Reform of the National Health Supply Chain in Sudan: Achievements, Challenges, Success Factors and Lessons learned

2nd Edition
2015

Federal Ministry of Health
National Medical Supplies Fund

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National Medical Supplies Fund

DEDICATION

To those who work hard to get essential quality medicines to patients

National Medical Supplies Fund

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First author contact details:
Tel: +249183461765 - Fax: +249183460935
Mobile: +249912318615
e-mail: gamalkh@nmsf.gov.sd - gamalkh@hotmail.com
National Medical Supplies Fund
Director General
P.O. Box 297
Khartoum - Sudan

List of Contributors

G. K. Mohamed Ali	Gamal K. Mohamed qualified as a pharmacist. He did a PG diploma in health economics and MSc in pharmaceutical services and medicines control. He did his PhD research in medicines financing. Gamal worked as manager of RDF in Khartoum State. He was a secretary general of the Medicines Regulatory Authority of Sudan. Currently, he is the Director General of NMSF
A. Makkawi	Ayat Makkawi has qualified as a pharmacist in Khartoum University. She did a PG diploma in health economics. She is a head of Monitoring and Evaluation department in Central Medical Supplies Public Corporation.
S.A. Elbasheer	Sheikhelddin A. Elbasheer has qualified as a pharmacist in the University of Khartoum in 2003. He worked as a pharmacist in Khartoum Teaching Hospital. He was a manager of inventory control in the Central Medical Supplies Public Corporation. Currently he is Executive Manager of NMSF. Now he is doing his MSC in the University of Bradford, UK.
E. Dablouk	Enaam Abdalah Dablouk qualified as a pharmacist. She did a PG diploma in health economics. Enaam worked as inspector of pharmacy in Directory of Pharmacy in White Nile State. She was Deputy director of educational pharmacy in North Kordofan State. She was a head of the department of Local Purchase. She was Director of the Department of procurement medicines and medical devices. Currently, she is the Director of the Department of Import and Customs Clearance.
N. T. Bakry	Nawal E. Bakri qualified as a pharmacist. She did a fellowship in pharmaceutical services management. Nawal worked in many departments in Central Medical Supplies Public Corporation. These are Need assessment, Sales and Distribution, and Procurement. Currently, she is the Director of General Procurement Directorate.
A. H. Awadelsid	Ahmed H. Awadelsid qualified as an administrator. He did a PG diploma in international relation and MSc in total quality management in public organizations. He did his PhD research in the excellence strategic performance in public service sector organizations. Ahmed worked as a manager of administrative and finance affairs department in national health insurance fund. Currently, he is the director of NMSF’s general directorate of planning and resources.
S. S. Abdelgadir	Sabah Sauliman Abdelgadir qualified as a pharmacist. She did MSc in Clinical Pharmacology. Sabah worked in many departments in Central Medical Supplies Public Corporation. These are people’s pharmacies, need assessment, Sales, Planning and Research, and Marketing and Distribution. Currently, she is the director of Medicines Procurement Directorate.

N. Hamid	Nagla Hamid Ibrahim qualified as a pharmacist. She did MSc in pharmacy practice. She participated in many workshops and conference in management and pharmacy. Nagla worked as a director of medical supplies in Giad hospital. She was community pharmacist in Qatar. Nagla was a director of overseas procurement in central medical supplies. Currently, she is the head of the planning and statistics department in NMSF.
S.A. Siddig	Shihabeldin Ali Siddig qualified as a pharmacist. He has MSc in management and business administration. He worked as eligible pharmacist in the Ministry of Health, Saudi Arabia Kingdom in different positions, including hospitals, central medical supply. In Sudan, he joined NMSF as a deputy manager in procurement department. Currently, he is the director of NMSF's general directorate of sales and distribution.
A. A. Elfadul	Ayman Ali M. Elfadul qualified as a pharmacist.. He worked as a community pharmacist for 5 years. He was a procurement officer and sales and marketing officer at NMSF. He was the focal person of the Emergency Medicines Program in NMSF. Currently, Ayman is the head of NMSF's Inventory Control Department.
N. E. Elnur	Nawal E. Elnur qualified as a pharmacist. She did a fellowship in pharmaceutical services management. Nawal worked as a senior pharmacist in Elsadig Abuagla hospital and in many departments in NMSF, these were Need assessment, head of overseas Procurement, manager of total quality management, Head of Planning and training and Manager of inventory management. Currently, she is the manager of quality assurance.
A.M. Algaali	Abdelrahman M. Algaali qualified as a pharmacist. He worked at Directorate of Pharmacy "Khartoum state". Algaali worked in many departments in NMSF. He was the head of different departments. These were need assessment department, domestic procurement, quality control department, administrative affairs department and worked as assistant director general. Currently, he is the head of General Directorate of States Medical Supply in NMSF.
S. A. Fagiri	Saideldin F. Abdelaal qualified as a pharmacist. He worked as a senior pharmacist in Elgadarif Hospital, manager of medical supply of Islamic African Relief Agency. Abdelaal was manager of Elgadarif drug revolving project, manager of people's pharmacies. He was a manager of quality assurance. Currently, he is the head of quality control section.
O. A. Mohamed	Osman A. Mohammed qualified as a Medical Engineer. He did a PG Diploma in Electromedical and Laboratory Equipment. He has a MSc in project management. Osman worked as a Head of Maintenance Department in Al-Shaab and Khartoum Teaching Hospitals. Currently, he is the manager of NMSF's medical technology Department.

A. A. Saloha	Abu baker Ahmed Elsalih Saluha qualified as a pharmacist. Saluha worked in different Departments in NMSF. These are department of planning and need assessment, procurement department, and marketing and distribution. He was executive manager Department. Currently, he is the manager of customer service department.
Ahmed S. H. Hassan	Ahmed Shoaib qualified as a pharmacist. He did a fellowship in pharmaceutical services management. Ahmed worked in many places: Police Hospital, Khartoum as a manager; Senior Pharmacist in Security Forces Hospital, Saudi Arabia; Supervisor in RDF Khartoum State; Manager of Inspection Department FMOH; Senior Pharmacist in Omdurman Teaching Hospital; and Different Department in NMSF.

Summary

The National Medical Supplies Fund (NMSF)[1], the successor of the Central Medical Supplies Public Corporation (CMS) is the national center for procurement and distribution of medicines in Sudan. NMSF has implemented a comprehensive reform programme started in 2011. This report aims to describe the changes that have taken place in the NMSF's medicine supply system. These changes include a number of initiatives to improve geographical, physical and economical accessibility to quality medicines and other health commodities. Investing US$ 27 million to establish NMSF branches in 14 states in 2014, e-procurement, online sales, purchasing of registered medicines, restrict supply of medicines mainly to governmental health organizations are examples of the initiatives that have been pursued during the reform period. The study was based on document research to present the progress in the implementations of the reform. Bids that occurred before (2008) and after (2011) the reform have been used for comparison to measure the impact of the reform on procurement. The time to finalize the bidding process, the total cost of the purchased quantities, the number of medicines with market authorization, sources of medicines, failure rate of quality testing, the rate of expiration, and the availability of medicines were evaluated. Implementing the NMSF's reform has improved the availability of quality of medicines without increasing the costs and therefore achieved its objective: the value for money.

Key Achievements

As summarized in Appendix 1, during the reform period, the availability of medicines at NMSF's warehouses increased from 43% in 2009 to 75% by the end of 2011 and shooting to annual average that ranges between 92% and 95% since 2012. More than 75% of medicines have market authorization in 2011 compared with only 4% in the tender conducted in 2008. Despite the sources of 51% of medicines were well-regulated markets in 2011, compared to 26% in 2008 there is no price increase. The time obtained to declare the result of the tender adjudication has been reduced from 6 months in 2008 to 4 months in 2011 and to only 15 days after introduction of electronic procurement in 2015. The percentage of rejected medicines for quality reasons dropped from 9% in 2010 to 2% by the end of 2011 and to only 0.3% by the end of 2014. Similarly, the percentage of value of expired medicines to the average annual inventory decreased from 7% in 2010 to only 1% in 2014. Despite the economic difficulties that face Sudan during the post-separation years, the NMSF very soon regaining its market share and has continued to grow, in terms of volume of sales and assets, and remains in good financial health. For example, NMSF's sales has jumped from US$69 million in 2010 to US$ 99 million and US$125 million in 2012 and 2013 respectively, and shooting up to more than US$ 160 million in 2014. Development of online supply (electronic sales) system for the first time in the history of Sudan in 2011. The electronic sales represented more than 50% of the NMSF's sales in 2014. Implementation of electronic pooled procurement (i.e. all public organizations participated in one tender). This is the first electronic tender in the history of Sudan, which worth €160 million for two years. All bidders have submitted their offers (more than 145 quotations) electronically. The number of drug companies, which their bids have been successfully received is 93. The saving that has been made as a result of pooled procurement exceeds €10 million. Pro-poor achievements

[1] The CMS has been transformed into a National Medical Supplies Fund after the National Assembly has approved a new Act for the first time in Sudan history. The authors agreed to refer to old archival documents and activities of the former CMS using the current new name, i.e. NMSF.

include cross-subsidization of expensive life-saving medicines and those used by patient with chronic diseases and children by more than 70% (Appendix 2). In addition to the signing of agreements with 15 states (including Blue Nile, North Kurdufan, West, East and Middle Dar For) to establish revolving Drug Funds. Change of accounting system from public to the commercial accounting system. In this regard, NMSF, for the first time in its history, has managed to submit their final accounts (Income and loss Account, and Balance sheet) of the fiscal year 2011 to Auditor General within the first half of the following year. Training and development program for all employees including labors and drivers for the first time in NMSF history (i.e. in the past, the training and development programs were exclusively to pharmacists and to some extent biomedical engineers. The annual number of trained employees increases from only 10 in 2010 to more than 580 and the training budget increases from less than US$40,000 to US$670,000 in 2014. More than 170 of them participated in overseas courses (e.g. Netherlands, China, India, USA, etc). Staff from NMSF partners also enjoy sponsorship training and attending regional and international conferences in the field of health supply chain and other pharmaceutical services. Transforming of the CMS into a National Medical Supplies Fund after the National Assembly has approved a new Act for the first time in Sudan history.

Success factors

Political commitment: this study shows that a firm commitment from the highest level in the country (i.e. the president and his vices president), the National Assembly, Ministry of Council of Ministers, FMOH, MOF and Central Bank of Sudan is vital to the success of the NMSF reform. It was the political commitment, which enabled the NMSF to encounter the fierce resistance to the reform of the procurement system led by the association of the importers of medicines. This resistance due to the fact that the NMSF, in its first tender after the reform, stopped the previous practice of giving preference to cheap non-registered medicines and regardless of the performance of the suppliers.

Motivation: much motivation has been given for the NMSF to succeed, by drawing attention to and praising its success, at the highest levels of the government. Examples of such praising include the visit of HE the President of the republic and in less than two months later, HE the First Vice President also visited NMSF. Other public health organizations are not allowed to establish parallel procurement systems. This pooled procurement through NMSF minimizes the tender costs and results in competitive prices through increasing purchased quantities (i.e. economy of scales) of quality medicines.

Hard currency: the availability of hard currency, especially after the separation of Sudan, is the cornerstone for the success of the NMSF reform. The commitment of the Central Bank of Sudan to secure the hard currency (which also reflected the commitment of the government) has helped the NMSF to have access to hard currency at official rates. This allows a regular supply of medicines from abroad to the NMSF, and from the NMSF to public health facilities.

Skilled staff: An effective public health supply chain requires motivated and skilled staff with competency in various essential logistics functions; staff have been empowered to make decisions that positively impact health supplies and supply chains. The NMSF, as a leader in medical supplies, fully recognized that its success and reform are achieved through people's expertise, and that appropriate training and development is the key to the success of its reform. NMSF conducted a very comprehensive human resources development programme.

Team work: It was the team spirit and the honesty, dedication of the highly motivated team members, dominated by pharmacists that made the NMSF's reform programme a great success in a hard time in Sudan (i.e. during post separation period).

Effective reward System: the NMSF is continuing to increase incentives and improve working conditions to ensure that suitably qualified and skilled staff, especially pharmacists, are retained for a longer period in a situation where huge number of competent staff migrates to Gulf States, mainly to Saudi Arabia kingdom. In this regards, incentives of NMSF staff increased by 876%, from 0.3 in 2007 to 3.2 times their gross salary since 2013. NMSF offers its staff private health insurance, transportation from and to their homes and uniform dressing.

Disciplinary system: The NMSF realises that, even the best design systems for accountability require enforcement. Disciplinary procedures provide a range of possible responses, from warnings through dismissal, depending on the severity and frequency of the offence. Those who fail to achieve their targets or to meet their deadlines have been taken accountable by losing some or all of their monthly incentives immediately.

Strategies to maintain the achievements

Although some initiatives seem to be irreversible (for example, the purchasing of registered medicines, transportation of medicines in temperature controlled vehicles, sources of genetically modifies biopharmaceuticals, branches of the NMSF at states' level), NMSF needs to set a number of measures to maintain the enormous array of initiatives and steady progress that have taken place during the last four years. The measures that are expected to protect the achievements and success include: the NMSF's Act 2015 is the one of NMSF's strategies to maintain the policies and initiatives that have been successfully implemented during the reform period. In addition, the administration board comprises representatives of main stakeholders (i.e. NHIF and Military services). The representation of stakeholders will safeguard the NMSF against deviation from its objectives that have been clearly stated in the Act. Also strengthening the ownership feeling and development of loyalty of staff to the NMSF through a set of benefits that they are gained during the reform period will help in maintaining the progress and development of NMSF. Moreover, organizational culture that has been evolved during the reform, which based on empowerment of senior managers and promote team sprit could contribute to the protection of the unprecedented development. Further, the establishment of the board of coordination of pharmaceutical services will help in monitoring NMSF activities and solve dispute between NMSF and other organizations within the FMOH. This board chaired by the minister of health and comprises state minister of health, FMOH's undersecretary, secretary general of NMPB, DG of the NMSF, manger of general directorate of pharmacy and manger of the free medicine project. Furthermore, active participation and involvement of senior NMSF staff in different FMOH events and committees, and increased awareness of laws and regulations that governs the NMSF activities will help them in maintaining their current achievements. Finally, supervision of the FMOH and close monitoring of the NMSF's performance by the committee on health, environment and population of the National Assembly, media, and customers' protection societies will maintain the current progress.

Lessons learned

Leadership: strong leadership is essential to ensuring that public employees (civil servants) dedicated efforts to produce fruitful results. It is the most effective strategy to get the most possible performance from employees that you have no role in their selection and whom you cannot hire (when needed) or fire (when necessary). The leadership that NMSF offers to its employees shines through a number of initiatives it undertakes. The leadership might be the only possible way to make your vision reality in a context where the carrot and not the stick should be used. A successful reform requires both political skills, to develop and mobilize political support, and technical skills, to manage and promote the reform.

The role of pharmacists: this study reveals at least three steps in the medicine procurement process in which the role of pharmacists is both necessary and useful: establishment of a medicine tender list, selection of the most appropriate offerings and analysis of the tender process and results.

Selection of medicines: another lesson to be learned from this study is the basis for selecting medicines to be included in the tendering process in the public health sector in Sudan for the years 2011 and 2014. Each of the national programme has its own method of selecting medicines to be included in the bidding list. Each method is considered highly subjective because it is knowledge rather than evidence-based. On the one hand, rationality dictates that any government in a resource-constrained setting would expect that an effective procurement system would ensure availability of quality medicines while optimising the finances to ensure the best outcomes. It is also in the interest of the government to run this system transparently to promote competition and thus efficiency. In addition, patients expect that affordable quality medicines are available at all times.

Post-marketing quality testing: continuing to evaluate pharmaceuticals after they have distributed as well as the routine collection of bottom line information from NMSF branches is an important part of ensuring the quality of medicines.

Performance-based incentives: the incentive structure is related to performance. This includes the achievement of the targets.

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Abbreviations

BNF	British National Formulary
CBS	Central Bureau of Statistics
CIF	Cost, Insurance and Freight
CMS	Central Medical Supplies Public Corporation
DG	Director General
ERP	Enterprises Resources Planning
FMOF	Federal Ministry of Health
GDP	General Directorate of Pharmacy
GF	Global Fund
GFATM	Global Fund for AIDS, Tuberculosis and Malaria
HAI	Health Action International
HE	His Excellence
Hera	Health Research for Action
HINARI	Health Internetwork Access to Research Initiative
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
IRP	International Reference Price
IT	Information Technology
LC	Letter of Credit
MDS-3	Managing Drug Supply - Edition 3
M&E	Monitoring and Evaluation
MOF	Ministry of Finance and National Economy
MOU	Memorandums of Understanding
MSH	Management Science for Health
NBHSC	National Board for Health Services Coordination
NCA	New NMSF›s Administration
NCIHD	Nuffield Centre of International Health and Development
NGOs	Non-Governmental Organisations
NHIF	National Health Insurance Fund
NMP	National Medicines Policy
NMPB	National Medicines and Poisons Board
NMQCL	National Medicines Quality Control Laboratories
NMSF	National Medical Supplies Fund
OECD	Organization for Economic and Cooperation Development
PMSP	Post-Marketing Surveillance Programme
PR	Principal Recipient
PSM	Procurement and Supply Management
PTD	People that Deliver
RDF	Revolving Drug Fund
RFQ	Request For Quotation
SDG	Sudanese Pound
SMS	Short Message System
TB	Tuberculosis
UNDP	United Nation Development Programme
US$	United States of America Dollars
WHO	World Health Organization

1. Introduction

The National Medical Supplies Fund (NMSF), the successor of the Central Medical Supplies Public Corporation (CMS) is the national center for procurement and distribution of medicines in Sudan. The CMS, established since 1991 as a semi-autonomous organization to facilitate the selection, procurement, storage and distribution of medical supplies for the public sector. The establishment of the NMSF is a result of various reforms and transformations that have been taking place since 1937 when the first Central Medical Stores was established with a view to provide more effective and efficient delivery of services to the public. CMS was incorporated under the public corporations' act of 2003 (Corporations' Act 2003), with the responsibility for all activities related to the supply of medicines and medical appliances for entire government health facilities at both central and state levels. In 2015, the CMS has been transformed into a National Medical Supplies Fund after the National Assembly has approved a new Act for the first time in Sudan history. The authors agreed to refer to old archival documents and activities of the former CMS using the current new name, i.e. NMSF.

NMSF is supervised by a 9-member board of administration, which chaired by the federal minister of health. At implementation level, NMSF is governed by an 11-member board of directors. The day to day administration of the corporation is looked after by the Director General (DG), who is appointed by the president of the republic based on a recommendation made by the federal minister of health (Corporations' Act 2003). In order to execute his functions, the DG is assisted by four general directorates, four specialized departments and various technical committees. Efficient professionals, mainly pharmacists, from various disciplines (for example, biomedical engineers, administrators, accountants and storekeepers) comprise the manpower of the NMSF (more than 400 employees).

To achieve its objectives of ensuring that essential medicines and medical supplies of proven safety, efficacy and quality are available to the population at reasonable prices, NMSF conducts its activities in accordance to government policies, laws and regulations that govern quality assurance of medicines. NMSF also pursues public procurement and financial laws and regulations. Although it is the policy of NMSF to focus mainly on the public sector, currently NMSF is also supplying the private sector.

The Global Fund for AIDS, Tuberculosis and Malaria (GFATM) designated United Nation Development Programme (UNDP) Sudan as the Principal Recipient (PR) for all Global Fund grants since 2005, in light of the additional safeguard policy that is applicable for Sudan. In its role as PR, UNDP Sudan strives to ensure quality financial management, timely procurement of supplies and service delivery as well as efficient monitoring and evaluation of grant implementation. A dedicated Project Management Unit is currently managing four ongoing grants (2009-2014) with an approved budget of over US$ 400 million since 2005. The overall goal of the projects is to prevent deaths caused by these diseases, to reduce the burden of HIV, Malaria and Tuberculosis, as well as to strengthen the Health System. The PR works with relevant government establishments, such as Sudanese AIDS Control Programme, National Tuberculosis Programme and National Malaria Control Programme for the establishment of an agile and sound logistics system capable of guaranteeing consistent and un-interrupted flow of all program commodities. Despite the existence of the NMSF, the Federal Ministry of Health (FMOH) has undertaken efforts to achieve this through the establishment of a separate Procurement and Supply Management (PSM) Unit, which was under the General Directorate of Pharmacy (GDP). Similar to what has been reported

by Dowling (2011) in developing countries, the motivations for establishing this unit and other vertical supply chains for national health programmes were driven by concerns of FMOH about the ability of the NMSF in doing the job, desire for improved performance and accountability for programme priorities, and the additional attention and resources the vertical programmes receive often thought to enhance performance than the typical bureaucratic public organizations, such as NMSF.

In 2007, the FMOH has mandated the Global Funds Medicines supply unit with the responsibilities for oversight roles on supply chain management for all commodities sponsored by the Global Fund (GF). The roles of the GF Medicines unit covers all such functions that would ensure a viable supply chain that can guarantee the availability of the right quantity and quality commodities at the right time, delivered to the right places, in the right condition and at prices that are affordable to the consumers. The medicines supply unit under the GDP has formed a binding partnership with the states' Ministry of Health supply system in the country and is currently implementing a pilot logistics system designed for GF supported commodities (HIV/AIDS and Malaria programs).

In an effort to improve public health supply chain in Sudan, NMSF initiated a reform programme in 2011, to ensure Sudanese accessibility to quality medicines at affordable prices. This reform is inline with the national medicine policy, which aims to ensure the availability of safe, efficacious, quality medicines at a reasonable cost to the society and to promote the growth and development of the domestic pharmaceutical industry. According to the World Health Organization (WHO 2004), the public expenditure on medicines is relatively very low (about US$4 per capita per annum).

Strengthening the public sector availability of quality medicines of affordable prices is one of the long-term, sustainable strategies to relieve a half number of Sudanese who may have no access to medicine (MSH 2013). NMSF had adopted well-designed, thoroughly planned and scientifically streamlined procedures for quality assurance, procurement, storage and distribution of medicines. For example, in the first tender after the reform, NMSF had taken a decision of purchasing quality medicines at competitive prices in a transparent manner.

Sudan depends for its supplies mainly upon import of medicines from various countries. In public sector, this is done by tender invitations every two years and drug consignments are imported at six-month intervals. Imported drugs are transported by sea (mainly from Asia) to the sea port of Port Sudan. From Port Sudan, they are transported by open long vehicles to the NMSF's warehouses in Khartoum and then distributed to the various parts of the country. However, the climatic conditions at the harbor in Port Sudan are very drastic, especially during summer when relative humidity is up to 60% and the maximum temperature is over 45°C. The shipping and unloading time is usually of considerable length. In addition, Sudan is large country with a total area of about 1.9 million km2. Consequently, medicines are transported for considerable distance from warehouses in Khartoum to the various parts (e.g. El Fashir, Dongla, Damazin, Port Sudan and so on). The climatic conditions are unfavorable to vulnerable medicines (Abu-Reid et al 1991). Consequently, most of the medicines and pharmaceuticals used in Sudan may suffer greatly from instability problems and deteriorate considerably under the prevalent conditions of transportation and storage along the supply chain. Such deteriorated medicines are not only ineffective but are sometimes unsafe. Consequently, the limited foreign currencies available to the country may not only be wasted on the purchase of useless medicines but, in fact, on harmful ones (Abu-Reid et al 1991).

