturer of premix, Quantity rejected, Quantity issued, Closing balance, Theoretical production, Actual production, Production unfortified, Fortified exports.

Indicators captured by premix suppliers include: Product (labeled by batch numbers), Company supplied to, and Quantity.
Indicators captured by market data include: **Producer of the product, Type of product, Brand name, Production (local or import), Date of sample collection, County of sample collection, Sample collection site, Date of sample reception in the laboratory, Date of product manufacture, Sample expiry date, Date of analysis, Results.**

**Limitations of system use**

Despite designing, roll out and implementation of the system in 2014, the system has not been in use by the National Public Health Laboratory who are responsible for analyzing samples found on the market shelves and Kenya Bureau of Standards. The reasons cited for not using the system by the national public health labs include: Inability to input data due to lack of sufficient brand information, the system was designed to capture date month and year of manufacture, however some of the products only have month and year of manufacture. The system is unable to recognize future dates associated with expiry of a product. The system does not recognize which micronutrient is being analyzed and therefore makes it difficult to indicate what was analyzed. The above reasons are minor and can easily be corrected. Competing interests in the Division of Nutrition and absence of a good relationship between the two departments hinders correction.

The public health laboratory has presented their challenges to the Division of Nutrition but no course of action has been taken since the roll out of the system. Kenya Bureau of Standards lack of interest has resulted in the non use of the system. It was confirmed that Kenya Bureau of Standards is mandated to inspect industries for compliance with a range of regulations and standards including food standard certification, as part of the process for business license application or annual renewal. The information captured is input into their system and retrieved on need basis and hence they did not see the need to input the same information into a different system.
Inability of the system to facilitate daily reconciliation of production information is a gap, as most production companies would like to conduct daily reconciliation using the system to facilitate corrective action. Production facilities have an internal system where they are able to perform daily summaries and facilitate corrective action if need be.

Tanzania

National mandatory fortification was launched in May 16, 2013. In order to provide production volumes for fortified wheat flour due to its large scale production in the country, a web based system which can be easily adapted to other food vehicles was developed by consultant contracted by Helen Keller International (HKI). The system is housed under Tanzania Food Nutrition Centre (TFNC) and a monthly fee of $80 is paid for the maintenance of the system. Implementation of the system was smooth as all the stakeholders were involved in development of an M&E framework and selection of the required indicators. HKI working closely with TFNC were largely involved in the roll out process. Government’s reception of the MIS was very positive as it made it possible to generate graphs and summaries of fortified wheat flour and to also know the number of wheat samples within compliance. Manufacturers were resistant to use the system due to data security as they thought information would be made available to their competitors. Advocacy to convince manufacturers of data security and to encourage monthly and timely submission of data was done. A total of 13 large scale companies were trained on the system use and currently all are utilizing the system.

The only training required was introduction on how to use the system. Production managers are solely responsible for keying in data into the system. The implementation of the
system was a phased approach where industries were trained first, then government officials later. Those trained included: nutritionists, food inspectors, and laboratory personnel. The performance of the system was averagely rated because more can be done in terms of purchasing computers and securing internet connection. Comparison of data collection efficiency has not been done; however, there is feedback that the system has made it easy to retrieve data and generate production trends, which makes it easy to assess coverage levels. No known plans exist of adapting the MIS to a more comprehensive health MIS though the idea of developing one single system for global use was highly appreciated and at the same time some concern that some manufacturers would exaggerate production volumes was pointed out. The idea would create an opportunity of having harmonized results and provide immediate feedback.

**Structure of the Web based system**

A unique password is needed to access the system. Currently the system is used to monitor wheat but it can easily be adapted for other food vehicles. Data entry form is shown below.