Therefore, NMSF in its reform of transportation and warehousing system aims to prevent the possible deterioration of medicines through the supply chain. In this regard, NMSF has signed a contract with Sudapost (the public owned mail company) to transport NMSF medicines in a temperature controlled vehicles and clearly stated in its tender documents that temperature controlled containers must be used (see section 8)

The aim of this study was to assess the first three years of the NMSF's reform on its performance as a largest public medicine supply agency in Sudan with US$162 million turnover (NMSF 2014). In this regard, the study will analyze the financial impact of medicines procurement with the requirement of marketing authorization (registration) in the NMSF's Tender 2011. It will also analyze the last NMSF's tender that has been conducted 2015. In addition to the analysis of the last tender, the study provides an overview of the main areas of the reform, such as warehousing and transportation, quality assurance and human resources. Finally, the paper discusses the success factors and lessons learned from the experience of NMSF in implementing the reform to share them with international readership. Such experience may help similar organizations in resource-limited settings to ensure more reliable and efficient ways for supplying medicines to public health facilities.

2. Methods

A retrospective study, based on document research of the archival records, is undertaken by a group of NMSF employees. For the assessment of the procurement policy, the year 2008 was chosen because medicine procurement was performed without medicine registration that has been required in 2011, and both years were compared. The archival records were also verified to report changes in other areas of the NMSF's reform. These areas include progress in storage and distribution facilities, account system, administrative and human resources. The information gathered from the NMSF's archival records relating to the period from 2010 to 2014 (i.e. at least one year before the reform and back to the last report available, see for example data on quality of medicines, which dated back to 2000). However, the authors also agreed to report some achievements and events that took place in the first six months of 2015, when necessary.

The evaluation criteria include, among others, the time to finalize the bidding process, the total cost of the purchased quantities, the number of medicines with market authorization, sources of medicines, number of bids made by importers, failure rate of quality testing, the rate of expiration, and the availability of medicines. These indicators are important to improve access to medicines. Although the rational usage of medicines is equally important to determine the success of the public procurement systems (Singh et al, 2013), this paper only deals with the supply side of the medicines access issue.

The archival and statistical records (For example, tender reports, NMSF annual reports, action plans and so on) provided valuable insights about the reform of the NMSF that cannot be observed or noted in other ways, such as availability of medicines, and quality of medicines distributed by the NMSF. This allowed authors to trace changes during years prior and after the reform.

The study compares prices of awarded medicines with those that have been published in the International Price Indicator authored by Management Sciences for Health[2]widely known

[2] The MSH reference prices are the medians of recent procurement or tender prices offered by not-for-profit suppliers to developing countries for multi-source products, and can be considered a useful gold standard for procurement prices in the developing world. Price analysis was carried out at wholesaling and retailing level.

as IRP (MSH 2010). World Health Organization (WHO) set an arbitrary benchmark for the analysis of the medicine prices in the countries of its East Mediterranean Regional Office (WHO 2007). For the purposes of this study, we use the same benchmark to measure the efficiency of the tender by comparing the prices of awarded medicines with those have been published in the IRP.

3. Findings

3.1 Context when the reform started: the challenges

This section presents the situation in Sudan when the new NMSF's Director General has been appointed to familiarize the reader with context of the reform. It sheds light on local currency devaluation, decree for studying the possibility of NMSF's privatization, the American-led economic sanctions, and the media campaign against the new NMSF's Director General.

3.1.1 Local currency devaluation

There was one major event dominated the scene in Sudan during the reform period. This was the separation of the South of Sudan in July 2011. Following the secession of South Sudan, Sudan has experienced a significant loss in oil revenue and exports and, as a result, a decline in growth (World Bank, 2011). The crisis is affecting the availability of foreign currency with subsequent effects on the foreign exchange rate: the black market rate is currently estimated to be SDG8.30 for US$1, while the official US$ rate is SDG 4.4 (and SDG5.7 for the Euro). The second event is the liberalization of the local currency in 2012. Foreign exchange is an extremely important issue that requires support and cooperation from government groups outside the health sector (Ministry of Finance and Central Bank) where local currency is not freely convertible and demand for foreign exchange exceeds supply. Due to the economic crisis, the Central Bank of Sudan is restricting the availability of foreign exchange. These events have affected the NMSF capital budget. The devaluation of the Sudanese pound during 2011 jumped to 15% and shot up to 94% by the end of 2014 (Figure 1), that is resulting in NMSF experiencing barriers to access the foreign currency necessary for procuring medicines on the international market. To cope with this economic situation, which led to shortages of foreign currency, NMSF negotiates with the Central Bank of Sudan on prioritizing orders.

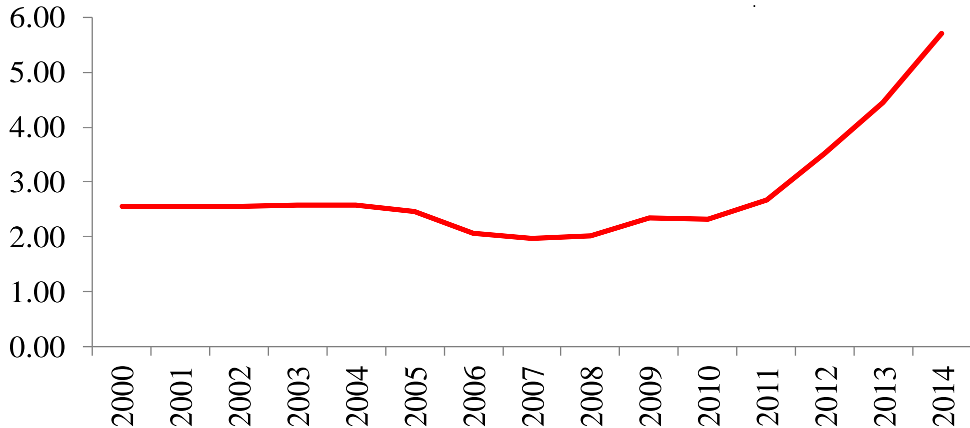
The lack of proper business accounting[3] poses a risk for working capital to be exhausted and threatening the sustainability of the medicines supply. An old SDG 71.24 million (US$30.71 million in 2009)[4] debt by National Health Programmes (SDG54.96 equal to US$23.69) and commercial customers, such as RDFs and community pharmacies (SDG16.28 equal to US$7.02) in the NMSF financial books is affecting the available working capital. This situation was exacerbated by empty warehouses (average of medicine availability was not more than 46%) and the liberalisation of the Sudanese pound in 2012. The devaluation of the local currency has resulted in a substantial (29%) decrease in the working capital of NMSF (from US$57.5 million in 2010 to US$44.5 million in 2014, despite the 36% increase in the working capital in SDG (from SDG133.3 million in 2010 to SDG253.54 million in 2014). For comparison: after the 50% devaluation, the Central Medical Supply Organisations of the West Africa states were practically deprived of liquidity (essentially equivalent to bankruptcy) and had to ask the donor community for new capital investments (Massow, et al 1998). To cope with the devaluation, the NMSF agreed with the suppliers to pay them 50% of

[3] The Government accounting system lacks essential management data to run NMSF efficiently

[4] In 2009, the time of the debt, exchange rate to US$ was 2.28 and it is 5.7 by the end of 2013

the proforma invoice in advance and to complete it after the receiving of goods. The Central Bank of Sudan, as mentioned earlier, has agreed to finance NMSF's purchases from abroad.

Figure 1: Annual Average of exchange rate of US$ TO SDG



3.1.2 Privatization decree

Some staff scare of the new Director General because he is an author of published article on the privatization of the NMSF before his appointment as NMSF director. They thought that he was coming to dissolve the NMSF. The suspicious increased in 2011, when the government appointed a committee to study the feasibility of NMSF privatization. The DG was a member of the committee. The committee on NMSF Privatisation concluded that full privatisation of NMSF is not an option as the public interest, in having essential medicines available and accessible all of the time, should prevail over profit-making. The committee recognised that a fully privatised NMSF would have profit as it first goal and consequently would therefore, potentially, reduce its focus on products that are life-saving but commercially not interesting, such as vaccines, narcotics and other medicines with restricted use, emergency stocks, and others.

3.1.3 Economic sanctions

The severities of the American-led economic sanction imposed on Sudan have limited the access to health services, in general, and resulted in the shortages of medications, in particular. NMSF suffers a lot in making international banking transactions because banks are either afraid, or can't be bothered to try and do business with Sudan. As a result, there is an imminent crisis, especially for life saving medicines. These medicines include medicines for cancers e.g. 6-mercaptopurin for children (an American-made medicine), hemophilia, and so on, but also for anesthetics, different prostheses, dialysis solutions, some vaccines etc. As a result, many run out of stock. The complications in transactions are challenges that face the NMSF reform. Although sanctions are not directly targeting Sudanese NMSF, measures imposed on Sudanese banks and trade restrictions have made importation of medical supplies extremely difficult for NMSF and thereby on patients across the country, who are facing difficulties in finding medicines imported from abroad. NMSF believes that these sanctions are taking the health of Sudanese people hostage, especially in regards to children and women.

3.1.4 Purchasing of registered medicines only

In Sudan, Medicines and Poisons Act 2009 compels premarketing authorization of pharmaceuticals, including those purchased through public tender (The Medicine Act 2009). Before the reform, NMSF did not comply with the law and staff at NMSF, generally, believe that the unlawful practice of purchasing non-registered medicines, using international open-tender improves affordability by getting cheapest medicines from the global market (e.g. in its last international open-tender of 2008, more than 95% of medicines that won the tender were not registered). But is this true? One of the reform targets, is to stop this extraordinary situation, which caused a number of scandals that were widely publicised in the media and national press. The purchasing of registered medicines in lieu of prevalence of substandard medicines worldwide can, in principle, be in the interests of both NMSF and drug importers and, therefore, improve public health, in general, and benefit patients, in particular. In its reform, NMSF decided to restrict purchases of medicines to registered ones only. Restricting NMSF's tender to the registered medicines only will give NMSF an opportunity to purchase safe, effective and quality pharmaceuticals without compromising affordability. By purchasing registered medicines, NMSF will avoid unnecessary loses due to hidden costs resulting from low quality medicines. However, this lawful requirement limits international procurement because registration process is complicated and time-consuming. To avoid such limitations, some flexibility is available to assure access to essential medicines under certain circumstances. These circumstances include no registered alternatives are available, registered medicines have no bioequivalence study; the supplier of the registered product has bad performance; and the price of the registered products is so high because of monopoly (e.g. one or two licence holders). Under these circumstances, NMSF is allowed to purchase non-registered medicines, either from their originators or generic versions from countries with effective pharmaceutical regulatory system, on condition that their suppliers must submit the registration dossiers of these medicines to the NMPB within 3 months from the date of issuing the first proforma invoice.

But this policy is not without challenges. One of these challenges is the existence of a number of medicines (e.g. narcotics) on the list of NMSF, which have no marketing authorization in Sudan. The policy needs special attention to avoid the possibility of stock-outs in the health system, increased prices and low availability of medicines at public health facilities. The second challenge is how can he, as a new leader, convince senior NMSF's staff, who are strongly believe that purchasing non-registered medicines improves affordability and increases availability, that the registered medicines will reduce the overall costs of pharmaceuticals and increase trust of patients in the health system.

3.1.5 Media campaign against the new NMSF's administration

NMSF faced a media campaign against the new NMSF's administration (NCA) by a group of pharmacists. These pharmacists tried to promote very isolated incidents to be a public issue through media. One example was Salbutamol solution (a medicine that used in hospital outpatient clinics to treat asthma) from a well-known supplier in Netherlands. The documents had been leaked by a member of staff of the National Medicines and Poisons Board (NMPB), the medicines regulatory authority of Sudan, who intentionally misled the media by claiming that NMSF imported a low-quality medicine from India (the origin of the medicine is Netherlands). NMPB reacted to the newspapers' coverage and recalled the product. The NMPB tested the product, and it was found complying with Pharmacopeia

specifications. Despite this fact and high quality of the product, the NMPB delayed the release of it for more than 10 months, when it was too late. NMSF has lost more than US$70,000 because the product passed its shelf life. Two persons, who have strong relation with the NMPB member of staff, took NMSF to consumer protection prosecution for distribution of substandard Salbutamol solution. However, they failed to confirm their allegation that medicine distributed by the NMSF was of low quality. The public prosecution acquitted the NMSF.

3.2 Procurement system

An effective procurement process at any level must ensure that four strategic objectives are achieved: the procurement of the most cost effective medicines in the right quantities, the selection of reliable suppliers of high-quality products, procurement and distribution systems that ensure timely and undisturbed deliveries, and processes that ensure the lowest possible total costs (Ombaka 2009).

In Sudan, according to the procurement act (Procurement Act 2010), all public institutions (including NMSF) must tender for commodities and services obtainable from multi-sources. In addition, there are many legal mechanisms by which NMSF purchases medicines and other medical supplies. However, the law allows direct purchase when medicine available only from a single source; price negotiation with pharmaceutical firms; and emergency purchase. As from its name, the latter, is made to meet an emergency situation. For example, emergency purchase is conducted due to the failure of the supplier to supply the ordered item in time. Recently, NMSF starts signing 5-year contract to purchase certain medicines at fixed price.

The public sector, through the NMSF, procures almost 35% of all the medicines consumed in Sudan. Procurement of medications in the NMSF is performed through a bidding process, with competition between participants. In its reform, NMSF has shifted from a policy that emphasizes cost as the primary consideration when choosing between competing producers to a policy of quality-assured medicines. According to the new policy, cost becomes after the quality of the product and the performance of its supplier. Considering the limited resources, the challenge for NMSF is to plan the medicines procurement process in order to achieve its objective: the value for money.

The National Medicines Policy (NMP 2005) has adopted the procurement of generic medicines provided that the efficacy, safety and quality are proven. This policy has been considered both nationally and internationally as a strategy to decrease costs and promote access to medicines (Homedes and Ugalde 2005; King and Kanavos 2002). NMSF establishes preference for generic medicines in its purchases, when prices and other procurement conditions are equal. The registration of medicines and the use of International Nonproprietary Name in public health facilities are the must according to the medicines and poisons act (The Medicine Act 2009).

3.2.1 NMSF's Tender procedures

Medicine procurement in public sector is a complex process. It involves many steps, such as selection and quantification. This is done in consultation with hospitals, and national health programmes. In the NMSF, procurement of medicines is based on their generic names. However, suppliers of brand name may also compete, but their bids must be in generic names. The NMSF policy requires certain medicines to be secured from their originators.

These pharmaceuticals include medicines of narrow therapeutic index, biopharmaceuticals or medicines in a high-risk therapeutic category (e.g. anticoagulants).In addition to tender's documents that are legally required (such as, free tax certificate), bidders must provide 5 free samples of their products to be assessed by quality control pharmacists for evaluation purposes. Because most medicines are registered, the quality judgment is mostly based on the visual inspection of the sample and verification of technical documents, such as certificate of pharmaceutical product.

3.2.2 Updating of NMSF list of medicines (Selection)

NMSF committee for updating medicines' list depends on the current lists of national health programs. These programs include: free medicines program, national blood bank, renal dialysis and transplantation program, and National Centre for Oncology. The NMSF' pharmacists were involved as a part of a multidisciplinary approach to medicine selection and updating. Initially, the series of negotiations with main public beneficiaries of NMSF, including directors of free medicines project, national health programmes, the blood bank and leading clinicians, was performed to establish medicine and medical supplies tender lists. In such negotiations, the NMSF pharmacists insisted on several principles, which are considered essential for good medical practice, such as: implementation of WHO essential medicine policy and rational use of medicines as much as possible; and discussion within the framework of evidence-based medicine. When consensus was reached among all stakeholders and to address the quantities of necessary medicines as well as recent fluctuations in disease patterns or drug consumption, the tender list has been prepared immediately prior to the tender release.

3.2.3 Electronic procurement: development of software

Electronic Procurement (e-Procurement) system has been developed as a component under purchasing and subcontracting module of NMSF's ERP system. Interested pharmaceutical companies apply for the registration through NMSF's website. After approval of the registration, the applicant received a username and password. Procurement team posted detailed specifications of tender's items in a Request For Quotation (RFQ) format. The RFQ closure time is specified. The RFQ would remain open till the specified closing time. The suppliers provided their offers through 'supplier offers submission activity', which has been developed to be as easy and simple as possible to allow suppliers easily provide their offers. Submitted offers remain in a draft status till suppliers 'Send and Confirm' the offer. Offers, which are not confirmed, can be modified at any point of time till their confirmation. Offers are stored in encrypted format, and decrypt automatically only after the specified RFQ closure time. Then all offers of bidders are displayed to the bidders in very transparent manner. Each bidder has received and email attachment with all bids. Received offers have been sorted out automatically in ascending order according to the unit price only. The Tender committee decided on each item using previously agreed criteria that has been posted on the NMSF website (Figure 2).

Figure 2: Steps of the e-Tender

Training and Technical Support: to train a focal person from interested companies on "how to register" and, later on, participate in online tender, NMSF has established a computer's skill laboratory that has been equipped with 18 computers. The IT department of NMSF conducted a one-time training and familiarization session. Each session lasts for 15 to 60 minutes, depending on the trainee's skills. This training continued for 47 days and benefited 180 pharmacists representing 113 medicine companies. The participants also have been trained on online process and how to fill the tender document. The training included telephonic support at the time of online tender process. IT department provided technical support as and when required for the application. The support is also available for all the medicine companies. If bidders while submitting the quotations encounter technical issues, support to resolve them is available from IT department through 24X7 help desk. In this regard, the IT team answered queries received from drug companies through emails by sending more than 70 messages. The team has published answers of frequently asked questions on the NMSF website. The team actively made 300 telephone calls to registered companies asking them, if they need any help. A member of IT team visited two companies at their premises to help them.

Displaying of electronic bids

On 15th March 2015 at 12pm local time, NMSF has displayed its historical tender in front of more than 150 representatives of drug companies. HE, the Federal Minister of Health and Director General of the National Health Insurance Fund witnessed the displaying of the offers. The Minister addressed the meeting. He acknowledged the contribution of drug companies and highly appreciated the transparency of the NMSF. The NMSF called it historical because it is the first one of its kind. First, all public health organizations (such as National Health Insurance Fund, Military Medical Services, Police Medical Services, Revolving Drug Fund of Khartoum and other States) participated in this tender (i.e. implementation of pooled procurement presidential decree for the first time). Second, it is the first electronic tender in Sudan, which worth €160 million for two years. All bidders have submitted their offers (more than 145 quotations) electronically.

Advantages of e-Procurement

Security: high level of security has been ensured through a trustworthy access-control technology. NMSF's IT department maintained security not only of the data that is stored on the server but also of the information that is in transit, such as quotations being sent to the server by the bidders. Modification of the bid is permitted before the submission. After the sending of the quotation, neither the bidder nor NMSF's IT staff has access to bids. The bidder could save a PDF copy of its bid(s). The offers received electronically have been stored in a time locked system, which only opened by the authorized Tender Opening Committee on the tender closing date and time.

Low costs: e-tender is fast and efficient process, which reduces the procurement cycle time. For example, the e-tender reduced the adjudication time from 90 working days to only 15 days. It is therefore decreasing the lead-time, which in turn reduces the inventory required to be maintained thereby resulting in reduction in cost. Using e-Procurement also offer gains in terms of efficiency and effectiveness. It eliminates paperwork, rework and errors. The e-tender reduces cost of transactions and enhance value-for-money. This can be measured in terms of increased competition. The number of drug companies, which their bids have been successfully received was 93 compared to 53 participants in previous tender conducted manually in 2011. As presented in table 1, the NMSF has received quotations for more than 600 items out of 785 (682 medicines and 103 consumable items). By making the procurement process paperless, e-tender helps in reducing stationery and warehousing cost significantly. For example, NMSF can issue any number of amendment online at no additional costs.

Table 1: Number of bidders and quotations received

	2015	**2011**
Items on the tender list	785	520
Expected amount of the tender in euro	200,000,000	65,000,000
Number of companies collected the tender book	113	53
Number of companies that completed e-registration	112	-
Number of companies submitted e-quotations	93	-
Number of quotations received from companies	145	63

High transparency: bids of all the suppliers were displayed in front of the representatives of bidders in a transparent manner. The system provided comparative report of all offers to those who submitted quotation 15 minutes later after the display. All bidders' representatives express their appreciation of high transparency and excellent organization of the meeting. The minister asked them clearly if they have any question or negative comments or if someone face any problem? In consensus, they thought there would be nothing more than what they have seen. Figure 3, showed the bidders' responses that have been received via anonymous questionnaire. The system inspires confidence among bidders as being fair and transparent. All tender information are publicly available on the NMSF website. Such procedures enhance the confidence of bidders in the NMSF's tendering system, promote transparency and reduce opportunity for corruptive and fraudulent.

Figure 3: Suppliers feedback on the e-tender

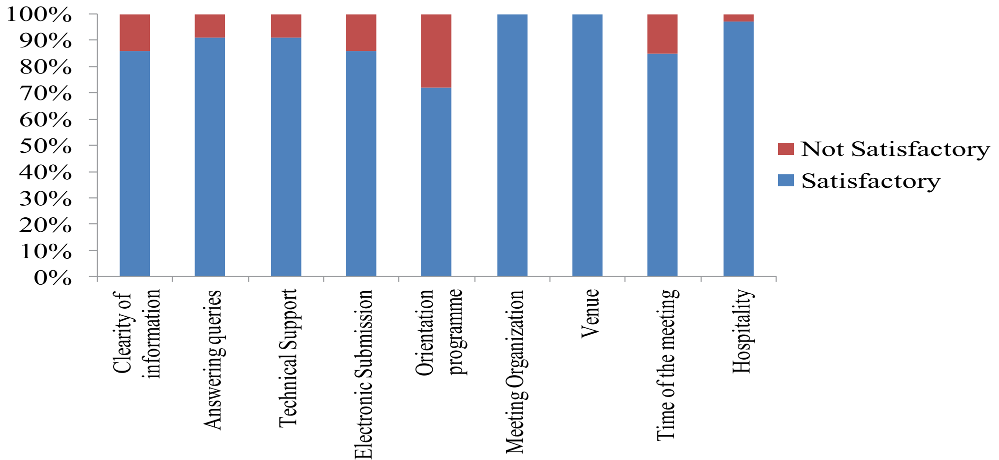


Photo 1: The day of tender's opening

The Minister (in the middle) addressing the bidders

Representatives of bidders witness the displaying of bids

A representative of a company signed in front of the committee

Representatives of Bidders checking their quotations

Increased purchasing power: pooled procurement through e-tender results in increased purchasing power to negotiate better prices from suppliers. The saving that has been made as a result of pooled procurement, in its first time, exceeds €10 million.

Benefits to bidders: the e-tender benefits bidders by making tender information available on

the NMSF' website. It also reduces the transaction cost, as the requirement of unnecessary trips to the NMSF and communication to find the required information gets eliminated. Further, e-tender decreases stationery cost as the drug company no longer needs to submit bulky multiple copies of its bid in the paper form. Also the companies can submit the bid from their office in Sudan or from abroad and need not to visit the NMSF for bid submission. Furthermore, local agents and their principals from abroad can fill in the tender or access of tender status anytime, from anywhere. Finally, e-tender software allows the bidders to modify their offers before the bid is submitted online. After the submission, nobody can modify or view the bid information.

Shortcomings

All necessary documents, such as tax payment proof, had been submitted as hard copy to meet requirement of procurement act. In the next tender and in compliance with the new automation policy of MOF, the NMSF will get a permission for the acceptance of scanned copies of these documents to be submitted electronically as a part of the bid.

3.2.4 Tender higher committee

The NMSF's tender committee is chaired by the NMSF's Director General and comprising 32 members from different government ministries (such as Federal Ministry of Health (FMOH), Ministry of Finance and Economy Planning (MOF), Ministry of Interior) and governmental agencies (For example, National Health Insurance Fund, National Medicines and Poisons Board). This committee approves the tender document, which states, among others, specifications and conditions of the tender, and its closing date. The procurement general directorate acts as a secretariat for the tender committee. It determines the required quantities based on past consumption data. The tender is conducted biannually and last tender overall value about 150 million Euros. The time obtained to declare the results of the tender adjudication has been reduced from 6 months in 2008 to 4 months in 2011 and dropped to less than 15 working days in 2015. This huge reduction is mainly due to implementation of electronic tender in 2015.

Open-Tender's committee on verification of bidder's documents: In the second step, the NMSF tender committee granted a sub-committee from the procurement department the duty to verify legal documents that should be submitted with bidder's offers. To fulfill such a task successfully, the sub-committee's pharmacists worked closely with the legal advisor and internal auditor of the NMSF, and representatives of the MOF.

Open-Tender's technical advisory committee: The tender committee appointed a technical advisory committee to lead the process of finding the best offering among tender applications and to make recommendations. In preparation for the tender adjudication, the technical committee collected and analyzed price data for medicines on the tender list. These data included: last tender price; last purchase price offered to the NMSF; Cost, Insurance and Freight (CIF) price published by the NMPB; selling price of the medicine to the pharmacy shops in Sudan; the price of medicines in the International Price Indicator (MSH 2010); supposed CIF price according to the regulations on pricing of registered medicines marketed in Sudan; prices from domestic medicine manufacturers; and price of the medicine in latest edition of British National Formulary (BNF 2011). In addition to this information, the registration status of the medicines, whether it is prequalified by WHO (in the case of vaccines, anti-tuberculous and anti-malarial medicines) and the past performance of its supplier were also checked.

NMSF has a policy that emphasizes overall cost as the primary consideration when choosing

between competing suppliers of quality medicines. The analysis of the technical committee resulted in two types of recommendations: the first involved the purchase of registered medicines whether generic or brand product and in both cases the committee considers quality of the product and performance of the supplier before the price in order to achieve the value for money goal. The second type of recommendations is for the purchase of non-registered medicines, despite the existence of registered one. The committee must support its recommendation with strong justifications, such as a registered medicine has no bioequivalence study; the supplier of the product has bad performance; the price is so high; the product has narrow therapeutic index or biosimilar one. In this case the recommended medicine must be marketed in a country that has a well-established medicine regulatory authority, originator product or prequalified by WHO. Due to existence of number of medicines (e.g. narcotics) on the tender list which have no marketing authorization in Sudan, the tender committee decided to accept them on condition that their suppliers must complete the registration of such medicines. This is to avoid the possibility of stock-outs in the health system.

Criteria to grant the tender have been set to be strict and transparent for all participants (Table 2). The quality, the lowest price and the guarantee of sufficient quantity are amongst these criteria. Recognizing that the winners have to be rewarded sufficiently, as there are otherwise no incentives to participate in the program, it is the NMSF's policy to award only one winner. However, in certain sensitive items, such as intravenous fluids, additional quantity (20%) has been given to the second winner. In this case the second winner must meet the first winner price and other facilities, if any. The price depends on the category of the country of origin according to the World Bank classification of states according to their income (high, low and middle). This policy is adopted to prevent shortages of medicines, which could endanger the safety of the populations' health and this has to be prevented at all time. In the rest of its items and where it is more likely that shortages would occur because of only one winner, and to avoid such shortage, NMSF nominates the second lowest bid as a backup. When the preferential supplier cannot deliver the sufficient pharmaceuticals, the backup supplier will provide those pharmaceuticals. NMSF needs to state in the contract that the winning supplier who failed to supply its awarded items has to bear the extra costs.

Table 2: Supplier's Performance Measures

Description	Score
1. Past experience of good performance	10
2. Substitution of rejected item(s) (in kind or in cash)	10
3. Response to enquiries	10
4. Delivery time	10
5. Adherence to delivery instructions	10
6. Provision of documents	10
7. Packing	10
8. Labeling (e.g. NMSF and its Logo)	10
9. Expiring product policy (Shelf life)	7
10. Payment facilities	7
11. Cost improvement	6
Total	100

Open-Tender's negotiation committee: The tender committee also formulates a negotiation committee, to negotiate with winners for further discount. The main functions of the negotiation committee are to prepare in advance the information on prices; research the prices of the awarded medicines as part of background information for the negotiation; negotiate the winners for further discount; and execute appropriate negotiation strategies to get the maximum value for money. The negotiation has resulted in the saving of €8million compared to €2 million in 2011 tender. Table 3 shows the details of saving that has been offered by 43 (68%) out of 63 companies which won in 2015 tender.

Table 3: Prices of Medicines before and after Negotiation

	Agent	N[1]	Amount (€) Before Negotiation	Amount (€) After Negotiation	Saving (€)	%
1	Kambal International Company	40	10,824,065.20	9,376,099.20	1,447,966.00	13%
2	PhramaIxir Co.LTD.	16	7,294,525.00	6,434,275.00	860,250.00	12%
3	Elshifa Pharmaceutical Industries Co ltd	23	3,933,950.00	3,201,930.00	732,020.00	19%
4	Dew international company for investment	15	8,137,460.00	7,587,662.00	549,798.00	7%
5	Raheeg Medical Company	32	9,682,362.40	9,260,466.40	421,896.00	4%
6	SudanAmco for Import and Export Co.	7	13,205,000.00	12,840,000.00	365,000.00	3%
7	Almotatawira forImport & Export	1	3,320,000.00	2,960,000.00	360,000.00	11%
8	K. A. Bodourian & Co. Ltd.	12	1,633,774.17	1,285,099.30	348,674.88	21%
9	Hiba Drug Company Ltd.	2	964,840.00	623,500.00	341,340.00	35%
10	Elshimalia Chemical & Medical Enterprise	20	1,614,340.00	1,327,155.00	287,185.00	18%
11	Marwaco Commercial Enterprises ltd.	22	2,709,604.96	2,436,517.64	273,087.32	10%
12	Alwaad Medical Co.	35	6,496,419.05	6,227,110.48	269,308.57	4%
13	Elhussien Commercial AG. for Chemicals	21	5,619,352.00	5,411,082.00	208,270.00	4%
14	DAL Medical Sevices Company Ltd.	52	26,268,072.56	26,060,348.68	207,723.88	1%
15	Dr.Nabil Pharmaceutical Co. Ltd	19	5,593,263.30	5,441,038.70	152,224.60	3%
16	EANA Medical Services and Investment Co.	3	2,711,648.00	2,575,953.60	135,694.40	5%
17	M.A Medics service co,ltd	3	1,000,000.00	900,000.00	100,000.00	10%
18	Salmawit Pharmaceuticals and Medical Int	10	1,278,559.00	1,185,238.00	93,321.00	7%
19	Fast International Co. Ltd	22	3,349,860.50	3,262,550.50	87,310.00	3%
20	Shanghai,Sudan Pharmaceutical Co., Ltd.	2	4,928,000.00	4,849,200.00	78,800.00	2%
21	Sudanese Medical Agencies	7	6,021,530.00	5,945,730.00	75,800.00	1%
22	Al Haitham Chemicals & Pharmaceuticals	5	3,602,500.00	3,527,100.00	75,400.00	2%
23	Africa Medical Company	1	937,500.00	862,500.00	75,000.00	8%
24	Shaweesh Int.Co. Ltd.	27	1,295,271.32	1,239,778.52	55,492.80	4%

Table 3: Continue

	Agent	N[1]	Amount (€) Before Negotiation	Amount (€) After Negotiation	Saving (€)	%
25	N.S.F Pharmaceuticals	5	588,700.00	543,700.00	45,000.00	8%
26	Abdelmoniem Chemical and Pharmaceutical	8	904,710.00	862,000.00	42,710.00	5%
27	Wafrapharma lab	2	225,000.00	188,000.00	37,000.00	16%
28	Alpha Medical Agencies Co. Ltd.	7	1,998,624.84	1,962,224.84	36,400.00	2%
29	Rebooa Medical Company	19	812,415.00	778,125.00	34,290.00	4%
30	Pharmacare Company limited	5	626,800.00	592,800.00	34,000.00	5%
31	Al khalidia Medical Tecnology	1	423,000.00	400,000.00	23,000.00	5%
32	Shima Medical Co. Ltd	7	1,518,360.00	1,495,920.00	22,440.00	1%
33	Global Channel	2	238,320.00	219,800.00	18,520.00	8%
34	Medica Import & Distribution	7	2,132,910.00	2,115,717.00	17,193.00	1%
35	Azal Pharmaceuticals	6	271,253.33	254,140.00	17,113.33	6%
36	Samasu Medical and educational services	2	212,700.00	199,500.00	13,200.00	6%
37	Health Care Pharma Ltd	1	136,500.00	123,900.00	12,600.00	9%
38	Tabasheer Meical Co.Ltd.	7	519,513.20	507,213.20	12,300.00	2%
39	Torque for Pharmaceutical Services Co. Ltd	1	240,000.00	228,000.00	12,000.00	5%
40	Landmark International Co.Ltd.	4	203,520.00	193,920.00	9,600.00	5%
41	Desert Star Company Ltd	3	74,076.00	67,326.00	6,750.00	9%
42	Mathely Trading and Drug Enterprises	9	270,575.00	265,055.00	5,520.00	2%
43	Almahdi Global Company .Ltd	4	184,900.00	183,650.00	1,250.00	1%
Total		497	144,003,774.83	136,001,326.06	8,002,448.78	6%

[1] N = Number of items

3.2.5 Analysis of open-tender

The tender list consisted of 785 compared to 509 items in 2011. Unfortunately for 163 items (77 in 2011), the NMSF received no offers. The medicine list contains 659 pharmaceutical formulations. The remaining (126 items) were medical consumables. As high as 161 companies (some of these companies have more than one manufacturing site) from abroad have participated in the tender of 2015 through 93 local agents compared to respectively 178 and 51 in 2011. The winners included 131 (81%) companies and 63 (68%) agents. Therefore, 584 (74%) tender items have been selected for purchasing, which represented the total expenditure of about €149.5 million. In addition, there are 2 local manufacturers have been awarded out of 4 participated in this tender. This amount has been achieved after a successful negotiation, which resulted in a total cost savings of €8million. The analysis of the prices of 143 overlapped items of tender 2015 and private sources reveals that, if these medicines were purchased on the domestic market, the total costs would have been increased by 341% (i.e. from €50.4million to €225.6million). The difference between tenders and private prices

ranges from 2% to 96%. It is also important to notice that the amount of the same quantities of the overlapped medicines decreased by 20% (i.e. from €59.4million in 2011 to 49.4 in 2015). This big difference between two tenders is mainly due to the implementation of the unified pool procurement in 2015. The bidders offer the best possible prices because, if they do not win in this tender, they will be shut out of the public market for the coming two years.

As shown in tables 4 and 5, in this tender, NMSF has managed to secure 38% (51% in 2011) of its medicines from countries that have well-established medicine regulatory agencies[5] (i.e. well controlled pharmaceutical markets). However, the absolute amount of medicines from these sources increased from 22.6million in 2011 to €43.5 million. It is the preference of NMSF to secure quality generic medicines from well regulated pharmaceutical markets. This is because in Sudan, NMPB does not require bioequivalent study to prove the safety and efficacy of generic medicines. Although generic medicines may contain the same active ingredient, concentration, pharmaceutical form, and dosage as the originator drugs, they do not necessarily meet quality specifications of the innovators and this may potentially impact their effectiveness and safety profile. Therefore, a generic product may not be bioequivalent to the originator version, or of equal quality. As mentioned, the availability of quality medicines is essential for patients. Coreale and colleagues (2014) reported that although generic therapies can appear attractive owing to their low acquisition price, this may be offset by the potential risks, such as lack of treatment efficacy or unexpected safety issues from impurities or altered bioequivalence, arising from poor quality control in excipient selection, manufacturing processes, and packaging. The tendering process should promote the procurement of low price but quality products (Kaplan et al 2012). The NMSF's partners, especially NHIF, mainly focus on acquisition cost medicines, regardless of product cost-effectiveness. The NMSF and NHIF need to apply the principles and methods of pharmacoeconomic evaluation in the tender adjudication exercise.

Table 4: Sources of Awarded Medicines and Medical Consumables

	2015				**2011**			
	N	**%**	**Amount in €**	**%**	**N**	**%**	**Amount in €**	**%**
Medicines:								
Regulated Markets	178	38%	43,523,232	32%	141	51%	22,576,383	46%
China, Egypt, India and Pakistan	153	32%	44,666,045	33%	89	32%	18,531,246	38%
Others	142	30%	47,613,383	35%	47	17%	8,002,339	16%
Total	473	81%	135,802,659	91%	277	64%	49,109,968	82%
Consumables:								
Regulated Markets	48	43%	7,318,296	53%	68	44%	3,066,567	29%
China, Egypt, India and Pakistan	31	28%	2,629,951	19%	70	45%	2,152,313	20%
Local Market	0	0%	0.0000	0%	4	3%	1,018,780	10%
Others	32	29%	3,800,107	28%	13	8%	4,318,710	41%
Total	111	19%	13,748,355	9%	155	36%	10,556,370	18%
Grand Total	584	100%	149,551,014	100%	432	100%	59,666,338	100%

[5] The list of these countries has been published by the NMPB

Table 5: Countries of Origins of Awarded Medicines

	Country	Manufacturers		Items			
		N	%	N	%	Amount in €	%
1	Saudi Arabia	5	4%	32	6%	23,152,265.00	15.53%
2	Germany	15	11%	61	11%	19,652,786.90	13.18%
3	India	27	21%	127	22%	19,241,901.22	12.90%
4	Egypt	18	14%	48	8%	16,111,231.80	10.81%
5	Jordan	7	5%	53	9%	12,786,363.00	8.58%
6	China	4	3%	8	1%	9,769,800.00	6.55%
7	France	7	5%	30	5%	9,633,375.00	6.46%
8	United Arab Emirate	1	1%	24	4%	5,205,337.20	3.49%
9	Italy	2	2%	6	1%	5,056,300.00	3.39%
10	Belgium	3	2%	39	7%	4,882,367.98	3.27%
11	Austria	3	2%	6	1%	3,626,425.00	2.43%
12	Sweden	1	1%	17	3%	3,005,792.60	2.02%
13	Pakistan	5	4%	14	2%	2,656,367.40	1.78%
14	Japan	1	1%	3	1%	2,575,953.60	1.73%
15	United Kingdom	5	4%	17	3%	2,078,444.34	1.39%
16	Switzerland	4	3%	14	2%	1,725,556.08	1.16%
17	Indonesia	1	1%	5	1%	1,710,317.00	1.15%
18	United States of America	2	2%	6	1%	1,050,000.00	0.70%
19	Spain	1	1%	5	1%	828,770.00	0.56%
20	Netherlands	1	1%	5	1%	728,082.24	0.49%
21	Portugal	2	2%	5	1%	607,500.00	0.41%
22	South Korea	1	1%	3	1%	600,000.00	0.40%
23	Turkey	1	1%	1	0%	510,300.00	0.34%
24	Canada	1	1%	8	1%	395,540.00	0.27%
25	Philippines	1	1%	1	0%	380,000.00	0.25%
26	South Africa	1	1%	7	1%	288,857.30	0.19%
27	Malaysia	3	2%	6	1%	231,550.00	0.16%
28	Greece	1	1%	2	0%	219,800.00	0.15%
29	Cyprus	1	1%	9	2%	182,760.00	0.12%
30	Denmark	1	1%	4	1%	121,263.20	0.08%
31	Poland	1	1%	3	1%	37,500.00	0.03%
32	Hungary	1	1%	2	0%	25,950.00	0.02%
33	Thailand	1	1%	1	0%	17,400.00	0.01%
34	Syria	2	2%	4	1%	13,017.30	0.01%
Total		131	100%	576	100%	149,108,874.16	100%

NMSF's awarded products are mainly generic pharmaceuticals. In the tender of 2015, generic pharmaceuticals cover 85% of the awarded medicines. The total amount of awarded generic is €125.05 million (84%). The remaining 15% are brand products and equivalent to €24.06 (16% of the total amount). As presented in table 6, the top three pharmacological groups (in terms of value) were medicines intravenous fluids and electrolytes (20%), used for infections (20%), and immunologicals (13%).

Table 6: Pharmacological Classification of Awarded Pharmaceuticals

	Pharmacological Group	Amount €	%
1	Fluids and electrolytes	27,647,875	20%
2	Anti-Infective medicines	27,323,284	20%
3	Immunologicals	17,376,172	13%
4	Ophthalmological preparations	9,181,371	7%
5	Endocrine medicine	7,956,830	6%
6	Gastrointestinal Medicines	7,713,457	6%
7	Analgesic antipyretic &NSAI medicines	6,809,386	5%
8	Antineoplastic and immuno-suppressives	6,496,468	5%
9	Medicines affecting the blood	5,389,171	4%
10	Cardiovascular medicines	4,217,913	3%
11	Anaesthetics	3,498,206	3%
12	Blood products and plasma substitutes	2,769,420	2%
13	Diuretics	2,305,827	2%
14	Vitamines & Minerals	1,583,180	1%
15	Dermatological medicines	1,469,121	1%
16	Medicines used in ear , nose , throat & dental care	1,081,300	1%
17	Medicines acting on the respiratory tract	903,496	1%
18	Psychotherapeutic medicines	864,453	1%
19	Anticonvulsants	862,061	1%
20	Antidote and other substances used in poisoning	512,492	0.38%
21	Disinfectants antiseptics and irrigation solutions	103,500	0.08%
22	Drugs used in neuro-muscular disorders	83,920	0.06%
23	Antiparkinsonism and related medicines	57,990	0.04%
	Total	136,206,891	100%

The top five pharmaceutical dosage forms comprise 270 million tablets, 199.4 million injections, 178 million capsules, 76.3 million bottles of oral suspension/solution and 10.5 million tubes of creams/ointments (Table 7).

Table 7: Dosage Forms

Dosage Form	Unit	Quantity	Amount in €	%
Syrup and Suspension	Bottle	76,289,950	41,732,390	45%
Injection	Ampoule	199,408,300	22,073,172	24%
Tablets	Tablet	269,765,000	12,837,500	14%
Drops	Dropper	5,639,900	7,451,121	8%
Cream and Ointment	Tube	10,533,700	4,256,611	5%
Powder for Injection	Vial	1,980,000	2,665,720	3%
Capsules	Capsule	25,462,000	1,512,578	2%
Spray	Canister	116,680	620,089	1%
Total			93,149,182	100%

Registration status of awarded medicines

One of the reform objectives is the compliance with laws and regulations that regulate circulation of medicines in Sudan. In this regard, 80% (83% of the total amount) of the awarded medicines have marketing authorization (registered) in Sudan (Table 8) compared to 77% in 2011 and only 4% in the tender of 2008. Although the absolute number of non-registered items increased from 65 in 2011 to 94 medicines in 2015, the percentage slightly decreased from 23% in 2011 to 20% in 2015. This situation is far better than it was before the reform (i.e. in the tender of 2008) when 495 (96%) of medicines had no marketing authorization in Sudan. According to the directions of the NMPB, 87% (58% in 2011) of non-registered medicines will be purchased from well-regulated markets.

Table 8: Registration Status of Awarded Medicines

	2015				**2011**			
	N	**%**	**Amount in €**	**%**	**N**	**%**	**Amount in €**	**%**
Registered Medicines								
Regulated Markets	96	25%	24,575,099	22%	103	49%	16,985,819	40%
China, Egypt, India and Pakistan	144	38%	41,432,345	37%	79	37%	17,934,098	42%
Others	139	37%	47,154,582.56	42%	30	14%	7,543,112.00	18%
Subtotal	379	80%	113,162,026	83%	212	77%	42,463,029	86%
Non-registered Medicines								
Regulated Markets	82	87%	18,948,133	84%	38	58%	5,590,564	84%
China, Egypt, India and Pakistan	9	10%	3,233,700	14%	13	20%	754,960	11%
Others	3	3%	458,800.00	2%	14	22%	301,415.00	5%
Subtotal	94	20%	22,640,633	17%	65	23%	6,646,939	14%
Grand Total	473	100%	135,802,659	100%	277	100%	49,109,968	100%

In 2015, the NMSF enforced to purchase non-registered medicines because there were no registered alternatives (87%), the local agent refused to participate in the tender (9%) or the local agent is black listed by NMSF (4%). However, NMPB has exempted importation of certain medicines from marketing authorization on condition that the agent(s) of such items starts registration procedures within 3 months after the submission of the first proforma invoice to the NMSF. The exempted medicines comprise medicines with no registered alternatives; registered item(s) but their agent(s) denied the participation in the tender; one competitor with high price (i.e. to break monopoly); genetically modified biopharmaceuticals; or medicines with narrow therapeutic index.

Tender prices

According to WHO (2007), prices of publicly procured medicines are considered "acceptable" if they have a median price ratio of 1 or less than 1, which means that the price of the awarded medicine is the same or less than the IRP of the same medicine. The analysis revealed that the prices of 68% (64% in 2011) of the awarded medicines were ≤ 1. It is important to notice that 82% (85% in 2011) of these medicines have marketing authorization in Sudan (Table 9). Despite 96% of awarded medicines in 2008 had no marketing authorization, only 9% of the prices of non-registered medicines were ≤ 1. This finding proves that the allegation that the unlawful purchasing of non-registered medicines before the reform had no effect on the prices. Further analysis of the awarded medicines with median price ratio less than one reveals that almost 30% (€10.3million) and 31% (€13.0 million) of these medicines were originated from well-controlled markets in 2015 and 2011 respectively. This means that shifting to quality medicines from well-controlled markets, instead of cheap medicines from less regulated markets is more cost-effective to achieve the goal of the medicine procurement.

Table 9: Comparison with IRP (i.e. awarded price/IRP)

	N	%	Amount in €	%	Registered items			
					N	%	Amount in €	%
≤ 1	195	68%	69,506,564	73%	160	82%	61,935,495	75%
1.1 to 4.99	78	27%	23,371,037	25%	56	72%	19,368,145	23%
5 to 9.99	4	1%	874,400	1%	2	50%	656,500	1%
More than 10	9	3%	1,223,552	1%	6	67%	938,700	1%
Total	286	100%	94,975,553	100%	224	78%	82,898,839	100%

The ABC-analysis reveals that the amount of medicines (99 items) in group A equals €119.5 million. As shown in table 10, 80% of the medicines in this group, are registered medicines (equivalent to 81% of the value). It is important to notice that 40% (€37.5million) of the medicines in this group originated from developed world.

Table 10: ABC-Analysis for the Awarded Medicines According to their Registration Status

Class	All medicines				Registered medicines only			
	N	%	Amount in €	%	N	%	Amount in €	%
	(a)	a/b	(c)	c/b	(d)	d/a	(e)	e/c
A	99	17%	119,467,060	80%	79	80%	97,230,627	81%
B	147	25%	22,558,725	15%	104	71%	15,897,018	70%
C	338	58%	7,525,230	5%	267	79%	5,636,410	75%
Total (b)	584	100%	149,551,014	100%	450	77%	118,764,055	79%

3.2.6 Long term contract

NMSF signed 5-year contracts with the local agents of 97 items (24 medicines and 73 medical consumables with different sizes) and belonging to 14 manufacturers, mainly multinational companies. Total amount of the long term contracts with local agents is €94 million. The saving made is €8 million. Advantages include fixed price during the contract, unless under certain circumstances; printing of the NMSF's logo and retail price; and assurance of continuous, uninterrupted flow of medicines; supplies received every three months. Finally, patient compliance could become a problem, especially for patients with chronic illness, if they have to switch their pharmaceutical every time the contract is granted (Maarse 2009). The long term contract will mitigate the negative implication of frequent tendering. A solid legal framework has been present for long-term contract, as pharmaceutical suppliers may challenge the procedure. The long term contract (i.e. 5-year supply contract) will be renegotiated under certain circumstances. Such circumstances comprise major changes in euro price or when a new medicine with high value for money enters the market, or when one of the parties failed to fulfill its obligations. The contract's extensions could be offered as long as preferred suppliers maintain their best-discounted price status.