<table>
<thead>
<tr>
<th>Element</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of Premix used (g)</td>
<td></td>
</tr>
<tr>
<td>Target - Premix Addition Rate</td>
<td></td>
</tr>
<tr>
<td>Actual - Premix Addition Rate</td>
<td></td>
</tr>
<tr>
<td>Total Wheat flour Produced (MT)</td>
<td></td>
</tr>
<tr>
<td>Total Wheat flour Fortified (MT)</td>
<td></td>
</tr>
<tr>
<td>Number of Wheat Samples Collected</td>
<td></td>
</tr>
<tr>
<td>Number of Wheat Samples Tested</td>
<td></td>
</tr>
<tr>
<td>Number of Wheat Samples Collected</td>
<td></td>
</tr>
</tbody>
</table>
The indicators captured by the system include: **Amount of premix used (g)**, **target premix additional rate**, **actual premix addition rate**, **total wheat flour produced (MT)**, **total wheat flour fortified (MT)**, **number of wheat samples collected**, **number of wheat samples tested** and **number of wheat samples complied**. Internal Quality Control/Quality Assurance at the industry is responsible for sample analysis while compliance monitoring at entry points is done through rapid qualitative tests.

**Limitations of System Use**

- Lack of adequate resources (computers and internet) make it challenging to report using the web based system.

- Most inspectors are not aware of fortification compliance and this therefore means that compliance in food fortification does not take a priority when conducting visits.

**Malawi**

Food fortification standards were made mandatory for wheat flour, maize flour, cooking oil and sugar in February 2015. Malawi’s system, known as Fort MIS, was developed by Project Healthy Children (PHC) and is housed in the Ministry of Health. It is a manual system and several individuals from the Ministry of Health were trained but it was deemed one person’s responsibility to enter food fortification quantitative analysis results obtained from the national testing laboratories every month. However most of the districts do not make timely submissions which delays data entry, collating and analysis. The system has not been rolled out to other departments only the Ministry of Health. It was recently upgraded.
Monitoring data is captured at various points using fortification inspection forms. They include entry points, community level, district level and national level. At the point of entry, port health officers are responsible for collecting data; at the community level the supervisor submits monthly data to the district and the district forward data to the national level where it is inputted into the monitoring tool.

Government’s reception to the system was positive as it enabled them to make more sense of the data due to the automatic generation of charts and graphs. The system enables easy identification of problem areas mainly; timely sample submission, testing issues and problem districts, brands that are not compliant, border points that are consistently problematic, and districts not sampled enough. Data collection efficiency and effectiveness before and after the roll out of the system has not been done, however, more districts are reporting due to the feedback given to them after inputting the data. The idea of developing a single system for global use with standardized indicators was highly appreciated, as it would result in uniform reporting and comparison of program performance among countries.

**Structure of the System**

Currently, the Fortification-Specific Management Information System (Fort-MIS) is an Excel-based workbook with tabs for manual data entry which link to generation of automatic charts for local industry, imports, and market level final product test results. Data on salt iodization levels is currently available because routine collection of other food vehicles has not been established.

The system can be adapted to any country-specific situation and used for any fortified vehicle that may exist. Excel as a platform was used due to the fact that it is user friendly and no password is required to use the system.
Limitation of Fort MIS

- The manual data entry is very laborious and time consuming.

- Lack of interest on the use of Fort MIS from other colleagues makes it overwhelming on the one individual using it.

- Constant reminder and follow up for the districts is necessary to make timely submissions.

- Users have faced issues with the graph creation in the upgraded Fort MIS.

- Limited resource allocation for the fortification program results in frustration from the environmental health officers during sample collection from the industry and market level.

Zimbabwe

Fortification in Zimbabwe is mandatory for cooking oil, sugar, wheat flour and maize meal. Salt iodization is being monitored using a fortification specific monitoring system.

Fortification data has already been integrated into District Health Information System (DHIS) through consultative process between Government, United Nations and non-profit partners, civil society, and industry. The reception of the system was good as all partners were involved in development of standards and regulations. Analysis of salt iodization levels is done centrally by Government Analyst Laboratory (GAL) that received training together with other Government departments. A password is required to access the system where data entry and editing is done at the Government Analyst Laboratory. Relevant staffs have the relevant skills to input data at one data entry point (GAL). Capacity to analyze samples at sub national level is
limited by lack of resources though there is a long term plan to equip the sub national laboratories.

The District Health Information System is able to generate data at weekly and monthly intervals and transmitted electronically from districts to national levels. This will, therefore, facilitate faster transmission of results once laboratories at sub national levels are equipped with the appropriate analysis equipment. Presentation of data after collation and analysis is done using tables, graphs, charts and report generation. The system is able to conduct data validation where it flags outliers and hence facilitates corrective action. Information from the system can be disaggregated by product, brand, and origin. Geographic information system mapping (GIS) of sample origins by compliance status is enabled and this helps to visualize the geographical areas affected. Dashboards are easily accessible as it allows visualizing data in real time.

Fortification monitoring was a success due to the ready availability of information and trends. There is need to advocate for nutrition policies and strategies so as to eradicate micronutrient deficiency diseases that are present in the country. Creating one single system for global use was deemed feasible.

**Limitation of DHIS for Fortification Monitoring**

- Limited information to build up the drop box menu to avoid misspelling.
- Lack of laboratory capacity at sub national levels.
- It is not fully functional for import monitoring as computers at the point of entry are not available to input sample test results into the system.
South Africa

Data capture systems are not well defined. Food fortification regulations are in the finalization stage. With the finalized regulations, compliance will be closely monitored as annual audits of the milling industry will be done against required regulations and standards. South Africa’s Department of Health (DOH) is responsible for inspection and monitoring of fortification compliance, however with decentralized governmental structure the actual implementation is by provincial and district governments, which ultimately direct and finance inspection activities of the country’s Environment Health Practitioners (EHP) who are responsible for conducting inspections. Fortification is a small component of EHP’s portfolio of responsibilities, which covers a wide range of environmental and food safety issues and since there is no longer a specific mandate for Environmental Health Practitioners to monitor the retail marketplace, food fortification is usually not considered a priority activity.

Information from the millers is captured at South African Grain Information Services (SAGIS). Indicators captured include: Amount in tones of manufactured, imported and exported maize products, amount in tones of manufactured, imported and exported wheat product and units of manufactured pan baked products. For various reasons the milling industry were reluctant to discuss details of their internal processes and referred me to the SAGIS website where they send their monthly production volumes.
Based on a Memorandum of Understanding (MOU) with the DOH, the external audit of 5 registered premix suppliers is implemented by the South African Bureau of Standards (SABS). The audit protocol is based largely on Hazard Analysis and Critical Control Point (HACCP) and Good Manufacturing Practice (GMP) and requires the premix supplier to inform the auditor of the source of the vitamin A and iron being used and present monthly records of premix sold, including the purchaser. The SABS also takes random samples of premix for verification at the SABS laboratory where they are able to capture: **Name of company, type of sample collected, date of sample collection, date of analysis and results of the analysis.**

There are plans to adapt the systems approach to compliance monitoring. The Department of Health will be working closely with Philip Randall (Independent Consultant) to implement a system approach to compliance monitoring that he proposed. The idea of having a globalized monitoring system was well received by the Department of Health as this would enable them to have access to production trends without necessarily viewing the production volumes from the mills.

**Jordan**

Flour fortification program began in 2002 where folic acid and dried ferrous sulphate were included in the micronutrient premix. The fortification program is managed by the Nutrition Division within the Jordanian Ministry of Health (MOH), other key actors that play a role in the external monitoring and they include: Ministry of Industry and Trade (MIT), Jordanian Food and Drugs Administration, provincial inspectors and the MoH Nutrition Division and responsible for preparing and reviewing food safety and fortification regulations and for conducting mill inspections. A prospective monthly monitoring system was established in 2009 to document the quality of the fortification program.
The system consists of five indicators:

- Quantity (MT) of fortified wheat flour produced is sent to MIT which is then sent to MOH upon request,
- Approximate utilization (number of 25kg boxes) of micronutrient premix used in the past month, mills are required to send their premix utilization to MoH via fax.
- Average addition rate,
- Iron concentration in flour sample in parts per million.