3.2.7 Analysis of closed tender: local manufacturers

Sudan has 18 pharmaceutical manufacturers. In addition, there are 6 producers of medical gases and one manufacturer of disposable syringes. Most of the manufacturers operate below their production capacities with an approximate market share of 30% (FMOH, 2010 and 2014). In order to support the domestic pharmaceutical industry, it is the policy of NMSF to give preference margins by conducted a separate tender restricted to local manufacturers. This is because the purchase of locally produced medicines from domestic manufacturing plants can be economically attractive, especially if they compete with overseas suppliers. In addition, the advantages of local manufacturers comprise the payment in local currency, the communication and transport cost are much cheaper, frequent inspection by the NMPB, and there is no need for a quality test, since items are only tested before release. Finally, the procurement act has required that public firms purchase their needs from local manufacturers, unless public firms could show that overall costs (including the landed cost) of imported goods is at least more than 10% less than those produced by the local firms.

Since beginning of the reform, and inline with the government policy of development of pharmaceutical manufacturing, NMSF executed two tenders restricted to the local manufacturers in 2011 and 2014. This section analyses the results of the last closed tender

that has been implemented in 2014. It also presents the measures that have been adopted by NMSF to mitigate drawbacks of the government's policy of supporting local pharmaceutical manufacturers.

Analysis of closed tender

Overall list of NMSF comprises 882 items (683 medicines and 199 medical consumables). As shown in table 11, the local manufacturers have limited product portfolios and were able to submit offers to 144 items out of 170 requested by the NMSF in its tender of 2014. The awarded items were 125 out of 144 items participated in the tender in 2014. The rest of the items either shifted to the open-tender (30 items), secured directly from the local market (eight items) or cancelled altogether (seven items). The total amount of the awarded items from local pharmaceutical manufacturers increased from US$5 million in 2011 to US$48 million in 2014. This is unprecedented restricted tender conducted by NMSF to support national pharmaceutical industry. The pooled procurement and the project of free medicines for under-five children are the main reasons behind such big tender. Participation of four manufacturers and in addition to Amipharma, which refused to participate in the tender of 2011 claiming that NMSF might compete them in the private sector, also contributed to this leap in the amount of the local pharmaceutical tender.

Table 11: Comparison Between Closed Tenders for Local Manufacturers

	2014	2011	Change	%
Items requested by NMSF	170	78	92	118%
Number of Manufacturers collected tender book	13	12	1	8%
Number of Manufacturers submitted quotations	12	8	4	50%
Number of bidders fulfilled tender conditions	12	7	5	71%
Number of items with offers	144	60	84	140%
Number of items with no offers	26	18	8	44%
Number of items with more than one offers	67	19	48	253%
Number of items with one offers	77	41	36	88%
Number of Awarded Items	125	31	94	303%
Number of items shifted to the open-tender	30	20	10	50%
Number of cancelled items	7	5	2	40%
Number of items shifted to the local market	8	3	5	167%
Number of bidders signed contract with NMSF	12	7	5	71%
Total amount in SDG (million)	270	16	254	1621%
Discount in SDG (million)	29	0.80	28	3524%
% of discount	11%	5%	6%	111%
Total amount in US$ (million)	48	5	43	905%
Discount in US$ (million)	5	0.25	5	2017%
% of discount	11%	5%	6%	111%
Exchange Rate of US$ to SDG	5.6	3.272	2.33	71%

Anti-monopoly measures

To avoid drawbacks of monopoly (more than 75 items have one offers- i.e. no competition) and to achieve value for money and to hit its target of selling medicines at least 20% below their pices in the alternative sources, the NMSF has shifted 30 products to the open-tender and has secured 8 items from the local market (not necessarily be manufactured in Sudan). Also it is the policy of the NMSF to negotiate with the winners to get further discount. Table 12 below reveals that the NMSF's negotiating committee has successfully managed to get US$5 million as a discount from all bidders. This discount ranges from 2% of the original offer to more than 20%. The negotiation efficiency is 64% (i.e. the negotiation committee achieved 64% of it targeted discount).

In 2014, Amipharma Laboratories Co. Ltd is the winner number one in terms of number of items (30 item) and amount (SDG143 million equivalent to US$25.51 million), while Azal Pharmaceutical Industries Co. Ltd ranked at the bottom of the winners' list (with only 2 items and SDG535,500 equivalent to US$ 95,625). In fact Azal is a new factory. HE the president Elbashier witnessed the opening ceremony of the factory in 2012, to show the commitment of the government to the local pharmaceutical industry.

Table 12: Savings Made by Negotiating Tender›s Local Winners in 2014

	Manufacturers	Awarded Items	Amount Before Negotiation (in SDG)	Amount After Negotiation (in SDG)	Saving (in SDG)	%
1	Shanghai - Sudan Pharmaceutical Co. Ltd	4	3,580,000	2,792,000	788,000.00	22%
2	Citypharm Pharmaceutical Ind.	10	11,027,500	8,856,500	2,171,000.00	20%
3	Tabuk Pharmaceutical Co. Ltd	21	26,159,500	21,253,000	4,906,500.00	19%
4	Abdel moneim Medical Industries Co. Ltd	13	22,623,000	19,851,500	2,771,500.00	12%
5	Yamani Pharmaceutical Co. Ltd	5	6,407,000	5,799,500	607,500.00	9%
6	Ageeb Pharmaceutical Lab.	2	21,650,000	19,750,000	1,900,000.00	9%
7	Amipharma Laboratories Co. Ltd	30	156,426,300	142,850,300	13,576,000.00	9%
8	Pharmaland Pharmaceutical	5	22,489,420	20,861,400	1,628,020.00	7%
9	Samf Pharmaceuticals	2	2,155,000	2,000,000	155,000.00	7%
10	Azal Pharmaceutical Industries Co. Ltd	2	565,250	535,500	29,750.00	5%
11	General Medicine Company Co. Ltd	9	3,503,800	3,328,050	175,750.00	5%
12	Blue Nile Pharmaceutical Factory	24	22,462,600	22,062,100	400,500.00	2%
	Total	127	299,049,370	269,939,850	29,109,520.00	10%

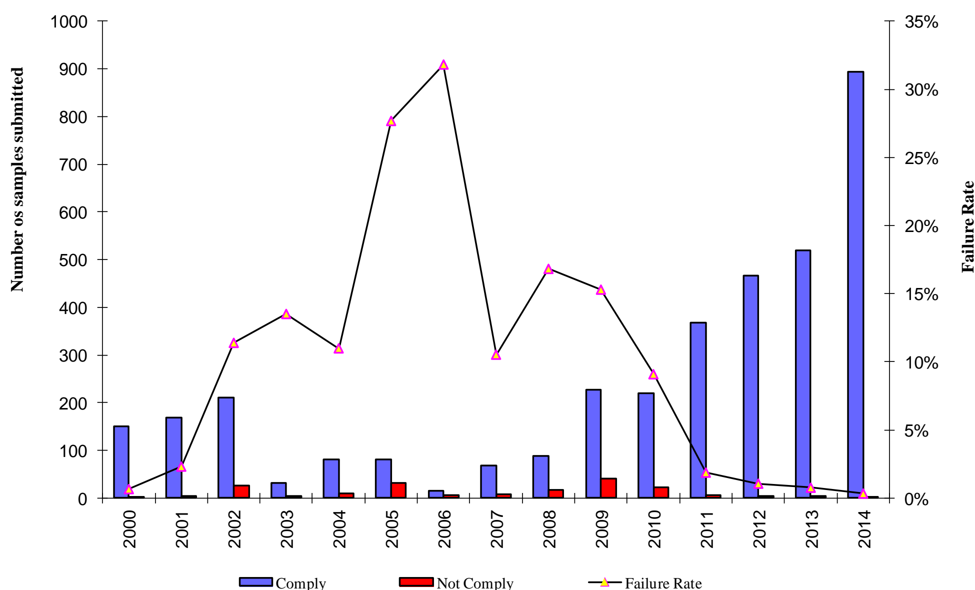
3.3 Assured quality medicines

In this section, we present the findings related to quality assurance measures that have been put in place during NMSF' reform to assure the quality of pharmaceuticals throughout supply chain. It highlights the outcomes of importing registered medicines. The section also presents the post-marketing surveillance programme. Finally, the section gives an overview of the recall system.

3.3.1 Importation of registered medicines

Samples of imported medicines have been tested at the National Medicine Quality Control Laboratory (NMQCL). The average failure rate of the samples that have been tested between 2001 and 2010 was 16%. However, the number of samples that found not complying dropped from 9% in 2010, to only 0.3% in 2014 (Figure 4). The low rate (less than 0.5%) of rejection of samples tested at NDQCL indicates that the NMSF's measures to assure which include purchasing of registered medicines from reputable sources do work. The above findings indicate that the quality assurance system applied by the NMSF prevents penetration of low quality or substandard medicines into its medicine supply chain. Authors, from their own experience, owed this huge reduction in the failure rate to the measures that have been put in place as a result of the NMSF reform. These measures comprise restriction of the tender to registered medicines only; purchasing of biopharmaceuticals and narrow therapeutic drugs from their originators; and securing of medicines that are non-registered in Sudan from countries with well-establish medicine regulatory authorities, WHO pre-qualified manufacturers (e.g. vaccines) or from internationally well-known medicines supply agencies.

Figure 4: Percentage of medicines that passed Quality Control Tests



We have analyzed 100 medicines that had been rejected by the NMSF because they failed to pass quality testing during the period 2001 to 2010 (Table 13). The analysis has shown that only 9 out of 100 medicines were registered products. The total value of the rejected items was US$4.8 million. More than half of this amount was accounted for by medicines originating from India (34%) and China (22%). These two countries were reported as a source of counterfeit medicines detected in 2005 (OECD, 2008). Only 8 importing companies out of 34 replaced their rejected items equivalent to 48% (i.e. US$ 2.3 million) of the total amount. However, the NMSF is still fighting to get its money (US$2.5 million) back from 26 importing companies. Three of them are now blacklisted. It is important to notice that

all rejected items (9 medicines) in 2011, 2012 and 2013 have been replaced (value = €0.7 million) and that there was no single item rejected in 2014. This is because NMSF agreed with its suppliers to submit a letter of guarantee and a cheque equivalent to the total amount of the consignment. The cheque is returned to the supplier after receiving positive results of samples that have been sent to NMQCL for quality testing.

Table 13: Sources and Registration Status of the Rejected Items from 2001 to 2010

	Country of Origin	Total No. of Items	Amount $	%	Registered	Non-registered
1	India	31	1,620,036.97	33.78%		31
2	China	21	1,039,078.60	21.67%	1	20
3	Jordan	4	269,902.77	5.63%	1	3
4	Egypt	13	179,841.17	3.75%	3	10
5	Kenya	1	161,979.02	3.38%		1
6	Turkey	2	144,337.01	3.01%		2
7	Saudi Arabia	2	86,947.94	1.81%	1	1
8	Italy	2	86,296.80	1.80%		2
9	Germany	2	83,386.96	1.74%		2
10	Pakistan	4	62,465.67	1.30%		4
11	Sudan	3	58,091.95	1.21%	3	0
12	Iran	1	46,811.71	0.98%		1
13	UAE	2	25,784.80	0.54%		2
14	Switzerland	1	23,892.80	0.50%		1
15	Greece	1	21,909.69	0.46%		1
16	UK	3	6,909.53	0.14%		3
17	Malaysia	1	5,124.55	0.11%		1
18	Others	6	873,226.24	18.21%		6
	Total	100	4,796,024.18	100%	9	91

3.3.2 Post-Marketing surveillance programme

Pre-marketing quality testing is conducted to ensure the quality of non-registered medicines. NMSF has initiated a Post-Marketing Surveillance Programme (PMSP) as a part of the reform. The aim of this programme is to monitor the quality of NMSF's medicines during their shelf-lives. It provides effective support and adequate basis for NMSF to make any subsequent administrative and legal action. The PMSP also fosters the trust of the customers in NMSF medicines and other medical supplies. The NMSF achieves this by testing samples collected from different levels in the supply chain. According to this programme, samples will be taken from NMSF and MSFs' warehouses and health facilities. The samples will then being sent to the NMQCL for quality check. NMSF takes appropriate action based on the results of the analysis of the samples and/or verification of the complaints. The action is communicated to the relevant organizations, health facilities and supplier of the defective product. Suppliers whose medicines are regularly failed the quality testing will be black listed.

A Retained Sample Pharmacy has been established and well equipped for the correct storage of samples, if necessary, under refrigeration (2–8° C) and securely locked. All specified storage conditions is controlled, monitored and records maintained. Access is restricted to designated personnel. A sufficient amount of retained sample of each targeted medicines is kept in its final pack to enable, if required, a number of replicate tests to be carried out. The samples are retained until all batches of a product are expired.

NMSF establishes a process for collecting samples from MSFs' warehouses as well as from health facilities and community pharmacies as part of its PMSP often undertake after medicines are sold. NMSF is currently in the process of implementing the programme by quality control department. It will work closely with NMPB to design optimal methods to collect the samples.

3.3.3 Recall and complaint system

Despite the measures that have been set by the NMSF, mistakes happen. NMSF has developed a recall and complaint system. NMSF receives reports of suspected defective medicines from its customers. An action is taken, as far as necessary, to recall a defective pharmaceutical that makes its way into the supply chain. The system aims to minimize the hazard to patients arising from using defective medicines. It also provides a good communication system between NMSF and its partners (i.e. NMPB, customers and users) on defective medicines. To achieve this, health facilities need to know fast. The NMSF has written SOPs in order to quickly communicate the presence of defective medicine batches and to ensure that in the event of a necessary recall, the recall operations are efficiently and effectively carried out to safeguard public health. A medicine or a medical device is withdrawn or removed from the supply chain because of defects or complaints of serious adverse reaction. The recall might be initiated by the NMSF, manufacturers, local agents or NMPB.

Before 2011, NMSF did not print batch number in its invoices, so it had been having great difficulty in tracing defective products in the event of recall. As a prerequisite to efficient and effective recall, NMSF generating batch numbers in its invoices, to tie in with the products it sells. NMSF also reorganizes products in the warehouses according to their batch numbers in order to expedite shipping according to the batches written in the invoices. NMSF has designed a form for receiving complaints, if any, about its products. The form is accessible from the NMSF's website. It is important to notice that the NMSF does not receive any complaint during the past two years. This should be carefully interpreted, because it did not mean that there was no problem, but the culture of reporting complaints is not very common in Sudan. The NMSF is very conservative about promoting this reporting system, because the local media is so sensitive towards medicines quality.

4. Focus on improving medicine supply chain

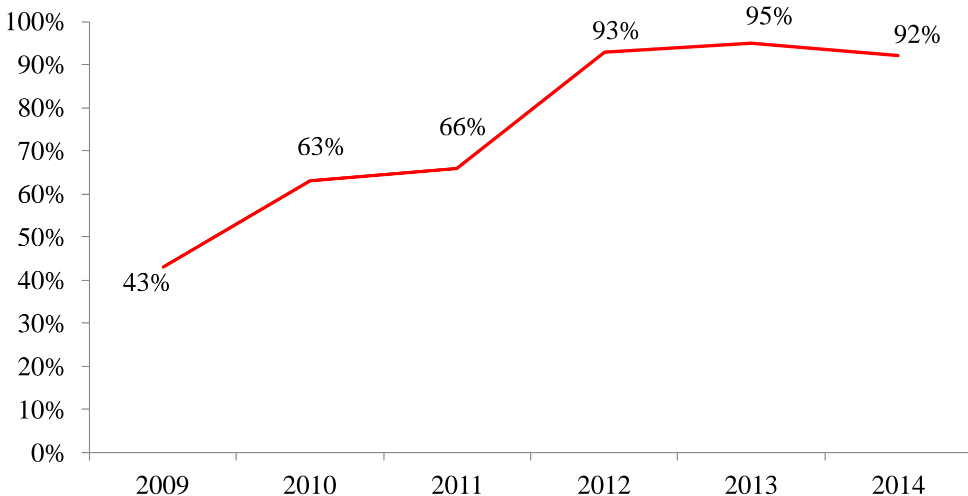
Despite its new policy of focusing on improving medicine supply, NMSF retains its shares in Shanghai-Sudan Pharmaceutical Company based in Khartoum. This company manufactures a number of capsules and tablets formulations. In this joint venture, the NMSF, on behalf of the government of Sudan, has 45% share, while the government of China has 55%. Pharmaceutical production is rightfully regarded not to be NMSF' core business. As a result, NMSF has sold its shares in an intravenous fluid manufacturing company (still being

commissioned). It also cancelled other two projects for pharmaceutical production. These procedures have resulted in the improvement in the NMSF's performance indicators, such as availability of medicines (see below). NMSF still can support local medicines manufacturing by buying their products (without compromising quality and prices). The government could also support domestic pharmaceutical industry by investing in better manufacturing techniques or an alternative form of market protection that does not affect accessibility to essential medicines in a negative way.

4.1 Availability of medicines

As shown in figure 5, there were severe medicine shortages at NMSF in 2009 and 2010. NMSF staff blamed such shortage mainly on the weak management during this period. Other factors include irrational selection, poor quantification and forecasting, lack of accurate delivery time, loss of focus and waste of medicines due to expiration. However, according to the NMSF annual reports (2009 to 2014), the average availability rate of medicines on the NMSF list, was greater (92%) in contrast to the situation prevailing before the reform (43% in 2009 and 63% in 2010).

Figure5: Availability of Medicines at NMSF's Central Warehouses in Khartoum



As presented in figure 6 (a and b), NMSF strives to make the medicines and consumables of certain National Curative Programmes available all the time (i.e. 100%). The items in these groups are vital and for most of them, there is no alternative source. The total number of the items is 270. Stock-out of any item of these products may cause a serious health problem and a very negative political effect. Despite all out of control circumstances, such as economic sanction, scarcity of hard currency, the NMSF has succeeded to achieve high level (on average 97%) of availability of these items in 2014.

Figure 6 (a): Availability of Medicines of Consumables of National Programmes in 2014

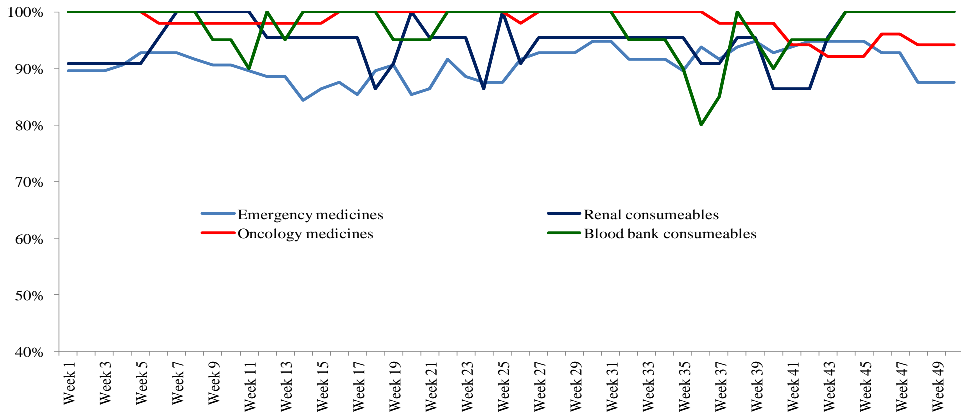
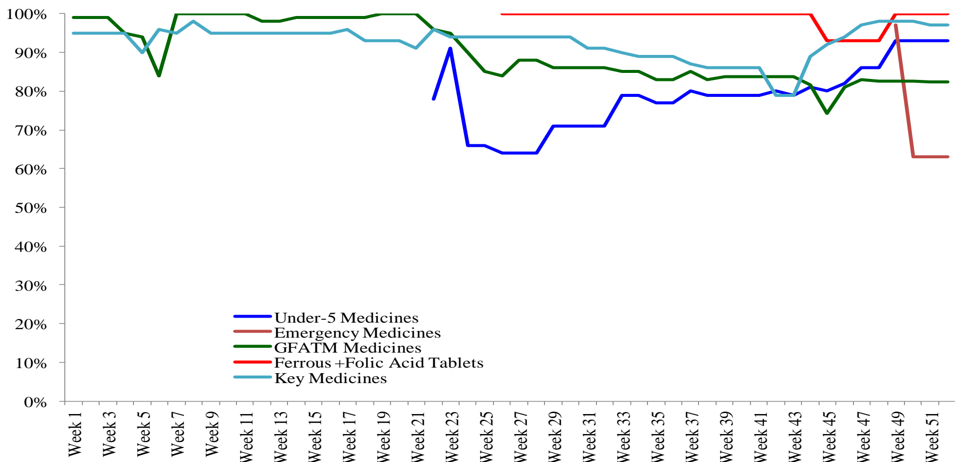


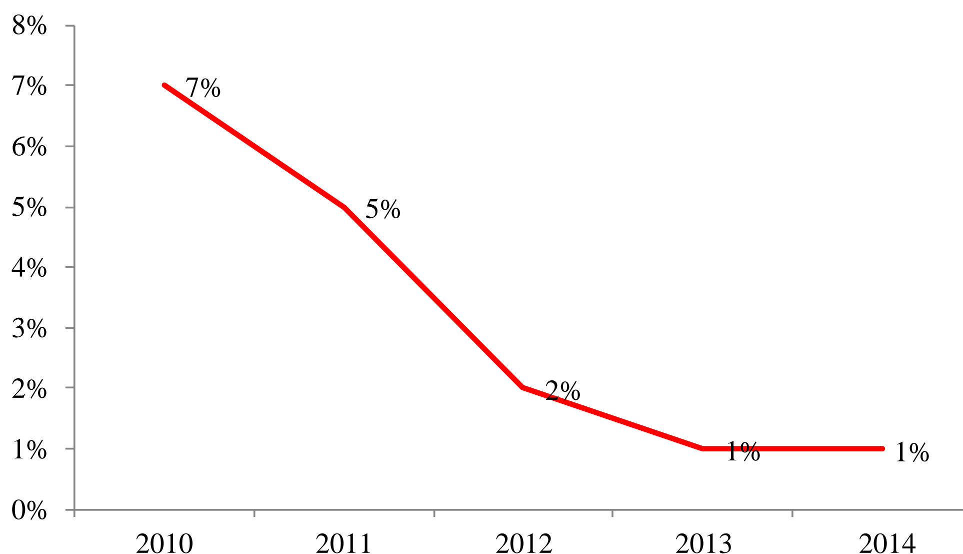
Figure 6 (b): Availability of Medicines of Consumables of National Programmes at States 2014



4.2 Expired medicines

First-expired first-out principles have been applied for distribution from NMSF's warehouses to its customers. Medicines of three months shelf-life were freely distributed to public health facilities of high consumption to minimize expired stocks. As a consequence, the percentage of expired medicines to the annual average stock dropped from 7% in 2010 to only 1% (SDG4.9million out of average medicine stocks SDG355.4 million) in 2014 (Figure 7). This is below the range of acceptable value of annual expiry medicines which is 3% to 5% of drug stocks (MSH 2013). The measures adopted by the management of the NMSF suggest that the quality of medicines was of high concern in the NMSF. The monitoring good storage condition and reduction in the percentage of expired medicines confirm the quality of the pharmaceutical supply systems at the NMSF.

Figure 7: Cost of Expired Medicines to Average Annual Inventory



4.3 Integration of the public medical supply systems

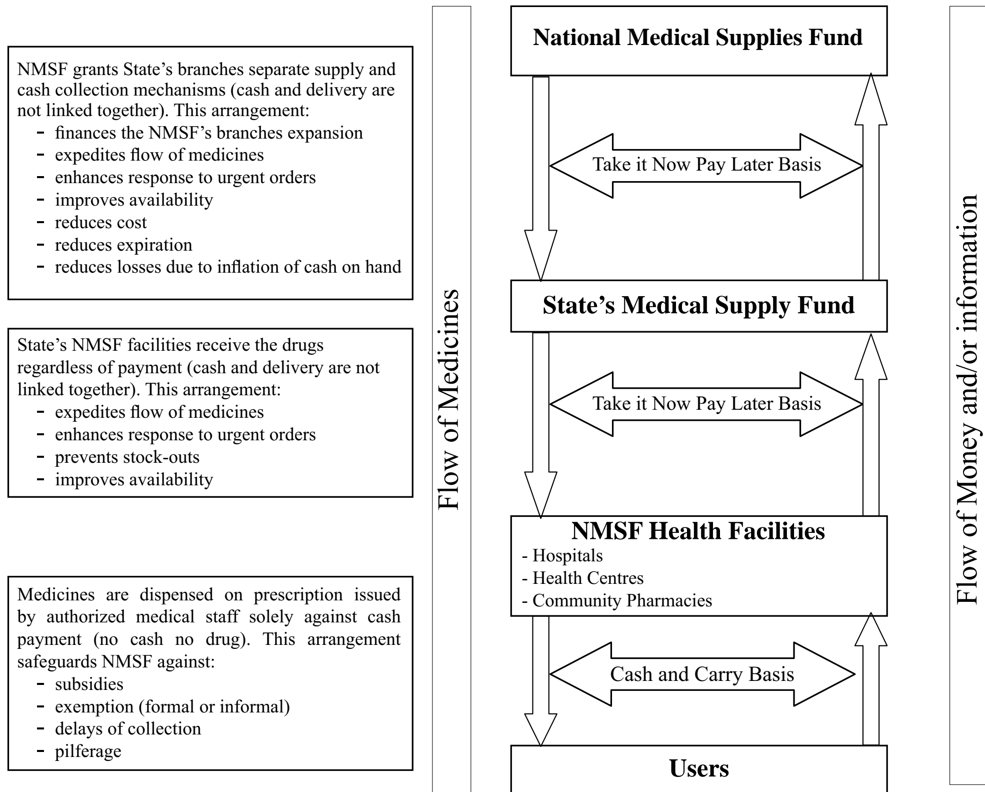
The medical supplies system in Sudan suffers from several inefficiencies. These include each state and within the MOH each health programme has its own supply system. The states and national programmes do their procurement, storage and distribution on their own. This fragmentation resulted in the absence of planning for needed quantities of medicines. It also missed economy of scale opportunities of having good prices. The government incurred additional financial burdens amounting as a result of the purchase price disparity among the different public health sector. While NMSF procures and stores, distribution is done through a "pull" system in which customers have to quantify their needs, place their orders and pick up their packages (with exception of MSFs and customers in Khartoum State who make their order electronically). Thus, it will be extremely important to build capacity for drug quantification and stock management at all levels. Before the reform, medicines of national health programmes were managed separately. One of the largest supply chain reforms has been the integration of these medicines into NMSF system. As for other elements in the health system, it is extremely important to streamline and consolidate key elements of the health supply chain in order to maximize the benefit from the limited resources available. The supply chain management of health commodities, including medicines, has been improved by reducing fragmentation and ensuring strong coordination and collaboration between NMSF, public health programs and private institutions responsible for drug procurement, storage and distribution.

4.3.1 Improving access to medicines

It is a reality that the availability of medicines at public health facilities is always remaining a problem. NMSF realises that it will not do much good to bring more medicines into the country, if the distribution system fails to ship supplies to the periphery. Recognizing the gravity of the problem of lack of quality medicines, especially at primary health care facilities, NMSF has launched a new model for integrated supply system of medicines to

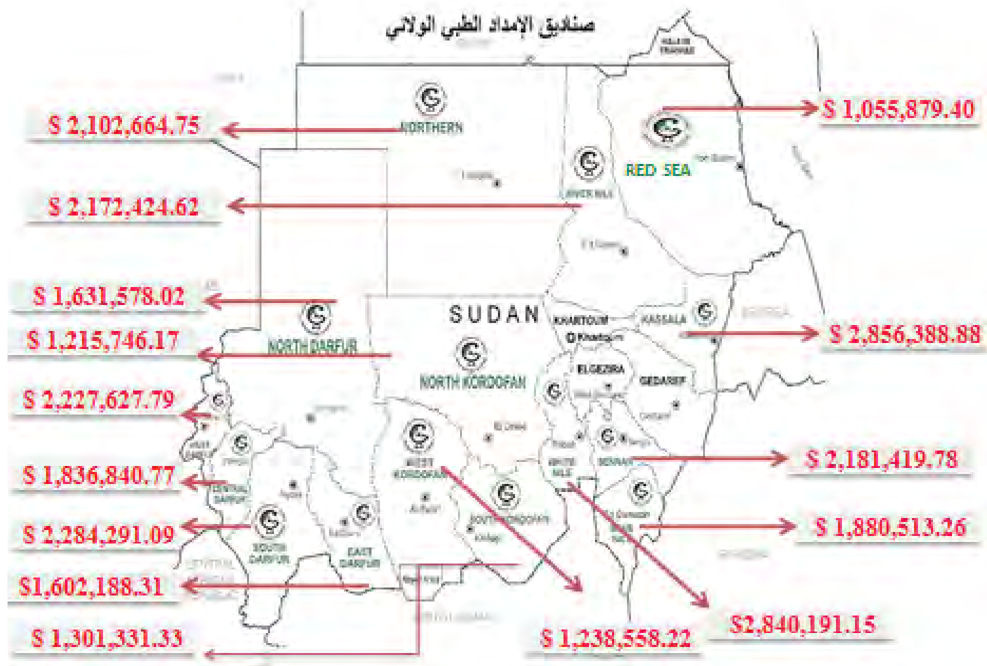
the states. According to this model, NMSF separates supply of medicines from the cash collection (Figure 8).

Figure 8: NMSF Supply Chain Model: States' Branches



By the end of 2015, 15 states have signed bilateral agreement with the NMSF. This agreement entitles the NMSF to manage the supply chain through establishment of NMSF's branch in each state. According to its obligations set out in the agreement with the states (and later in the Act), NMSF provided the capital seed stock of medicines as a revolving fund. As in figure 9, the NMSF invested more than SDG168.4million (US$ 28.4million) to establish these branches. In 2015, the agreement has been included in the NMSF's Act.

Figure 9: NMSF’s Branches in States as in 2015



NMSF investment was not only in medicines but also included human resources training, infrastructure development, such as vehicles (14 pick-up double cabinet Toyota) for supervision and trucks (14 temperature controlled trucks) for delivery of medicines to health facilities, and the establishment of an operational system of NMSF management at state level (Photo 2). In mid 2015, another 16 supervision vehicles and 16 temperature controlled trucks have been added to the fleet of vehicles donated to the NMSF branches in different states.

The branch of NMSF is under direct supervision of the state minister for health. The NMSF is also responsible for the distribution of medicines that treat HIV/AIDs, TB and Malaria donated by the Global Fund (GFATM); medicines that are dispensed free of charge during the first 24-hour in hospital outpatient clinics; and very recently, free medicines project for children under-five years of age. The NMSF, according to the NMSF’s Act, is responsible for the availability of quality medicines at health facilities and is taken accountable to the MOH for any shortcomings or failure in the system.

Photo 2: Vehicles for Delivery and Supervision

The MOH at state level obliged through administration board (chaired by the state minister for health) of the NMSF's branch to make sure that medicines are regularly available and are sold at the prices set by the NMSF. The income generated from selling medicines (the difference between whole and retail prices) to patients is used by the state's NMSF to cover its running costs, including staff incentives. The key objective of the NMSF is to ensure uninterrupted availability of safe, effective and quality medicines in public health facilities at cost determined by NMSF. NMSF also promotes rational use of medicines based on their generic names. Through the new model, NMSF introduces pooled procurement of medicines for states that signed the agreement. Additionally, NMSF avoids the drawbacks of the old pricing system (see reform of the NMSF pricing) by unifying the retail price to the public across the country (i.e. NMSF bears the transportation cost). It also manages to establish efficient and effective distribution systems to ensure that quality medicines reach the intended users. Finally, any issue of cost recovery, such as cost of expired medicines, is the responsibility of NMSF.

4.3.2 GFATM

The long-term goal of the government of Sudan is to have a unified and harmonized logistics system for all Global Fund supported commodities, especially those used for the mitigation of the impacts of HIV/AIDS, Malaria and TB to ensure consistent availability of medicines and other medical supplies at all levels for successful treatment outcomes. In 2010, before proposing the bases for an integrated system, undersecretary of the FMOH, appointed a committee chaired by Dr Isameldin Mohamed (Later, in 2011, he promoted to be undersecretary of FMOH). The committee comprised the Director General of NMSF, Secretary General of NMPB, and heads of National Programmes (TB, AIDS and Malaria). The committee conducted a study designed to identify critical problems in supply chain management. The study revealed evidence of fragmentation in distribution process and poor storage. The committee also affirmed that the fragmentation of public health supply chain lead to high costs. The results of the study were presented at a meeting chaired by undersecretary

and attended by executives and technical staff from the National Programmes, different departments within FMOH, and the deputy Director of NMSF and the Secretary General of NMPB. The evidence presented substantiated the need for the integration of existing supply programmes of all commodities at FMOH and state levels, including GFATM ones, into NMSF. This recommendation aimed to improve public access to quality medicines and medical supplies at lowest administrative costs possible. It also aimed to reduce waste and to maximize the benefit from the limited resources available to the national supply chain for health commodities, to remove the parallel system, to utilize the already existed NMSF and its logistics (i.e. warehousing, vehicles, human resources …etc.).

At the end of the meeting, attendees gave their support to the integration of all systems for managing medicine supply into the already existing, well-established NMSF. The integration has been organized around the following principles:

1. Strengthening of the NMSF and its revolving funds at state levels (After the integration of all systems in the states' revolving drug funds, they are renamed Medical Supply Funds to accommodate managing the free medicines, such as GFATM medicines). These states' funds (see section 4.3, for further details) would be responsible for ensuring the appropriate selection and use of medicines and for carrying out periodic exercises for planning purchases and distributions throughout the entire health network.
2. Integration of the inventories and distribution systems of all vertical programs under NMSF at the central and state levels through MSFs.
3. Execution of the Presidential Decree of the unification of public procurement through NMSF. The decree empowers the NMSF to act as the sole manager of purchases of medicines and health supplies for the entire public health system. The NMSF collaborates with all stakeholders to decide on medicines and medical supplies to be purchased. All partners are members of the NMSF tender committee.
4. Improvement of storage and transportation conditions.

In June 2011, based on the committee recommendation, the FMOH has made the decree No.30. According to this decree, all GFATM and other national programmes' commodities have been integrated in the NMSF. NMSF has been reorganized to accommodate these commodities in its system by establishing a new general directorate named states' medical supplies. A separate bank account has been opened for GFATM reimbursement through UNDP (the Principle Recipient).

4.4 Warehousing and distribution reform

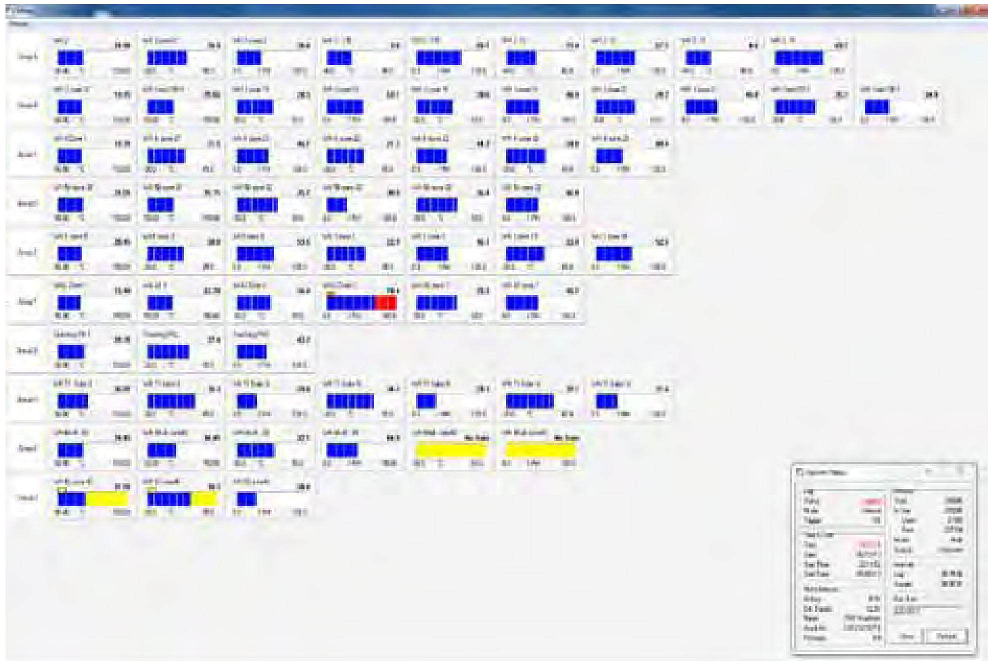
In this section, authors present the reform of the warehousing and transportation of pharmaceuticals and medical devices. The transportation of pharmaceuticals in temperature controlled vehicles to NMSF and from NMSF to its customers, and the electronic monitoring of temperature and humidity in NMSF's warehouses are among the major developments in the reform of the NMSF.

4.4.1 Warehousing reforms

NMSF comprises 20 warehouses ranging from cold to normal storage conditions (2-8°C, 8-15°C and 15-30°C). One of the requirements of Good Distribution Practice is the control of temperature and humidity of the warehouses. As all warehouses are air-conditioned, a system to monitor and report temperature and humidity in all warehouses has been installed in the

late 2012. Before the installation of the system, two daily temperature readings were noted on papers but were not reported or monitored to demonstrate the quality of storage conditions over the year. In the new system, real-time temperature and humidity data are transmitted and saved on the data logger, which interrogated by a computer in 14 warehouses. These data saved in a folder on a central server accessible by computers in the stock control room. The room is equipped with a big flat screen to enable staff to view the data for all stores. Each member of staff in the control room could open the saved temperature and humidity data files using the computer. Temperature and humidity in each store are monitored and checked against low and high alarm values by the system. Each warehouse is divided in a number of zones (i.e. Temperature mapping). As shown in photo 3, each zone appears on the screen around the clock as blue bar. When there is a problem the colour changes to yellow and if there is no intervention after 30 minutes the colour changes to red. The system registers an audible warning at each zone in the store (local alarm). If the default continues without correction, an SMS will be sent to a list of registered senior managers and there will still be an audible warning at each store. SMS alarms contain the time, name of the store and more importantly the temperature measured. This system enables NMSF to monitor its warehouses' environmental conditions. It also helps NMSF to keep records of the storage conditions. For example, the Stock Control staff report the temperature and humidity at all zones throughout the year to demonstrate good storage conditions. This report is a good tool for NMSF to demonstrate its quality assurance to its customers.

Photo 3: Temperature and Humidity Screen



The use of a barcode system on the outer cartons is generalised for the bulk area warehouses in 2011. On the arrival of pharmaceuticals into the store, the ERP system prints a bar code label containing the NMSF code, the expiry date, the batch number and the quantity of the received product. Once unpacked and accepted by Quality Control, all cartons of the

consignment are labelled with bar code labels (stickers) and are registered into the ERP system. Portable scanners are used to check cartons and boxes before delivered to customers.

To increase its storage capacity and in order to meet the expansion of it services, such as pooled procurement, establishment of branches in 15 states, NMSF starts constructing a huge modern two floors warehouse (Photo 4). The volume of each is 19,565meter^3 (70 X 43 X 6.5 meter). This size is more than the current storage capacity. It will help NMSF to get rid of 9 rented stores, which are, to some extent, not up to the standards of NMSF warehousing system. The building also accommodates specialized training centres on third floor (see section 5.2 Human Resources Development Programme). The cost of the new warehouse, which is financed by Farmer Commercial Bank is SDG173million (US$28.8 million). This cost includes financing cost with annual interest rate of 11% and establishment of the turn-key training centre. After two years grace period, NMSF will pay the amount in SDG in monthly equal instalments over two years. The warehouse has been designed and is being constructed by two different Chinese companies. The work started in April 2015 and expected to finish by the end of May 2016. The vertical warehousing is introduced to reduce cost of NMSF's inventory. In the new warehouse automatic fire-extinguish gas system will be installed. It will also be equipped with detection system to prevent theft.

Photo 4: New Warehouse's Construction

4.4.2 NMSF transportation of medical products

In its reform to assure quality of medicines, NMSF transports its medicines from Port Sudan to Khartoum and from its warehouses in Khartoum to customers elsewhere in Sudan in temperature controlled vehicles (Photo 5). The receiving and the delivery are made through an outsourced service (by Sudapost, Sudan Mail Company). However, some customers still collect their orders at the NMSF using their own vehicles.

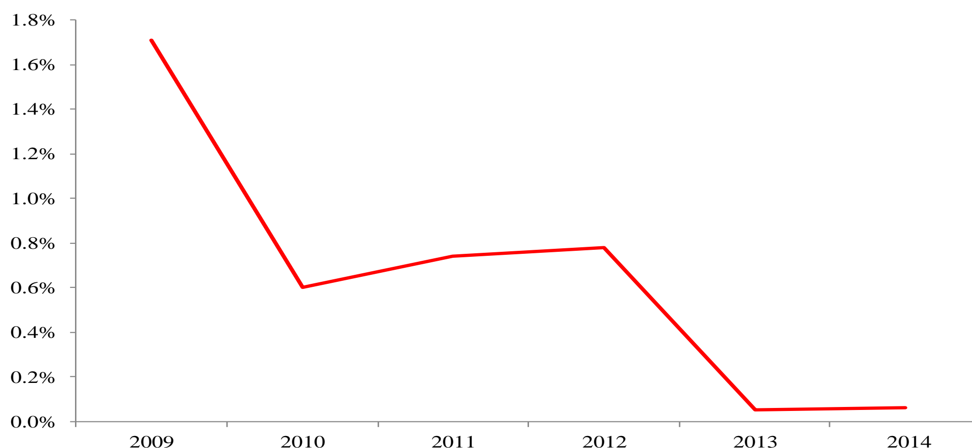
Photo 5: Temperature Controlled Long Vehicle

4.4.3 Inventory physical count

A committee assigned by the DG takes the annual inventory. The committee comprises a number of pharmacists, accountants, internal audit, National General Auditor Office in addition to the warehouses' staff. Before the reform, the deficit reported by the committee was compensated for by the surplus found in the same warehouse. In 2013, the board of directors decided that the deficit and the surplus should be considered by the committee as a deviation from what should be found in the warehouse (i.e. the inventory according to the computer system). The responsible storekeeper is taken accountable in the case of surplus, deficit or both. The board of directors also has introduced, for the first time, a mid-year inventory in addition to the surprising inventory for each warehouse at least twice per year to reconcile the physical stock with the theoretical one reported by the computer. The consequences of implementing the new inventory system and incentive paid for the responsible storekeeper on monthly basis, have not only been an improvement in the area of the performance, but also on the reduction of level of stock losses. The stock absolute value of non-compliance between value of stock on the system and that actually found at NMSF's warehouses began to reduce from around 2% of the inventory value in December 2009 to 0% by the end of 2014 (Figure 7). By achieving 0% of the inventory, NMSF has managed to hit the target set by MSH (MSH 1997)

Additional advantages of stock inventory include: enforcing procedures and regulations designed to prevent loss and wage; ensuring that security measures and records of received stock and issuing of medical products are adequate; verification of registration status of the medicines (Figure 10); identification of surplus, expired and obsolete stock; and to tighten loopholes suspected of creating loss through leakage.

Figure 10: Compliance Percentage of the amount of inventory physical count with computer records



Like many developing countries, Sudan has relied on generic companies as its sources of medicines. Many imports into Sudan markets, in general, and NMSF, in particular, come from other developing countries. NMSF imports from developing countries account to 60% of its purchases in 2014. This ranked NMSF after Uganda, which imported 63% of its medicines from developing countries (Table 14). Despite the old data, it is worth noting, however, that a few African countries nonetheless imported substantial portions of their pharmaceutical supplies from industrialized countries, for example, Senegal at 96% and Togo at 93%, as shown in table 14 (Roberts and Reich 2011).

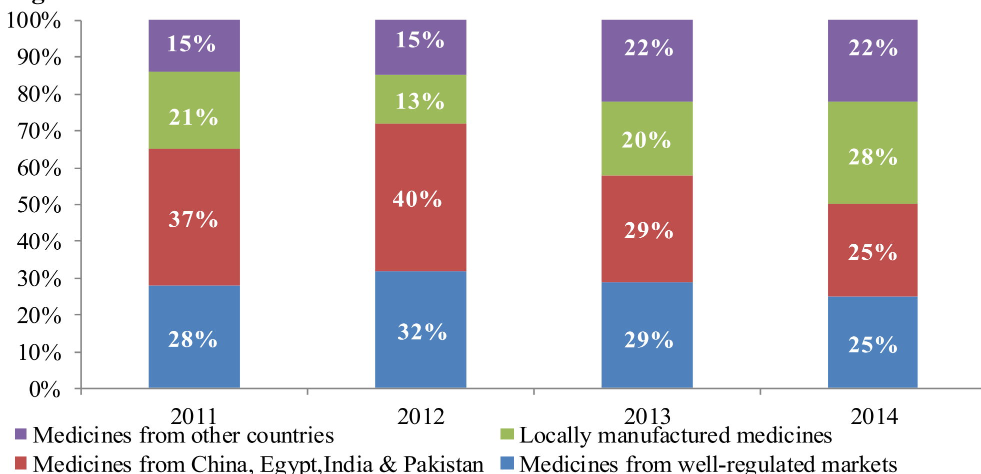
Table 14: Top 10 Pharmaceutical Importing Countries in Africa, 1998

		Total (US$ million)	Industrialized country sources (US$ millions)	Imports from industrialized countries as % of Total	Developing country sources (US$ millions)	Imports from developing countries as % of Total
1	Senegal	51	49	96%	2	4%
2	Tunisia	172	164	95%	8	5%
3	South Africa	601	565	94%	36	6%
4	Togo	14	13	93%	1	7%
5	Mauritius	38	32	84%	6	16%
6	Madagascar	16	13	81%	3	19%
7	Kenya	105	78	74%	27	26%
8	Nigeria	118	79	67%	39	33%
9	Tanzania	41	19	46%	22	54%
10	Uganda	54	20	37%	34	63%
11	NMSF 2014	169	67	40%	102	60%

Modified by Authors from table 3.2. Source: Roberts and Reich 2011.

Annual inventory also identifies the main sources of NMSF medicines (Figure 11). It is the policy of the NMSF to shift to locally manufactured medicines (account for US$19.3million in 2014) and to the well-regulated markets (account for US$67million in the same period). Despite slight progress in this area, the trend shows the shift of NMSF from its historical sources, which are India, Egypt, China and Pakistan (account for US$45.8million in 2014) to European manufacturers of medicines.

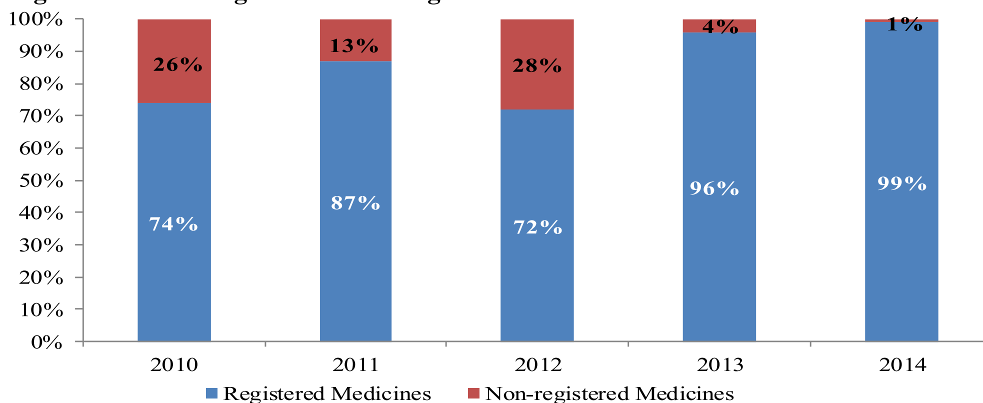
Figure 11: Sources of NMSF's Medicines



As reported by Roberts and Reich (2011) China and India have moved steadily up the value chain through massive investments in the pharmaceutical industry and research capacity. These two countries, in addition to national pharmaceutical manufacturers, have become increasingly important sources of generic products for NMSF. Worrisome issue is that India has been pinpointed as by far the biggest culprit in making fake drugs - according to 2005 TAXUD statistics released by the European Commission, 75% the global cases of counterfeit medicines originated from India, 7% from Egypt and 6%from China (OECD 2008, P351.). India at the top of NMSF sources of medicines. As a result, measures should be in place to protect the public medical supply chain from the penetration of substandard, spurious, falsely labelled, falsified and counterfeit medical products.