The system is a simple data log which is not automated and data collection mostly entails sending monthly records to MIT and MoH. Premix subsidy was the motivation for the system use which was rolled out at once.

The system is easily accessible and there are clear roles and responsibilities set out but they are not being executed to the later due to competing priorities in the department. There is one central data entry location. Summaries are used in analysis and simple reports are presented after the analysis. Data collection efficiency before and after the system use hasn’t been done, though what is of interest is that all the same indicators as mentioned above were collected with the exception of premix usage reconciliation.

**India**

India’s Management information system was developed in 2009 by VBSOFT Ltd. (India) with support from GAIN, UNICEF and MI so as to improve the effectiveness of the Salt Department in monitoring India’s USI program. The web based system was implemented in 2012 and is currently being used to manage both edible and industrial salt; it can however be
adapted to other food vehicles. The system connects all of the department offices to salt production plants to enable real time information flow.

The system implementation process was smooth as the stakeholders were involved in the initial stages of system development. VBSOFT took a primary lead in the roll out process where they conducted role based application training and basic computer literacy. Officers from the salt Department received training, they used a train the trainer model where either one or two personnel in each region was trained and positioned as champions. The trained personnel further trained other staff members within their respective regions. The MIS was positively received by stakeholders as its use resulted in increased efficiency in decision making, efficient reporting and a decrease in administration time delays, the application is able to monitor all activities related to salt production, supply and quality to the country besides all other operational functions required for operational purposes. There were various motivating factors that enabled the system to be used and they included: auto consolidation of quality and production data on time, data availability, laboratory results communicated to the compliance agencies automatically and to the receiver states. This helps in ensuring that batches that have been tested and shown to have inadequate iodine content are not distributed for human consumption.

The implementation of the MIS has brought radical transformation to people in their personal capacities as they are able to execute their job in the best possible manner. The transformation has enabled the employees to find new communication ways with their peers. IT literacy was the major system implementation challenge faced as the average age of the resources within the salt department is over 50 years and very few had hands on experience working in a technology environment. To overcome the challenge the team went about training the resources on basic computer literacy and gradually training on MIS application.
**Structure of the Web based system**

The MIS was developed on web based technology (Microsoft platform) and hosted at Salt department’s data centre. The application offers role based access management and depending on the credentials, users can experience various processes of the system. There is multiple remote data entry options where officers at different hierarchical levels in the salt department are responsible for data entry depending on the roles and processes assigned to them.

The Microsoft based platform was chosen because of its easy access due to the opportunity of anywhere anytime data capture. System compliance is captured by the system by having salt production and quality compliances defined in salt MIS and iodine quality assurance system as per department standards. Annual data quality audits by the salt department are done where immediate feedback is provided to the respective agencies. The indicators captured by the system include: production and distribution volumes, laboratory analysis, price and export.

The system adds value to the department by offering all services carried out by the salt department like land management, legal management, human resources management, meteorological data management, laboratory management, by-product management, and salt production planning. Information in the system is organized and displayed through a simple user interface including dashboards which display quality, production, and distribution information. Reporting is predominantly carried through the MIS; the sophistication of the system allows multidimensional data extraction from salt MIS for building future or ongoing strategic road map for the salt department.

**Egypt**

The Management Information System used to monitor fortified flour for processing baladi bread was developed in 2010 by an Information technology company recruited by World
Food Program (WFP). The system is currently used for wheat though there were plans to use the system for edible oil fortification and a similar system was used for the national study to test the iodine content in the fortified flour used for the production of the subsidized bread. The following was done to facilitate functionality of the system: Training of data entry persons, availing enough premix in the mill, securing the mills with infrastructure (computer and internet), calibrated and functioning feeder, and equipping the mills with chemicals and reagents for the qualitative tests.