Unlike the countory of origins of NMSF' medicines in 2010, the inventory of the year ended in December 2014, reveals the increase in the percentage of regiostered medicines from 74% in 2010 to 99% (Figure 12). This great leap is mainly due to the fact that the NMSF is no longer purchase non-registered medicines unless under certain circumstances (recall section 3.2.5)

Figure 12: Percentage of NMSF's Registered Medicines



NMSF, for the first time, identifies priorities by using the well-known ABC- analysis (2o / 80 per cent rule). The ABC-method classifies medicines of NMSF list in decreasing order of cost of the volume issued and those in the warehouses on annual basis and places them in three categories: class A-items 10- 20% of the items usually accounting for 75- 80% of the fund. B-items another 10 –20% of the items represent 15 - 20 % of the fund and C-items account for 60% to 80% of the items but only 5-10% of the value of the annual consumption and the hold inventory.

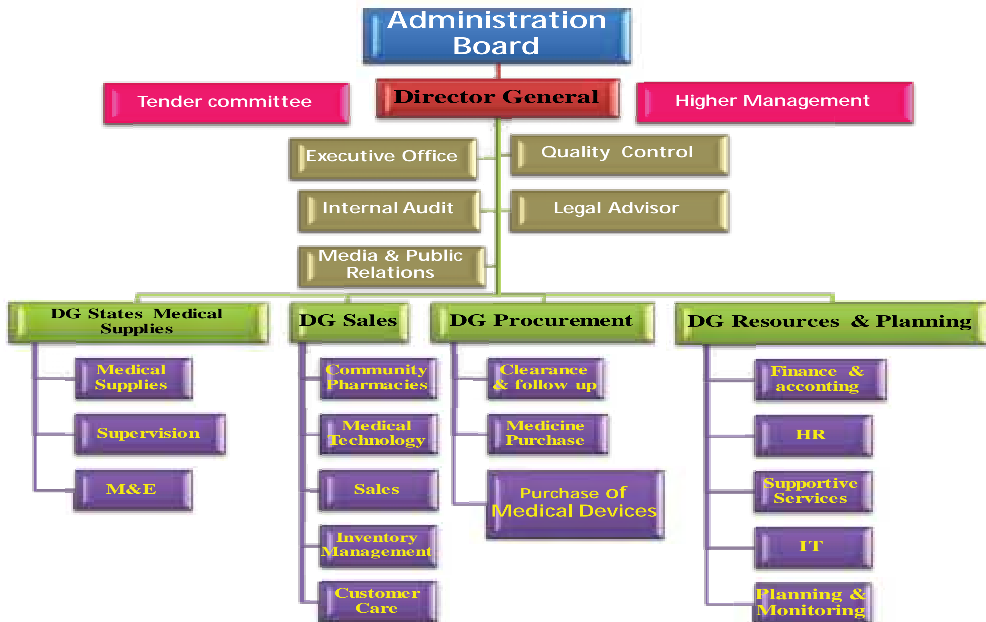
5. Administration and Human Resources Reform

One of the objectives of HR reform is to get the maximum possible from typically civil service staff. Strategies that have been adopted to do so include: leading, delegating and motivating of the senior management team to achieve the objective of NMSF. This section presents the development that has taken place during the reform period.

5.1 NMSF's Organograme

NMSF was a typical bureaucratic public organization, with very flat organizational structure. When the reform started in 2011, there was a risk for silos developed within the NMSF where different divisions did not clearly understand and/or know what the others were doing. A set of corrective measures have been taken, such as change of the organogram and merging of certain subordinates. The old NMSF organograme comprised eight general directorates and five specialized departments. The council of ministers has circulated a model organograme for all ministries and government organizations requiring the reduction of organogrames into only four general directorates (one of them is finance and resources department). Accordingly and in light of the NMSF's assessors proposed structure, NMSF's board of director decided to merge the flat structure into only four general directorates and five specialized departments. The reorganization aims to better address priority areas, avoid bureaucracy, achieve the efficiency and flexibility, concentrate resources, and streamline operations, in line with the NMSF programme of reform (Figure 13). The activities of different departments have been coordinated in an efficient and effective pattern. Harmonious environment has been created to get maximum benefits possible from the different departments.

Figure 13: NMSF Organogramme



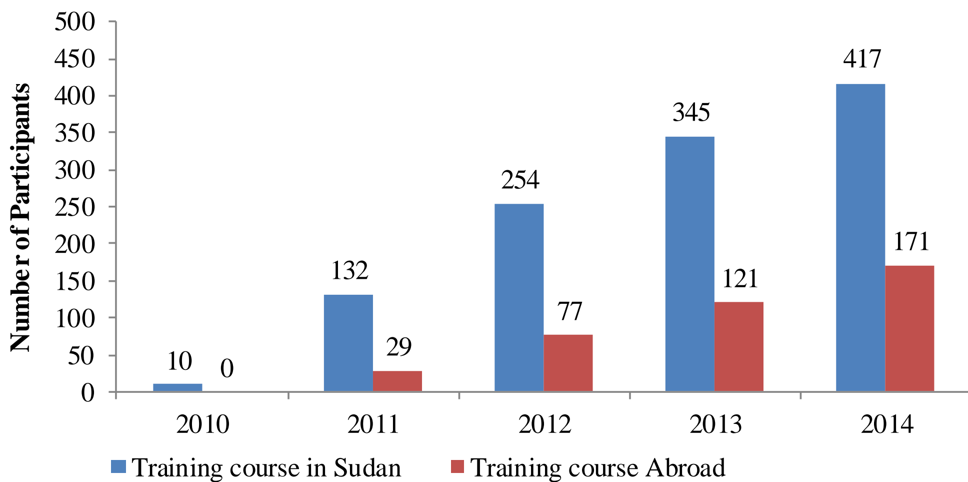
Employers are empowered to make decisions at their level instead of passing things up line. After the restructuring, managers, head of departments and divisions can go and talk to their colleagues face to face, if they need to. The reform stops the circ and changes the culture of 'write it down and I will respond in writing to you'. This expedites communications and builds trust among NMSF staff. NMSF has some good people who are loyal, knowledgeable and committed. They have done a lot during the reform.

5.2 Human resources development programme

To strengthen the teamwork and maintain consistency, NMSF has printed job description and management manual, which specifies staff responsibilities and roles in the teams, and NMSF operating procedures. In addition, the NMSF has provided a wide variety of external and internal training and development opportunities for its staff. NMSF's DG is a firm believer that training and exposure to others' successful experiences can bring desired and effective change. These are effective tools in motivating the teams, and thereby maximizing the benefits from available resources. More than 580 members of staff have benefited of this programme in 2014, compare to less than 10 in 2010 (Figure 14). The annual budget for Human Resources (HR) development increased from US$40,000 in 2010 to more than US$ 670,000 in 2014. The NMSF has continued to provide computer skill training for all staff. Additionally, NMSF has published a NMSF's medicines datasheet book for pharmacists and other health professionals to equip them with needed information about NMSF's medicines. This information include: indications, side effects, contraindications and precautions. NMSF also gives free copy of the latest edition of the British National Formulary (BNF) to its pharmacists, senior pharmacists in big hospitals and MSF's pharmacists to keep their knowledge about medicines up to date.

Moreover, in its staff development programme, NMSF has distributed more than 200 copies of a book entitled MDS-3 Managing Access to Medicines and Health Technologies6 to all NMSF pharmacists and managers of the MSFs, General Directorate of Pharmacies at federal and state levels, and libraries of government owned schools of pharmacies and postgraduate medical institutions. The NMSF will arrange a monthly session for pharmacists in order to study the relevant chapters of the book. Being deficient in the curricula of schools of pharmacy, the donation of a number of copies of the MDS-3 may help pharmacy graduates to be acquainted in pharmacy practice, in general, and management of health supply chain, in particular. The NMSF in its medicine supply systems relies very much on the procedures laid down in this book. Finally, The DG of the NMSF volunteered to provide a 10-hour pharmacoeconomics course to the pharmacists.

Figure 14: Human Resources Develpment Programme



Since October 2010, NMSF has two different weekly meetings to monitor the performance (board of directors and departmental meetings). These meetings also deal with constantly arising issues and warrant regular monitoring to keep on track and to achieve annual plan objectives. In the board of directors' meeting, head of different departments presents brief weekly written reports. This meeting also monitors NMSF performance on weekly basis (see Appendix 3). In the second meeting, which attended by heads of general directorates, departments and divisions, 3-month performance reports are presented by mangers of different directorates. In these reports, managers focus on how their directorate performed during the previous 3-month. The reports present achievement against targets set in the annual plan. Shortcomings are also reported in a transparent manner. The annual plan is approved in a big gathering every year. In this annual meeting, senior management clearly communicates mission, vision and goals of NMSF before the beginning of the new year. This meeting also helps NMSF to give direction to its staff. Each report concluded by providing a number of recommendations to improve performance and to achieve objectives. In fact, the DG has given them the opportunity and encouraged them to voice out their views at weekly meetings. This practice gives the staff the feeling of ownership and makes them very keen to do good

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[6] This book authored by MSH and published in 2013. It is highly recommended by WHO as a manual for those who have a responsibility in pharmaceutical services, in general, and managing drug supplies, in particular.

job. The meetings are very valuable in keeping up personal and departmental motivation and momentum. They help promote and embed a common approach to solve problems and to work practice across NMSF. In addition, the NMSF DG presents an accumulative 6-month report together with a financial report to the meeting of NMSF board of administration, which started to meet regularly, since 2011.

In accordance with NMSF Ordinance for the establishment of NMSF (2007) and later NMSF Act, and the National Medicines Policy (2005), the main objective of NMSF is the provision of the needed medical supplies at the minimum possible cost to health facilities. The NMSF is facing challenging conditions in performing this job, especially after establishing medicine supply funds' agreement has been signed with more than 15 states. The establishment of states' funds opening newly accessed areas for health service that have long been inaccessible. Thus, newly accessed areas need service provision, and human resources are the corner-stone. As well, the NMSF is struggling to collaborate with internationally-recognized entities in order to use the best available knowledge, experience and methods in managing the medicine supply chain, including training, consultancies, technical assistances and setting policies and strategic plans to guide the NMSF activities, as well as monitoring and evaluation of supply chain. With limited resources, facing huge responsibilities, the NMSF is exerting its best efforts to effectively and efficiently establish systems and setting priority policies, plans and strategic plans to improve the public supply chain in Sudan.

In its effort to institutionalize the HR development and to make its staff more modern and professionals, NMSF has signed three Memorandums of Understanding (MOU) to improve supply chain of health technologies in Sudan public sector. One MOU has been signed between the NMSF and Health Research for Action (hera)[7]. The parties have agreed to initiate cooperation in conducting training and public health consultancies in the field of medicine supply. In this regard, hera Foundation funded a mission 12-16 January 2014 to develop a technical proposal on the options for a National Training Centre in response to the NMSF proposal, based on a better understanding of local needs, issues and capabilities. Early 2015, NMSF requested hera to work with them on the organisation of a training course for the general managers of the State Medical Supplies Funds. NMSF provided the topics that were to be part of the training. hera was to develop the contents and format of the training. The purpose of the training course was 'to strengthen the general management skills of the general managers of the State Medical Supplies Funds'. Twenty-five participants, all pharmacists with management responsibilities working at the Medical Supplies Fund at national and state level attended this course in August 2015. In this training, participants have

1. learned the concepts of an efficient drug supply according to internationally accepted standards
2. analysed and interpret the main accounting tools;
3. practiced communication skills (using open questions, active listening techniques and constructive feedback);
4. became skilled at forecasting, quantifying, storing and distributing essential drugs;
5. became aware of the values and pitfalls of the human resource management process;

[7] hera has defined itself as an international multidisciplinary team based in Belgium. Active since 1990, hera has contributed to strengthening the health sectors in more than 100 countries in different regions of the world. It has been transformed to a non-profit foundation working with a network of experts, research organizations, governments, NGOs and institutions to promote the right to health and development for all.

6. gotten to know and exercise the roles of an organized manager;
7. chose and learn to apply different leadership styles;
8. became capable of incorporating teambuilding practices in their management approach;
9. acquired win-win negotiating skills;
10. aimed for quality results using key performance indicators.

The second MOU has been signed between NMSF and Nuffield Centre of International Health and Development (NCIHD) University of Leeds8. The NMSF and the NCIHD have the desire to work together to develop a collaborative projects between the NCIHD and the NMSF for strengthening Health Supply Chain in Sudan and to undertake joint research and consultancy assignment in a bid to develop and sustain the institutional capacity at the NMSF and its MSFs at state levels. The parties shall explore the possibility of the training programmes that could be provided to Sudanese candidates in Leeds. These programmes include Postgraduate Training courses in health commodities supply chain management and certificate courses in relevant disciplines of the supply chain for NMSF staff and its states' branches. In 2014, NCIHD has conducted a rapid assessment of training and institutional needs in collaboration with the national consultant who has been identified by NMSF. In 2015, NCIHD, conducted a short training course designed to familiarize course participants with the key concepts and best practices of leadership and change management. It aims to develop the participants' capacity in leading change by systematically improving their skills in analyzing, planning, controlling and implementing change in health care with a focus on challenges. The participants for this workshop were senior NMSF staff from central and state levels and other NMSF stakeholders and partners (i.e. NHIF, and Police and Military services).

The third MOU has been signed between NMSF and i+Solution9. The parties have the desire to work together to develop collaborative training courses between i+solutions and the NMSF, FMOH for strengthening the Pharmaceutical Supply Chain in Sudan. The first training course on 'capacity building on monitoring and evaluation of supply chain management of essential health commodities' has been conducted in Khartoum at NMSF's training center in October 2015. In short, the objectives of the course include:

1. to discuss the major issues surrounding M&E of PSM systems such as accountability, continuous improvement, sharing of "lessons learnt" and "best practices", avoiding duplication through encouraging single M&E systems at country and regional levels;
2. to provide practical tools to decision makers and staff working in public health programmes to ensure accountability, transparency and to improve their performance;
3. to encourage the exchange of views and experiences between senior officers and decision makers;
4. to develop M&E indicators for procurement and supply management;
5. to write the outline of a plan for M&E of a PSM system for the participant's organization.

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[8] The Nuffield Centre of International Health and Development was set up in 1978, at the request of the UK Department for International Development and the British Council, with a focus on health in middle and low-income countries. It is now a major international resource for education, research and technical assistance in health and development.

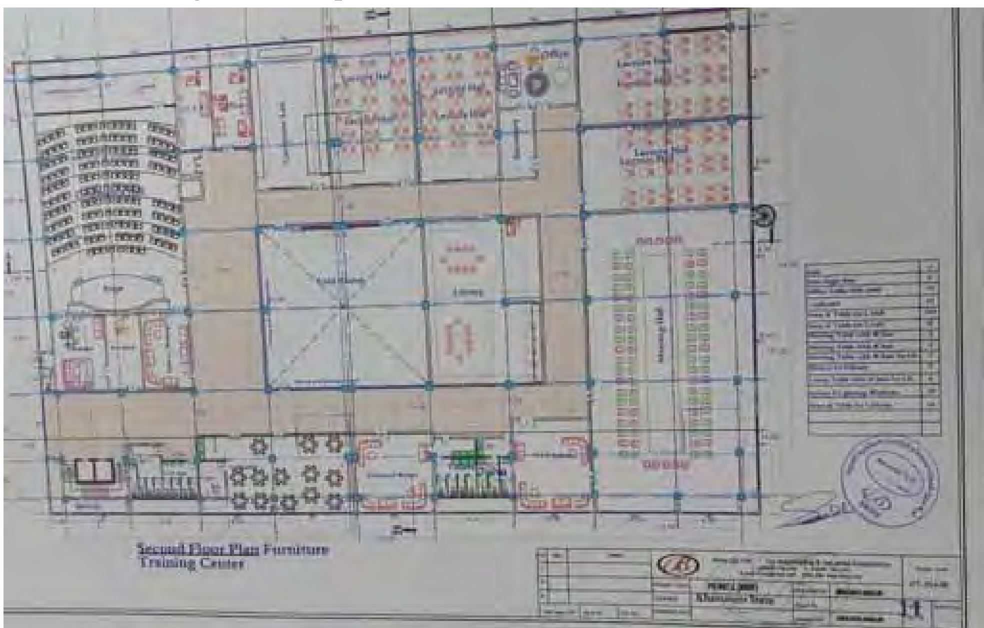
[9] Headquarted in Netherlands, i+solutions, established in 2005, is an independent, international, not-for-profit organization specializing in pharmaceutical supply chain management in low and middle-income countries. It is one of the member organisations of the Partnership for Supply Chain Management, the partnership of various professional organisations managing the Supply Chain Management System, as well as the Pooled Procurement Mechanism projects.

The participants of this training were 30 pharmacists involved in different parts of the health supply chain (selection, purchasing, inventory management, sales and distribution). The participants were NMSF's staff at central and state levels and its partners, such as NHIF.

Finally, NMSF's DG approached the Health Internetwork Access to Research Initiative (HINARI) to get a user name and password for NMSF. HINARI is the programme set up by WHO together with major publishers, enables low- and middle- income countries to gain access to one of the world's largest collections of biomedical and health literature. The HINARI team responded positively to the request of the DG. NMSF staff are now, like many others in the HINARI countries, benefiting of having free access to up to 14,000 journals, up to 46,000 e-books, and up to 100 other information resources. This access clearly contributes to improve NMSF's performance.

The training and staff development programme will be implemented by establishing a National Training Centre, specialized in health supply chain. The construction of the centre by a Chinese company started in April 2015 and expected to be finished by the end of January 2016. The centre comprises 4 well-equipped training halls (the area of each hall equal 112meter^{2}); library furnished with hard and electronic learning resources, VIP 80 seats meeting hall, in which the meetings of National Health Coordinating Board will conduct its annual meeting; conference hall with 150 seats and translation services; computer skill-laboratory; refectory; female room; VIP sitting room; offices (Photo 6). The centre will accommodate the Continuous Pharmacy Professionals Development Programme founded by Pharmacists Union in collaboration with Coacs, which is a British company that innovated the software.

Photo 6: Training Centre Map



5.3 Effective rewarding and disciplinary systems

NMSF has adopted a system for staff motivation. Performance-based incentives, and systematic supervision and monitoring were established to ensure that duties are completed. NMSF continues to help its head of departments to bring out the best performance from their staff by running an effective appraisal process providing clear and honest feedback about their performance on monthly basis. In addition to financial incentive, NMSF improves working conditions by offering staff health insurance coverage by a private insurance company, transportation from and back to their homes, uniform dressing education, training and coaching programme, and good work environment. To increase staff motivation and their productivity, NMSF equipped all employees, whose jobs require deskwork, with computers with very advanced programme called Enterprise Resources Planning (ERP). They are now networking with each other using the Microsoft Outlook, for the first time, since the late 2010.

The incentives of staff operating the NMSF should be updated if the trained staff are to be kept. In this regards, incentives of NMSF staff increased by 572%, from 0.6 in 2010 to 3.2 in 2013 and 4times their gross salary since 2014. This is reflected in the increase in the incentive budget line, from 2013. The justification is that the senior staff have been retained for a considerable period of time on the NMSF. Although existence of this line may be seen as controversial in public institution improvement, the increase in the availability of quality medicines (from 63% to around 92%), decrease in the rate of rejection due to quality issues (from 9% to less than 0.5% in 2014) and the reduction of the rate of expired medicines (from 7% to 1%) after the reform justify its introduction. The NMSF is continuing to increase incentives and improve working conditions to ensure that suitably qualified and skilled staff, especially pharmacists, are retained for a longer period in a situation where huge number of competent staff migrates to Gulf States, mainly to Saudi Arabia kingdom.

The NMSF realises that, even the best design systems for accountability require enforcement. Disciplinary procedures provide a range of possible responses, from warnings through dismissal, depending on the severity and frequency of the offence. Those who fail to achieve their targets or to meet their deadlines have been taken accountable by losing some or all their monthly incentives immediately.

5.4 Membership of People that Deliver

People that Deliver (PtD) is an international initiative. It aims to build global and national capacity to implement evidence-based approaches to plan, finance, develop, support and retain the national workforces needed for the effective, efficient and sustainable management of health supply chains. One of its strategic goals is to achieve "global recognition that strong supply chains are essential for positive health outcomes and require a competent, recognized and supported supply chain workforce with significant technical and managerial capacity" (PtD 2014). In 2013, the DG submitted a membership application to the PtD. The application has been accepted and NMSF becomes a member of the initiative and also a member of its administration board (Photo 7). The NMSF has been elected for the membership of the administration board for another two years in 2015. The membership allows NMSF to benefit from PtD publications on HR. Advantages of PtD membership also include access to PtD resources, such as technical guidelines and tools. The PtD also pursued the development of case studies that document how public and private sector organizations successfully manage the human capital in their supply chains. The first two of these case studies were

done for Imperial Health Sciences and NMSF. The published report concluded that NMSF has demonstrated improved supply chain performance through better workforce training and management (Deng and Wilkerson 2015). In 2014, the DG has been contacted by PtD to present the experience of NMSF on HR development to the 2nd PtD conference (27-30 October 2014, Copenhagen, Denmark). The materials of the 2nd PtD conference are available at: http://www.peoplethatdeliver.org/content/main-page-2nd-ptd-conference-page.

Photo 7: NMSF is the member of PtD

6. NMSF Automation Programme

NMSF embarks on a very comprehensive automation programme. Its main feature is the installation of ERP. Making use of such programme, NMSF re-launched its new website. It also introduced the electronic sales and procurement, for the first time in Sudan. This section will highlight the achievement of the NMSF in this field.

6.1 NMSF website

The NMSF has relaunched its main website to try to tell its customers and Sudanese health professionals about the changes coming with implementation of the NMSF reform. The main purpose of the website, *NMSF.gov.sd*, is to help patients who seek a medicine whether it is available in NMSF's pharmacies or not. The revamped website also provides weekly updated information about the availability of medicines and other medical consumables. In addition, the website is designed to provide an online marketplace where public health institutions and community pharmacies can purchase their medicines. Customers are able to register their firms by online applications from January 2012 to get a user name and password to use them later for online purchase. Through the customer's web interface, the customer is assured of certain stocks and can place an order accordingly. Once the order has been released, the quantity ordered could be virtually reserved in the system (i.e. the quantity will not be available for sale to other customers) and once the order is confirmed by the payment, the quantity is taken out of the stock register in the system (the system means ERP). More than 900 customers are now using this service. They made 5,710 orders worth SDG 456 million (equivalent to 51% of NMSF's sales) in 2014 through the online interface (Table 15). However, despite efforts to promote the online purchase service, many clients still know little about it. For the first time in Sudan, NMSF introduces electronic payment in collaboration with Faisal Islamic Bank. This service enables electronic purchasers to pay their invoices online. Finally, the website gives opportunities to consumers and customers to ask questions and to send online complaints about the quality of the medicines distributed by NMSF.