The system used a phased approach in its roll out process where Government stakeholders were trained first followed by the data entry clerks at the mills. WFP with support from the contracted IT Company and the Ministry of Supply and Internal Trade (MoSIT) information centre were responsible for the roll out process and training of the data entry clerks at the mills who undertook a two day course on system operation. The MIS was positively received by most stakeholders as they identified the importance of the system in providing a reliable alternative to the much slower manual process, the high technical control and the promptness of the data reaching the policy maker for corrective actions. During the initial stages of system use, challenges in providing the required infrastructure (computer and internet) to the mills for data entry and cultural and technical unfamiliarity with a computer system were reported. Support visits by the technical officers were done to demonstrate how the monitoring system is easy and friendly to use.

The MoSIT suffered an attack from demonstrators barely two years after the system roll out, and most computer devices and the system server were destroyed, paralyzing the monitoring efforts. In Mid 2014, the amount of premix was fully consumed and the program ceased, however a task force to revive the fortification program has been formed.
**Structure of the Web based system**

The web based system is designed to allow the mills that have valid login credentials to have access to their page. Members of the technical committee have the rights to access and view all the system’s pages using a special password. Millers are expected to fill the online automated versions of the paper quality control records which the mills have used since the start of the program; this therefore makes it easy to collect the indicators. The indicators captured by the system include: **Quantity of fortified flour**, **quantity of premix consumed on a daily basis**, **premix inventory** (with an alert that is sent to mill management and MoSIT if it drops below a 3-week supply), **Results of feeder check** (a weighing test which entails premix flow rate per minute), **Results of qualitative iron red spot test** and **results of quantitative iron tests** if any.

The system is designed to generate a set of automated alerts that allow designated personnel at MoSIT to receive customized alerts in cases of fortification outside the range, premix unavailability in the mill warehouses or any malfunction in the system. Alerts are sent by e-mail to those tasked with taking corrective action. After data entry, the system is able to generate charts, graphs and reports on a monthly, weekly or daily basis which will then be submitted to the Supply Minister to make informed decisions.

**Bangladesh**

The National Edible Fortification Law 2013 was endorsed in 2013 making it mandatory to fortify edible oils (soy bean and palm oilen) with Vitamin A. The data capture system in Bangladesh is basic and in its infancy stage. Data collection of indicators involves telephone enquiries from the Project monitoring unit (PMU) housed within the Ministry of Industry to factory managers. The indicators collected include **total edible oil production** and **production**
of fortified oil; some refineries provide **monthly purchased premix** and **stock information**. The information gathered from the factory manager is recorded in a register book and transferred to an excel sheet by a GAIN officer. The current system is primarily used for edible oil but can be adapted for other food vehicles. Refineries have an internal monitoring system managed by a quality manager, while the Bangladesh Standards and Testing Institution (BSTI) is responsible for external monitoring. However data from internal and external monitoring cannot be interlinked because the refineries do not share any information from internal monitoring. Data entry is done centrally; PMU and GAIN are responsible for maintaining the registers and the excel sheets, no password is required to access information from the excel sheets. The excel program neither recognizes irregularities nor generates alerts; however production information from PMU is cross verified and scrutinized by BSTI. Analysis in excel is done to compare the proportion of fortified edible oil against total production, this information is shared with GAIN and other partners. New excel sheets are created for the new refineries joining the fortification program.

**Canada**

Canada is utilizing the Hazard Analysis Critical Control Point (HACCP) approach to monitor compliance in food fortification. The indicators collected include: **system’s based inspection, premix usage reconciliation, sampling and analytical testing**. Collection of these indicators is done annually and more frequently if need arises and it entails auditing of HACCP and premix usage reconciliation where a mismatch warrants further investigations including sample analysis. The system is currently used for maize flour, wheat flour, oil, sugar and milk. Due to the underlying 7 principles that HACCP uses, the system is able to generate alerts in case of outliers and also track standard operating procedures used at production facilities. Initial data
collection for brands, districts, and producers was done. Food inspectors are responsible for data entry into the system, which is easily accessible; they have the required skills to operate the system. The particular system was chosen so as to allow optimization of scarce resources. Graphs and pie charts are used to present information after analysis which is sent to industry and importers if necessary. Information is confidential and the only time it is shared is when it comes before the courts.