Table 15: Online supply service

Description	2012	2013	2014	Progress
Number of users of online supply (customers)	266	542	912	646
% Of users to overall NMSF›s customers	9%	13%	36%	27%
Number of electronic orders	535	2,509	5,710	5,175
% Electronic orders to the public sectors	85%	92%	93%	8%
% Electronic orders to the private sectors	7%	15%	8%	1%
Amount of electronic orders in SDG million	30	167	486	456
% of the electronic sales to the total NMSF›s sales	9%	31%	51%	42%

6.2 Telephone hot line 5959 and SMS

The hot telephone line '5959' helps consumers to ask queries about the availability of certain medicines. During the first 10 months of the service, the department of pharmacies has received and answered 15,110 calls. The number of calls shooting to 44,562 in 2014 and only 362 were missed. The average waiting time for reply was only 10 seconds. The NMSF offers its customers the option of importing the requested item(s), if it is not available in Sudan, within 72 hours at costs without charging any additional fees. The pharmacies department has signed a contract with an Egyptian and Jordanian pharmacies to avail these medicines upon request and on prescription-base. This service is not for profit. In 2014, 82% of the requested medicines (75 out of 92 medicines) have been secured from Egypt, Jordan and Saudi Arabia (Table 16).

Table 16: 5959 service

	2013	2014
Received calls	15,110	44,562
Missed calls	86	362
Total calls	15,196	44,924
Response %	99%	99%
Medicines requested	22	92
Medicines made available	17	75
Percentage	77%	82%
Number of patients requested medicines		934
Number of patients received medicines		917
Percentage		98%

The NMSF has developed a Short Message System (SMS). The system automatically sends message to mobile phones of the NMSF's customers, immediately after new items have been added to the inventory. This service updates the NMSF's customers on the availability of medicines and other medical supplies.

7. Financial reform: Business oriented NMSF

NMSF was a typical public sector organization, whose thinking tends to revolve around costing and to equate costing with pricing. This is because the concern of public sector accountants is to balance the fiscal budget with expenditure. NMSF's accountants were unfamiliar with the classic income statement and balance sheet accounting that is conventionally used in business. The lack of proper business accounting[10] practices poses a risk for working capital to be exhausted and, consequently, threatening the sustainability of the medicines supply. This section, presents the reform of financial and accounting system of the NMSF. It also highlights the growth of sales of NMSF and its customers. Finally, the section presents the argument that has been made by the DG to waive the dividend paid annually to the MOF.

7.1 Commercial accounting system

One of the main areas of the NMSF reform is that NMSF decision-makers start viewing the NMSF more as a commercial operation than a public service. In its reform, the NMSF conducted a comprehensive training of accountants to make the NMSF business oriented rather than mere public medicine supply department. This is because accurate statistics can only be obtained with a system that allows for double entry bookkeeping and for analytical accounting, such as common practice in the private business sector (i.e. balance sheet, and profit and loss account). From the beginning of 2011, the NMSF has been using the new ERP system which is equipped with a proper accounting system, as used in commercial businesses. Formats of annual financial statements have been changed to be in accordance with the international accounting standards and reporting standards, and approved by all the stakeholders. The double entry system (debit & credit) allows the system to provide,

[10] The Government accounting system lacks essential management data to run NMSF efficiently

on a regular basis, a profit and loss account (income statement) and a balance sheet. The very direct outcome of these efforts was the submission of the Annual Financial Statements (income statement and balance sheet) of 2012 to the National Auditor General within allowed period (i.e. only 45 days after the end of 2012). Prior to the reform, the submission of the fiscal account had an average lag-time of nine months (Table 17).The reformers have changed the NMSF to a commercially oriented organization to meet its objectives of recovering medicines costs and raising sufficient revenues to remain viable. The business thinking in the NMSF allows it to make some surplus to substitute its debits and to finance its expansion. This change in the NMSF behaviour makes it more efficient than being a public sector organization. As a result, the cost wastage and losses are significantly lower than they are prior to the reform. The leadership is found to be of paramount importance for the implementation of this kind of reform.

Table 17: Submission of the Annual Financial Statements (income and balance sheet) to the Auditor General

Year	Date of submission	Delay in Months	Date of receiving Audited Account	Waiting time in Months
2001	20 November 2003	22	07 February 2007	38
2002	15 July 2004	18	26 June 2008	47
2003	23 December 2004	11	26 June 2008	42
2004	09 March 2006	17	09 November 2008	30
2005	31 January 2007	13	03 May 2009	27
2006	20 June 2007	6	15 September 2010	38
2007	26 October 2008	9	25 January 2010	26
2008	17 May 2009	5	07 August 2011	26
2009	03 August 2010	7	03 July 2013	30
2010	24 October 2011	9	03 July 2013	21
2011	24 July 2012	6	01 October 2014	26
2012	13 February 2013	1	17 May 2015	26
2013	06 February 2014	1	Not Yet	??
2014	April 2015	4	Not Yet	??

7.2 NMSF Sales

Despite the economic difficulties that face Sudan during the post-separation years, the NMSF very soon regaining its market share and has continued to grow, in terms of volume of sales and assets, and remains in good financial health, in terms of its assets to liabilities ratios. Since 2010, the NMSF's Sales steadily increase. It has jumped from US$69 million in 2010 to US$ 125 million in 2013 and shooting up to US$ 162 million in 2014 (Figure 15). Being non-profitable organization, NMSF considers its sales increase as an indicator for expansion of its services (See Figure 16: NMSF's Customers).

Figure 15: NMSFs Annual Sales in US$

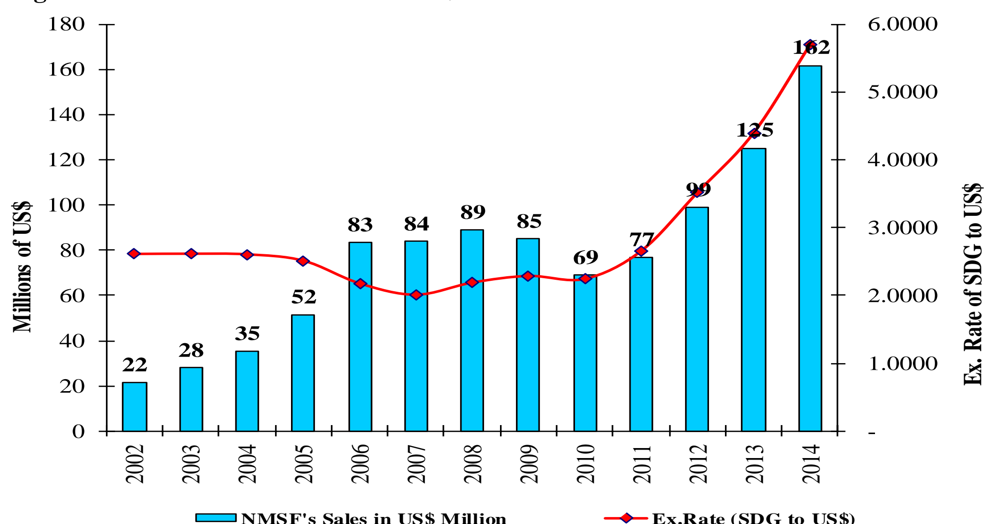


Table 18 shows the balance of revenue coming from sales of medicines and medical devices to different NMSF's customers. Although medicines have a smaller mark-up, their contribution is higher than the medical devices (ranging from 93% to 98%). Nevertheless, the medical devices have very big potential market in Sudan. This side of the business is growing, and there are no competitors in the market. In additional, the medical devices have no price control. NMSF needs to do more in this area. The administration Board passed a resolution to hire a technical consultant from abroad to strengthen the supply chain for medical devices (Selection, Procurement, Storage, Maintenance and Disposal).

Table 18: Annual Sales of medicines and medical devices

Years	Sales of Medicines		Sales of Devices		Total in US$
	Amount in SDG	%	Amount in SDG	%	
2007	170,118,385.81	96%	6,682,579.68	4%	89,792,262.82
2008	172,044,986.64	94%	10,679,043.35	6%	90,234,088.88
2009	187,443,003.85	94%	11,379,882.95	6%	84,930,750.45
2010	160,663,218.81	93%	12,243,734.71	7%	74,593,163.73
2011	164,479,601.15	94%	10,465,464.92	6%	65,517,588.97
2012	298,334,013.38	98%	6,211,337.53	2%	98,851,080.35
2013	534,387,145.66	97%	18,041,403.43	3%	124,144,793.12
2014	875,238,759.60	95%	46,439,012.20	5%	161,817,088.35

7.3 Selling medicines at debt

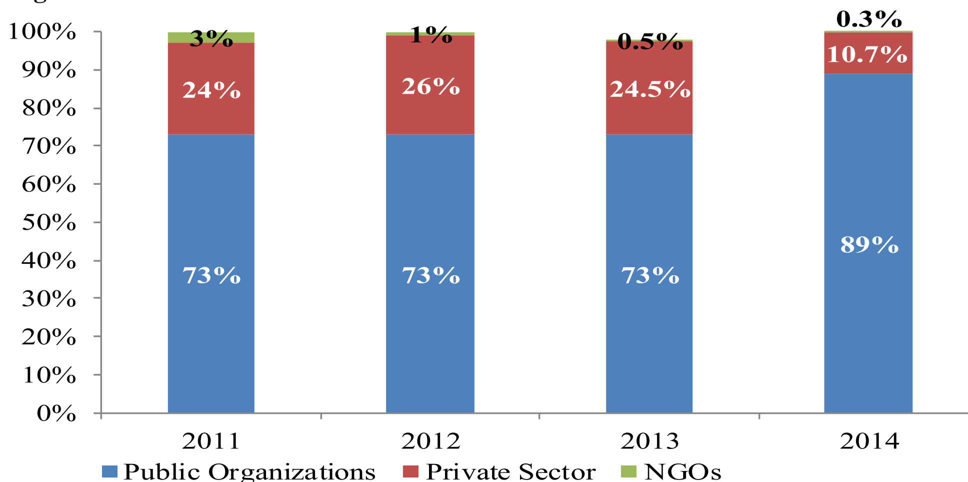
In 2008, the DG of NMSF at that time and under pressure of the FMOH, started to distribute the needs of the certain national programmes, namely blood bank, free emergency medicines programme and renal dialysis and transplantation scheme at debt (i.e. beyond the allocated budget in 2008 and 2009). The NMSF's report on financial performance for the 2009,

revealed a huge debt SDG 51.00 million (US$ 22.4 million) equivalent to 38% of its working capital. This huge debt is currently covered by borrowing from the Central Bank of Sudan at high financing rate (10%). The evaluation revealed that if the Central Bank requested immediate settlement or cash against document for coming consignments, the NMSF would have a real problem. However, the current DG, with the help of new undersecretary of the FMOH, has restricted selling medicines to these programmes within the annual allocated budget, since January 2011. To convince the MOF to pay the debt, is the real challenge that faces administration of the NMSF.

7.4 NMSF's Customers

Before the reform, NMSF sold medicines to any customer, regardless of its eligibility. One of the former sales managers, argued we sell medicines, even to devil once he has money to pay. This was absolutely unlawful practice. In line with its new sales policy, which prohibits selling of medicines to brokers and commercial NGOs, NMSF restricts sales to mainly public health organizations (NMSF states' branches, national health programmes, public health facilities) and eligible customers., community pharmacies and private hospitals). The eligible customers include, NGOs that provide not-for profit services, private hospitals and licensed community pharmacies in certain circumstances. The public organizations provide the bulk of the revenue. For example, in 2014, the shares of public organizations, community pharmacies and genuine NGOs were 89%, 10.7% and 0.3% respectively (Figure 16). These are indications of good performance and it proves the fact that the NMSF is now on the right track.

Figure 16: Customers of NMSF



7.5 Waving of the monthly dividend to the MOF

In 2008, the Ministry of Finance and Economic Planning (MOF) had imposed a dividend, which has to be paid on monthly basis to the public treasury by NMSF. In its fiscal year 2013, the Director General (DG) of the NMSF has convinced the decision-makers at the MOF to drop the annual dividend paid to the public treasury. In its proposal on the waving of the dividend, the DG argued that the dividend often offend those who are poor and only

when they are sick enough to seek curative care at public health facilities (well-off patients most probably using private health facilities). He added, this is against the government policy of fighting poverty. It also interferes with Sudan government economic goals, which are based on the principles of distributive justice. It is well-documented that the poor people use more service than the others (Mustard and Frohlich 1995). The DG concedes that user-fees policy disproportionately hit hard on poor people (Arhin-Tenkorang 2000). The user-fees policy was not adopted specifically to increase government revenues, instead it is imposed to increase government budget allocated for medicines. The last point, the DG mentioned in his argument to wave the dividend was the clear discrimination against those who use the system, instead of taxing general public.

8. Formulation of policies

In its reform, NMSF has formulated a number of policies to improve the efficient use of limited public resources. In the formulation of NMSF's policies, the major change was the shift from knowledge-based and individual experience to evidence-based policies and informed decision-making. The NMSF also changed from sales-oriented and profit-making organization to focus on provision of service on cost-recovery basis. The procurement policy shifted from the acquisition cost of the product as a base for tender adjudication to the quality and overall costs of the product and the performance of its supplier. Finally, NMSF policies moved from being working in different areas to focus on improving supply chain (i.e. from diffusion to focus).

The policies include the new procurement policy, which focuses on the quality of NMSF's products. According to this policy, NMSF runs three types of procurement. Open-tender, restricted tender to support local manufacturers and long term contract for certain medicines. NMSF adopted a scheme for prequalification of suppliers. The suppliers will be carefully screened, according to selection criteria that have been approved by the NMSF board of administration. Those who pass the screening are invited to tender. Although initial screening can be time consuming, this approach will significantly reduce the administrative burdens of an open-tender, particularly after the system has been established. More importantly, this approach is perceived as the most crucial element of quality assurance, as it is a powerful preventive measure.

8.1 Pooled purchasing resolution

For different allegations, the main public health organizations (e.g. NHIF, Military Services, National Health Programmes within FMOH and states' RDFs) have developed their own procurement systems. These allegations include high NMSF prices; low quality medicines; NMSF did not meet their requested quantities and needed items; frequent out of stocks; customers were not respected; and no facilities were offered except deferred payment. The reform focuses on how others view NMSF's performance and the quality and price of its of products.

The former NMSF's DG has presented a paper on the health supply chain in Sudan to the first meeting of the National Board for Health Services Coordination (NBHSC) chaired by HE the president at Khartoum Teaching Hospital in June 2009. The paper concluded that the potential opportunities inherited in pooled procurement outweigh any threats. In this meeting, the NBHSC has decided that all public organizations must unify the purchase of their needs to health commodities from NMSF. The meeting considered the pooled procurement as one possibility to reduce the waste and maximize the benefit from the limited resources

available. It also thought to be a mechanism for improving the national supply chain of health commodities. From our personal experiences as active members in policy-making teams at FMOH, and from the findings of the report of the committee appointed to study the public health supply chain in Sudan, it was clear that the purchasing of health commodities in the public sector is very fragmented. As a result, there are several inefficiencies in this sector. By unifying public purchase through NMSF, the public organizations consolidate their purchasing power. Additionally, the quality standards of pharmaceuticals are harmonized in all governmental organizations. In the unified purchase each supplier is expected to give the best price possible in its offer, because if it does not win, it will be shut out of the public market for at least two years (the NMSF's tender is conducted biannually). This is the key to the price reduction without compromising quality. Using such logical argument, NMSF has led the committee that has been appointed by the Health Board Executive Secretariat to enforce the resolution of NBHSC. Some of the public organizations were very reluctant to the resolution of NBHSC with regard to the unification of public purchase of health commodities through NMSF. To buy them in, NMSF started to deal with them as partners rather than mere customers. All public organizations are now implementing the resolution of the pooled procurement, which later became mandatory according to the NMSF Act, and participating in the NMSF's tender since 2014. The best examples are National Health Insurance Fund, National Renal Dialysis and Kidney Transplantation Programme and National Blood Bank Services.

8.2 Reform of pricing of medicines and other health commodities

The pricing policy was built into the system as a routine administrative exercise from the very beginning of the NMSF, because affordability is a critical factor in a country like Sudan (46% of its population are below the poverty line[11] as reported by the Central Bureau of Statistics). The old pricing system used a fixed percentage on the cost price of every batch being received, which resulted in price changes with every new consignment. In this system, NMSF sold medicines to the 'RDFs' in other states which in turn sold them to the public health facilities. Each level added its own mark-up before the medicines were finally sold to end users. In this type of NMSF drug supply system, any issues of cost recovery are problems for institutions not the NMSF. And the original price of medicines was multiplied two to three times before reaching the end users. This is an important difference. In the old system, NMSF and other states' 'RDFs', each level sells on (after putting its own mark-up) to the one below, rather than taking the full responsibility for the complete cycle to the end user. All potential risks are, therefore, passed down the line. As a result, in the public sector, although the tender's prices recorded were largely below the IRP, the mark-ups of NMSF on generics were found to be higher than those of the private wholesalers (Ali and Yahya 2011). Therefore, lower prices at NMSF do not help much in controlling of prices in private sector, because some retail pharmacies sell the low-cost tender items from NMSF at the retail prices equal to those set by the wholesalers for the same medicines.

The reform of the medicine price aims to ensure provision of affordable medicines, in comparison to the alternative sources, and to maintain NMSF's prices for as long as possible without change. It also introduces a unified pricing system across the country. This pricing system gives a new role to the NMSF to closely monitor State-MSFs with a uniform pricing system to the patients using public health facilities. The CIF price is determined by the tender committee. As shown in table 19, costing is done also by NMSF pricing committee to all

[11] To allow for international comparisons, the World Bank has established an international poverty line of $1.0 a day per person in 1985 (Soubbotina 2004). Despite being old, it is still used to measure the poverty.

items, immediately after the announcement of wining prices. After adding all costs, the medicines then sold on to public and private health facilities at a 15% mark-up. The overall topping ups (customs are excluded) dropped from 41% in 2010 to only 28%, since 2012. This led to the more than 20% reduction in the margin between NMSF and private sources.

Table 19: NMSF old and current costing and mark-ups

	2010	2012
Custom tax[2]	10%	0
Port fees	3%	3%
Clearance expenses	7%	1%
Insurance	2%	2%
Disposal, damaged products	3%	0%
Sudanese Metrology & Standards	1%	1.5%
Bank charges	2%	2.5%
Transportation	4%	3%
Total	31%	13%
Mark-up	20%	15%
Total Toping up on CIF	51%	28%

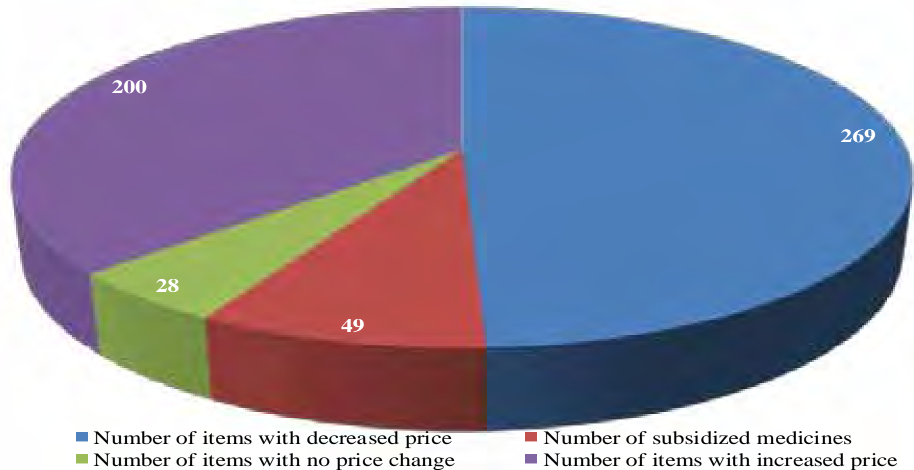
[2] Removed in 2012

Yet the overall NMSF charges amounted to 1.28 times the cost price. This mark-up rate was less than the range (two to three times) recommended by the Bamako Initiative to sustain the continuity of RDFs (Chisadza, et al 1995). Despite this, the average top-up (28%) on CIF prices that are charged by the NMSF safeguarded the NMSF during the hard time of local currency devaluation in the mid-2012, as a result of the separation of Sudan. By improving its procurement and supply management systems, NMSF increases its market share considerably. Among other things, NMSF is now making sure that its prices are competitive at the procurement stage by making sure that its procurement prices are substantially lower than the local market prices as well as the international medicines prices.

The lower costs, and thus lower sales prices, have downward effects on the private market prices when patients favour the lower prices in the public sector. To assure that mark-ups through the supply chain do not compromise affordability, thus hampering access, NMSF unified the retail price of its products across the country. One of the major mechanisms to make medicines affordable to all is cross-subsidisation of more expensive, essential medicines, such as Clopidogrel bisulfate (Pelavix®) and Immunoglobulin (Appendix 2), through a higher mark-up on less expensive, but fast moving items, such as Paracetamol tablets. The mark-up on the cost of the expensive drugs with great health impact is subsidised by increasing that of the cheapest ones. The average percentage of this subsidy is more than 40% (i.e. it ranges between 9% and 74%). The absolute amount of the subsidy in 2014 was more than SDG٥٥ million (US$9.6 million). The NMSF also charges equal medicine prices for all health facilities throughout the country regardless of the distance from its warehouses in Khartoum (i.e. there is a cross-subsidy from closer health facilities to more remote rural ones). The new system has resulted in a price reduction of 49% of the medicines on the NMSF list (Figure 17). However, the NMSF needs to review medicine prices regularly to

keep pace with inflation. The price revision will enable the NMSF to maintain its ability to replenish exhausted stocks and to adjust its prices to those of alternative sources. Finally, this adjustment prohibits leakage and convinces people that NMSF medicines are not of low quality and at the same time keeps down the cost of obtaining medicines.

Figure 17: NMSF price change after adoption of the new pricing systemin 2012



8.3 Changing the legal status of the former CMS

The Central Medical Supplies Public Corporation, CMS, is an organisation with a lengthy, 80 years, pedigree. At different points of time in its history, there has been no hesitation in making the changes necessary for CMS to maintain its mission, i.e. to serve the public interest, ensuring access to quality medicines at all times. Such a point of time has come again as its current status as public corporation is outdated and constrains further necessary improvements, especially in financial and personnel management. The change of the CMS' legal status is essential for it to be able to function as a proper business entity and continue its path of increased efficiency and cost-effectiveness.

As a response to the recommendations of the evaluation conducted by hera (for further details, see section 9), HE the president of Sudan has signed a new act in the mid 2015 that changed CMS to be a National Medical Supplies Fund (NMSF) after its approval by the National Assembly. This development gives the NMSF independent establishment status. According to the Act, the NMSF is a juristic person, it can sue and be sued. The Act gives the NMSF the legislative authority to conduct its business as an autonomous organisation under the direct supervision of the administrative board. This gives the NMSF legal independence from certain public sector regulations. For example, it has been exempted from all governmental charges (approximately 5%). It becomes responsible, by law, for supplying health commodities to all public health institutions and facilities. According to the Act, the pooled procurement of public organizations is mandatory and the medicine prices should be the same across the country, regardless of the distance from central stores. The purchasing of medicines with market authorization in Sudan is the must. The sources of medicines with narrow therapeutic index, genetically modified products and vaccines are clearly identified.

These sources are originators, prequalified products by WHO or generics from well regulated countries recognized by the national medicine regulatory authority. The NMSF is responsible for establishing branches at state levels. It also responsible for the promotion of rational use of medicines and the development of the supply chain for health commodities, including development of human resources.

The pursuit of this Act requires a comprehensive reform of the supply chain. Such reform will include establishment of branches of the NMSF in each states to enhance access to quality medicines across the country. Leadership and strong political commitment is needed to facilitate the enforcement of the Act and other regulations that aim to increase the access to medicines and other health commodities. The improvement of the country's supply chain, combined with equity-oriented strategies for increasing geographic and financial access to high quality drugs through the public sector, will play an important role in the improvement of Sudanese health.