A phased approach was used during implementation where Food inspection agency within Health Canada was primarily trained. Software implementation glitches were experienced during the implementation and required no interventions. Food inspection agency is responsible for maintaining the system by conducting data quality audits whose results are communicated to the respective agencies within 0-4 weeks. To ensure compliance, the Canadian Government has included fortification into the food safety policy.

**Senegal**

Compliance monitoring in Senegal involves tracking of iodization indicators in a tracking excel sheet which is housed within Cellule de Lutte Contre la Malnutrition (CLM) - a government agency coordinating nutrition projects in the country. The information on the excel sheet is captured from registers and files at the site level. Project officers are involved in data entry at the operational level while a project manager is involved in the synthesis and analysis of data.

The indicators tracked by the excel sheet include:

- **Amount of iodized salt.**
- **Amount of potassium iodate purchased at central level,**
- **Amount of potassium iodate remaining at Economic Interest Group level.**
• Number of iodization machines, number of machines available,

• Number of functional machines,

• Quantity of salt marketed at the local market

• Quarterly salt exports.

The functionality of the excel program helps to identify probable issues to facilitate corrective action by having cells colored red if iodine content is non compliant. After analysis, charts are generated. The processed data on production data, potassium iodate and functionality of iodization unit is sent to the micronutrient advisor and CLM monitoring and evaluation team. The stakeholders in Senegal would like to have a functional management information system in place to monitor compliance in industrial fortification and salt iodization.

Recommendations

• The development of a global standardized system was recommended by all the stakeholders; however data security needs to be guaranteed to the users and this can be achieved by allowing each user to have access to their data entry page only and limiting the rights of the administrators to viewing only the dashboard where trends, charts and graphs are automatically generated.

• Autonomy needs to be given to the users so that they are able to use the system without having to seek permission from the administrators. This was experienced in Kenya where one of the laboratories was unable to make an autonomous
decision to select a particular date for the products which did not have the exact manufacture date.

- More inspectors need to be trained because the few that are trained are overburdened.
- Recognition for the countries or companies who report on time and that are within the acceptable range of compliance.
- Adequate resource allocation for the food fortification program.
- Hiring / recruiting of a competent person to help in reconciliation and interpretation of data.

Annex 1:

The following agencies, departments, and individuals took their time and participated in the study and their consolidated responses made this write up possible:

Kenya

- John Mwai Division of Nutrition
- Nancy Njine National Public Health Laboratory
- John Kabue Kenya Bureau of Standards
- Manoy Binoy Bio Food Kenya
- Francis Nduati Unga Group Limited
- Saisi Strathmore University

Tanzania
- George Kaishozi, Helen Keller International
- Celestin Mgomba, Tanzania Food and Nutrition Centre

Malawi
- Florence Dimba, Ministry of Health
- Wanangwa Sindani, Malawi Bureau of Standards

Zimbabwe
- Arthur Pagiwa, Project Healthy Children
- Chris Nyadzayo, Ministry of Health and Child Care

South Africa
- Maude de Hoop, Department of Health
- Amit Raga, South African Bureau of Standards
- Gerda van Schalkwyk, Tiger brands
- Philip Randall, Independent Consultant

India
- Arijit Chakrabarty, GAIN India
- VB SOFT Ltd

Bangladesh
- Debashish Chanda, GAIN Bangladesh
- Bangladesh Standards and Testing Institution

Canada
- Quentin Johnson, Independent Consultant

Jordan
- James Wirth, Independent Consultant

Egypt
- Nada El Husseiny, Independent Consultant
- Dr. Magdy Shehata, Independent Consultant

Senegal
o Cheikh Ahmadou Lo, GAIN Senegal
o Ndye Khady, Cellule de Lutte Contre la Malnutrition