9. Evaluation of NMSF

The evidence-based approach has been adopted by the NMSF as one of its reform agenda. A number of research and field studies have been conducted during the reform time. Examples of these studies include: evaluation of NMSF's performance, training need assessment, study of workload and Pharmaceutical Supply Review in North Darfur. This section presents brief on only three evaluations. The first research conducted in 2012 by hera to evaluate the performance of NMSF and to set recommendations on how to make it an efficient cost-effective organization without losing its public objectives. The second evaluation has been done by NCIHD in 2014. The objectives of the NCIHD assessment were to identify the training needs and to write a proposal how these needs can be addressed. The last evaluation has been conducted by Mubarak Audit Office. This is a national private auditing company specialized in accounting system. In response to hera recommendation, NMSF contacted Mubarak Audit Office to assess the accounting system of the NMSF and to set recommendations for the development of the NMSF's accounting system.

9.1 Evaluation of NMSF's performance

In late 2011, NMSF has made a call for interested specialized firms to submit a proposal for its evaluation. The announced evaluation includes development of procurement, logistics and delivery systems. It also includes development of accounting system and payment mechanisms and systems for human resources development. Later on, the evaluation has been conducted by Health Research for Action (hera).

After 21 days of assessment, the evaluation team (hera 2012) reported that the NMSF has made a considerable progress in different areas of medicine supply chain. The team clearly highlighted the progress in the new procedures of forecasting and quantification; new, more transparent, tender documentation and procedures that ensure quality of the medicines and commodities by excluding non-registered medicines; and proper tender adjudication.

The evaluation team concluded NMSF is on the right path for increased efficiency and cost-effectiveness. The central role of NMSF in strengthening the State-RDFs supply management systems and infrastructure is expected to substantially increase access to essential medicines and commodities at all levels. These conclusions are supported by the results of the basic performance indicators proposed by the Evaluation Team and for which results could be obtained. The increased efficiency and cost-effectiveness over the last 15

months has been expressed particularly by the increased availability of essential medicines and supplies (from 35% to 84% availability) and the procurement of quality products that represent good Value-for-Money, i.e. 68% of 183 items have prices that are less than the median international medicines prices. However, data in key areas are lacking or inaccurate which indicates inefficient or sub-standard performance, especially in financial, personnel and information management. However, the NMSF evaluation founds that a complex mix of further interventions in all areas is needed. At different points of time in NMSF's history, there has been no hesitation in making the changes necessary to maintain its mission (i.e. to serve the public interest by ensuring access to quality essential medicines and commodities at all times). Such a point of time has come again as its current status as public corporation is outdated and constrains further necessary improvements, especially in financial and personnel management. The change of the NMSF' legal status is essential for it to be able to function as a proper business entity and continue its path of increased efficiency and cost-effectiveness. The change of legal status of NMSF into that of a governmental company (i.e. the Evaluation Team's preferred option), is a pre-condition for successful implementation of the team's recommendations. In implementing such reforms, NMSF would follow examples in various other countries in the Middle East and on the African continent where similar measures have been taken, clearly improving the performance of their public pharmaceutical procurement and supply organisations.

9.2 NMSF's training needs assessment

In 2014, NMSF asked the Nuffield Centre for International Health and Development (NCIHD) to conduct a training need assessment. NCIHD has sent a public health expert with special interest in medicines to address this request in collaboration with a national expert on human resources. The assessment comes at a very important moment in the history of NMSF, because the future of the former CMS as a semiautonomous governmental organization was being discussed. The outcome of this discussion will also influence the training needs of staff. Another important contextual factor is the limited range of postgraduate pharmaceutical services and supply chain management courses with an academic qualification. The objectives of the mission were to identify the training needs and to write a proposal how these needs can be addressed.

The main findings and its analysis indicate that NMSF already invests considerable resources into staff development and capacity building. It has some basic training facilities, which will be improved with the construction of an internal training centre. The training needs of NMSF departments should be closely linked to the key performance indicators of the organisation, while the training needs of individual staff members should be closely to individual job descriptions, performance assessments and identification of training gaps. The quality and delivery of internal and external training should be assessed by the HR department in terms of design and input, process of implementation, output in terms of skill development and after some time in terms of improved staff as outcome and departmental performance as impact. Particular emphasis should be placed on training for capability, which prepares staff to operate in a complex environment. Further emphasis should be the training of and by support units, such as information technology, the training of trainers to facilitate internal training and the training of support staff to strengthen the effectiveness of departments. The NMSF training needs have been summarized in three groups: generic, group and individual abilities. Most generic abilities can be addressed by local internal or online courses, while the others require either internal, national or international courses.

The report concludes that NMSF should develop an annual training plan based on performance gaps linked to training needs as identified by staff member and reviewer and a strategic staff development and training plan linked to the strategic development plan of NMSF. Ten recommendations are presented how NMSF should address the short and long term training needs of its staff members.

9.3 Evaluation of the NMSF's accounting system

In its evaluation report of NMSF's performance, hera (2012) stated that 'Financial department needs to elaborate a monthly dash board as a decision making tool. Technical assistance will be required to develop and implement these tools'. In response to this recommendation, NMSF asked a number of national audit offices to submit quotations to conduct a comprehensive evaluation of its account system. The winner was Mubarak Auditing Office. The critically revised the NMSF's accounting system. The weaknesses were highlighted. The NMSF financial department works hard to put the auditors' recommendations in place.

10. Appreciation of what has been achieved

What has been achieved by the NMSF is highly appreciated by its Administration Board and the federal minister of health (the chairman of the board). To show this appreciation, the minister invited HE the President Omer Elbashier to visit NMSF. The President, who was accompanied by Presidency of the republic Minister, Minister of health and minister of defence, made this visit during a ceremony marking the official launching of the MSF on Wednesday 28th August 2013 (Photo 8).

Photo 8: H.E. the President visited NMSF

After inspection of warehouse of the keep-cool products and inventory control room, the President witnessed phase two of the handing over of vehicles (8 Toyota Pick-up) and temperature controlled trucks (8 Mitsubishi Canter) for medicines transportation from states'

warehouses to the health facilities (Photo 9). He talked to the ministers of health of states who have received the vehicles and trucks to make sure that the vehicles and trucks are used for their purposes.

Photo 9: HE the President presented the vehicles' certificates donated by NMSF to the states' ministers

Photo 10: HE the President chaired the meeting of the NBCHS at NMSF's hall

After his 30 minutes historical and memorable visit, the President went to the NMSF's meeting hall (Photo 10) to chair the first meeting of the National Board for Coordination of Health Services (NBCHS). The members of this meeting were: Ministers of Health, Defence, Interior, Social Security, Finance, Decentralization; Governors of States (North Kordufan,

Khartoum, Sennar, White Nile); 16 States' Ministers of health and other senior government officials. NBHSC is a national forum initiated by the FMOH and chaired by the President himself, for coordination of health service in Sudan. This platform also seeks to build a sense of national and cross-sectorial ownership through coordinated leadership and action. Commenting on the implementation of the recommendations of the past meeting, President Elbashier made it clear that all government medical supplies organization, including the military ones, should meet their needs from NMSF. He clearly said that he knows NMSF very well, and he is sure that the quality and prices of NMSF medicines are better than those from alternative sources.

Photo 11: HE the First Vice President witnessed the launching of the under-5 free medicine project

In a related official engagement, First Vice President Ali Othman Taha visited NMSF on Thursday 10th October 2013, where he launched a free medicines programme for children under-five year of age (Photo 11). Led on the tour by the Federal Minister of Health Mr Bahar Idris Abugarda, in the company of states' ministers of health, First Vice President Taha underscored the mobilization of resources for improvement of child health as everybody's business. The First Vice President described efforts gearing toward health improvement as an indication of Sudan's commitment to minimize the child mortality rates in the country and reiterated the involvement of other partners in the process. Addressing the states' ministers of health, Taha said "We must go beyond sensitization and make sure that these medicines are distributed free and reach their targets. He added we can't afford to allow the selling of medicines". Asked by First Vice President for the safety of medicines, the health minister replied: security measures have been put in place to protect every quota of medicines being delivered to health facilities in the country. The minister said the process is fully decentralized

and health workers will be trained by expert teachers identified by his ministry to undertake the distribution across the board. Responsible pharmacist, Tahani Gawish explained how data is collected on the distribution of free medicines; a system, she said, is replicated in all states in the country. She said receipts are given back to the NMSF for every quantity of medicines delivered to any health facility anywhere the free medicine programme targets.

During his visit to NMSF, First Vice President received the minister of health of Chad Republic and his companies at the office of NMSF's DG. The federal minister of health attended this meeting. He said the receiving of Chad minister at NMSF affirmed the recognition of the First Vice President to what has been done in the NMSF (Photo 12).

Photo 12: HE the First Vice President met the minister of health of the Republic of Chad

11. Discussion and Conclusion

11.1 Discussion

The success of health programmes largely depends on the quality of medicines (USP, 2007). Patients in wealthy, strictly-regulated countries can generally be confident about the efficacy, safety and intrinsic quality of their medicines. People in low resource countries however often only have access to substandard medicines. Ensuring that patients have access to quality medicines at reasonable prices is the one of the fundamental principles of the NMSF reform. Although quality is one of the key components in the operational principles of good pharmaceutical procurement and distribution, it is highlighted here because of the increasing failure rate of samples tested by the NMQCL, during the first decade of this century. The

NMSF decision of purchasing registered medicines only ensures that medicines distributed by the NMSF meet national standards of safety, efficacy and quality. The data presented in this study prove that purchasing of registered medicines by the NMSF is strong indicator of quality of medicines. The data also confirmed the fact mentioned by the DG: that the previous international tender operated by NMSF poses a number of quality issues. This must remind NMSF pharmacists that the purchase of non-registered medicines before the reform, which they thought to be benefit to poor patients turned out to not be beneficial, or even to be harmful. Laboratory testing of medicines is carried out mainly to confirm the accuracy of content of active ingredients in the drug sample. It will not guarantee the quality of medicines with regard to stability and bioavailability, since pharmacopoeial specifications do not necessarily address these issues (WHO 1997). Given the alarming prevalence of counterfeit and substandard medicines in the global market (WHO 2006), restricted tender to the registered medicines safeguards against the entry of substandard or counterfeit medicines to the NMSF supply chain.

Access to price information, at the national and international levels, is important. It can improve the ability of procurement departments to make informed decision and to negotiate good medicine prices.

We identified at least three steps in the medicine procurement process in which the role of pharmacists is both necessary and useful: establishment of a medicine tender list, selection of the most appropriate offerings and analysis of the tender process and results. Reputable suppliers who are priced competitively have been awarded a contract. They usually win a contract award on the basis of quality, in combination with price and past service performance, and not on price or other sources of influence, legal or illegal.

The distinction between the two periods was the requirement of certificate of market authorization. This requirement was responsible for differences between the tenders 2008 and 2011 in the time to complete the bidding processes, failed items, per unit cost and total value to procure the medicines. The technical requirement to present the certificate of registration made the process faster. Due to existence of a number of medicines (e.g. narcotics) on the tender list, which have no marketing authorization in Sudan, the tender committee decided to accept them on condition that their suppliers must complete the registration of such medicines. This is to avoid the possibility of stock-outs in the health system.

Another valid issue to consider in this study is the basis for selecting medicines to be included in the tendering process in the public health sector in Sudan for the years 2011 and 2013. Each of the national programme has its own method of selecting medicines to be included in the bidding list. Each method is considered highly subjective because it is knowledge rather than evidence-based. On the one hand, rationality dictates that any government in a resource-constrained setting would expect that an effective procurement system would ensure availability of quality medicines while optimising the finances to ensure the best outcomes. It is also in the interest of the government to run this system transparently to promote competition and thus efficiency. In addition, patients expect that quality medicines are available at all times.

A successful reform requires both political skills, to develop and mobilize political support, and technical skills, to manage and promote the reform. It also requires strong leadership that is capable of managing the reform by adopting financial transparency and developing anticorruption measures. Finally, the usage of hard and soft data in decision making without

forgetting the signs of denial and act on them are also necessary to make the change. This study shows that a firm commitment from the National Assembly, Ministry of Council of Ministers, FMOH, MOF and Central Bank of Sudan is vital to the success of the NMSF reform. The authors recognize that political commitment is of paramount importance for the success of the NMSF reform. Examples of such commitment are supporting of NMSF stand during importers resistance to the tender's conditions; waiving of annual dividend, and exemptions from customs which count up to 10% of the amount of imported medicines, business profit taxes (15%), and Zakat. These exemptions helped the NMSF to provide low cost quality medicines. Much motivation has been also given for the NMSF to succeed, by drawing attention to and praising its success, at the highest levels of the government. Examples of such praising include the visit of HE the President of the republic and in less than two month later, HE the First Vice President also visited NMSF. Other public health organizations are not allowed to establish parallel procurement systems. This pooled procurement through NMSF minimizes the tender costs and results in competitive prices through increasing purchased quantities (i.e. economy of scales).

Access to convertible currency remains one of the major planks of sustaining international procurement. This is more so for public sector procurement in developing countries, particularly in Sub-Saharan Africa, where governments in many cases may not be in a position easily to provide foreign currency (Wang'Ombe and Mwabu 1987; Knippenberg, et al 1997). The availability of hard currency, especially after the separation of Sudan, is the cornerstone for the success of the NMSF reform. The commitment of the Central Bank of Sudan to secure the hard currency (which also reflected the commitment of the government) has helped the NMSF to have access to hard currency at official rates. This allows a regular supply of medicines from abroad to the NMSF, and from the NMSF to public health facilities. It also enables the NMSF to maintain its medicine costs at more than 20% less than the prices charged at alternative sources while making a surplus to finance its operating costs. Additionally, availability of foreign currency helps NMSF to keep its price of medicines without change for longer period (more than 15 months, despite the very frequent changes in the private sector). As a result, National Health Programmes enjoy the same quantity of items based on annual budget (i.e. no need for asking for additional budget to meet patients demand as a consequence of price increase). Finally, the availability of hard currency has protected the NMSF against excessive losses by devaluation of local cash in hand as a result of local currency inflation, particularly during 2012.

In many countries, a lack of trained staff is a frequent cause of supply chain system breakdown and poor performance, resulting in poorly maintained information systems, ill-functioning product management, and, ultimately, product stock-out. An effective public health supply chain requires motivated and skilled staff with competency in various essential logistics functions; staff must be empowered to make decisions that positively impact health supplies and supply chains. The NMSF, as a leader in medical supplies, fully recognized that its success and reform are achieved through people's expertise, and that appropriate training and development is the key to the success of its reform. The NMSF's reform based on shifting the way of doing things from knowledge-based to evidence-based and learning from others' successful stories. To do this, NMSF conducted a very comprehensive human resources development programme. The participation of the key pharmacists in regional and international training courses, conferences and workshops helps them, for example, to change their minds about purchasing cheap non-registered medicines.

NMSF's senior management realizes that a motivated workforce is an asset to their organization.

In the early stages of the reform, the board of directors took bold decisions deviating from the traditional way of doing things in the NMSF raising, *changing the way of doing things,* as slogan for the first year. It was that courage and the political commitment, which enabled the DG to encounter the fierce resistance to the reform of the procurement system led by the association of the importers of medicines. This resistance due to the fact that the NMSF, in its first tender after the reform, stopped the previous practice of giving preference to cheap non-registered medicines and regardless of the performance of the suppliers. It also stopped prepayment to manufacturers through letters of credit, and took their agents responsible for delivering of medicines to the NMSF's warehouse. However, the NMSF reached agreement with association of the importers to pay them in hard currency up to 50% of proforma invoices in advance and to complete the payment after receiving of shipments in NMSF's warehouse. One year later, and due to the scarcity of hard currency, the Central Bank of Sudan obliged itself to charge the NMSF only 25% of the proforma invoice in advance and to be completed on the receiving of the shipping documents. As a result, NMSF re-started opening LCs, except in cases that the corresponding bank refuses to make transactions with the Central Bank of Sudan.

Although studies (Silva 2013, PJ 2008) claim that financial incentives do not always affect production of employees, our experience in NMSF, where salaries are very low (i.e. on average equal US$2,213.6/annum/year), reveals otherwise. This is being said, The NMSF does not ignore other incentives. These include good working conditions, education, training and coaching programme, health insurance and free transportation of staff from and back to their homes. Although morale, satisfaction and commitment are important HR policies, they should not be used as ultimate criteria for success in organizations. The management must focus on performance.

Strong leadership and calibre of the NMSF Director General enables him to lead the change. His long experience in managing drug supply and pharmaceutical regulation were an asset. It is interesting to note that the DG himself spares enough time to meet with all members of staff of different department, irrespective of their category, twice per year to monitor the reform; listen to their ideas and complaints, if any; and motivate personnel from bottom to the top. It was the team spirit and the honesty, dedication of the highly motivated team members, dominated by pharmacists that made the NMSF's reform programme a great success in a hard time in Sudan (i.e. during post separation period).

Continuing to evaluate pharmaceuticals after they have distributed as well as the routine collection of bottom line information from MSFs is an important part of ensuring their quality and therefore their safety and learning new things about their benefits.

NMSF combines the objectives of the policy of local pharmaceutical industry development and health policy that aims to assure access to quality affordable medicines, so the sector can develop, the economy can grow and people's access to high quality affordable medicines is not compromised. However, although support to local pharmaceutical manufacturers is a reasonable policy priority, this should not be at the cost of less access to essential medicines due to higher prices. Additionally, this policy may distort the market, as local small companies may not even attempt to be competitive (African Union 2007). Finally, greater price preferences make it difficult to achieve value for money (MSH 2013). This is critical

in Sudan, where poverty is deep and widespread. According to the Sudan Central Bureau of Statistics, over 45% of the population in Sudan is below the poverty line (CBS 2012). Estimates made by the WHO (2004, p.126) show that Sudan had spent US$13 per capita on health in 2000. Analysis by source of funding shows that the government in Sudan provides 21% of health expenditure. The balance (79%) was met by citizens themselves (WHO 2010). It is therefore recommended that government seeks other ways of support to the national pharmaceutical industry without affecting accessibility to essential medicines.

11.1.1 Study limitation

The perceived assumption is that, any public archival documents represent the imprint of the organisation that produced it, and thus bias arises simultaneously from both the author and the organization (Denzin 1989). However, the fact that official records were not prepared for the purpose of the evaluation gave authors more confidence in them. Some of these documents are stock records and tender reports which are more likely to be accurate; because the stocks of medicines at NMSF's warehouses were taken annually by committees comprise NMSF staff, in addition to external members (e.g. auditor general, representative of MOF, legal advisor and internal auditor). Moreover, all authors, except the first one, are working with NMSF at least since 2009, some of them since the early 1990s. The danger is that staff may be too willing to provide good image about their organization. To counter the inbuilt bias resulting from being members of NMSF staff, evaluation team set indicators and decided to report findings when there is a consensus prior to assessment. We thought that these measures secure the accuracy of the information, and thereby, the credibility of the findings and conclusions.

11.2 Conclusion

The revolutionary programme aims to make NMSF efficient organization. This strategy might bring general benefits to Sudanese people by reducing cost of quality medicines. Such revolutionary change will not come about unless NMSF's leaders persuade policy-makers and other stakeholders to welcome 21st century style of management and develop system for unified medicine supply chain. Sometimes, changing existing structures for new procedures may be a herculean task, which needs to be well thought out before undertaking (Singh, et al, 2013). Clarity of the vision and knowing the targets are of paramount importance in making the dream of the NMSF reality. The empowerment of the senior employees and selection of teams with a mix of analytical and action-oriented members are another important lesson to be learned from the experience of the NMSF. Having gone through the training programme and participation in a number of regional meetings and conferences and being part of the reform, managers were more committed to making this reform happened.

In its reform, NMSF considers price after the quality of the product and the performance of its supplier. NMSF has adopted well-designed, thoroughly planned and scientifically streamlined procedures for quality assurance, procurement, storage and distribution of medicines. The tender is a lengthy, laborious and risky exercise (Milovanovic, et al, 2004), which consumes many resources and needs monitoring and audit. The new tender procedures have ensured lower possible total costs without making any compromise for quality. Such procedures have helped the NMSF to increase availability of medicines from 46% before reform to around 95% in the years of the reform. The NMSF experience has also shown that the value for money can be achieved, if objective adjudication is built in through continuous review and monitoring of prices of medicines circulated in the market. The best value for

money was achieved not by the selection of cheap items, but by considering overall costs, which may sometimes lead to accepting higher prices. The new tender procedures also proved that, the purchasing system will become cost-effective, if measures are put in place to have a transparent and corruption free process and follow WHO guidelines on good procurement practice (WHO 1999). Access to price information, at the national and international levels, is important. It can improve the ability of procurement departments to make informed decision and to negotiate good medicine prices.

The focus of the NMSF is now on the quality and not only on the price. In this regard, purchasing of registered medicines from reliable sources is one step to avoid human suffering, and even death because of ineffective medicines. NMSF staff need to be trained to notice a suspected product if a large number of batches is received, if the label is not in good order, if the expiry date is not stamped or unreadable.

The efficiency of a procurement system requires special skills, both pharmaceutical and administrative. The experience of the NMSF has proved that the trained pharmacists are the cornerstone in pharmaceutical purchasing system. Such system, in similar situations to that of the NMSF, cannot be established and maintained without the support of pharmacists.

Innovation, like publication of NMSF's medicine datasheet book; donation of MDS-3: managing access to medicines and health technologies to the NMSF and MSFs' pharmacists, departments of pharmacy at federal and state levels, and schools of pharmacy; and distribution latest edition of the BNF (free of charge) every year, aims to improve the capacity of the pharmacists work in the national medical supply chain and to promote rational use of medicines and keeping pharmacists at NMSF, MSF, and big hospitals up to date.

Based on the qualitative observations made, the authors assert that some of the critical success factors of the experience of NMSF include strong leadership and political support; well-qualified motivated staff; sufficient budget allocation to meet drug demand and administrative costs, scientific quantification and forecasting, and objective adjudication; outsourcing of non-core services like transportation and cleaning; mandatory external quality testing; prompt payment to suppliers; scientific warehousing and inventory management; real-time stock monitoring (both at the warehouse and facility levels); and robust IT systems.

The website's redesign was based on consumer search for medicines and "online purchase". The new website, SMS system and toll- number have a simple mission: to make sure every Sudanese who needs medicines has the information they need, to make choices that are right for themselves and their families or their businesses.

DG enables faster and better decision-making, such as stop selling to non-licenced customers, commercial NGOs, stop NMSF commercial activities (e.g. investment in pharmaceutical manufacturing firms), focus on medical supplies to the public health facilities and organizations (For example, RDFs, free emergency medicines), restricted purchase to registered medicines only unless under certain circumstances, pricing system, and open-tender for medical devices. ERP was in trial stage, when the reformer DG has been appointed. The high commitment of the new DG, who used to visit IT department on daily basis, made this programme gone live rapidly. Although the DG plays some part in all this, it would be remiss of him not to credit his colleagues, especially the directors of different directorates, and the predecessors NMSF's DGs (who set foundation and the current DG only built on it) for the NMSF's phenomenal reform. Without the sound cooperation and foresight of his colleagues, the reform would not have been achieved, at least it would have taken the DG a

longer time to make his vision a reality.

While much has been achieved in the first 4-year of NMSF reform, much remains to be done. Improved supply chain at all levels (i.e. central, state, locality and facility levels); quality use of medicines; independent sources of medicine information; the widespread use of new technologies, such as electronic payment are just examples.

Conflict of interest: The authors are NMSF members of staff,

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Appendix 1: Achievements

Description	2010	2011	2012	2013	2014
Medicines from abroad (US$ millions)	45.3	55.4	81.3	113.0	103.9
Medicines from local manufacturers (US$ millions)	3.0	3.8	5.1	9.2	19.8
Stock end of the year (US$ millions)	31.3	32.0	43.8	49.2	62.3
Sales (US$ millions)	73.2	65.9	86.7	124.9	161.8
Free medicines budget (US$ millions)	26.2	24.5	31.8	66.0	102.0
Electronic customers	NA	57	266	542	912
Availability of medicines	63%	66%	93%	95%	92%
Expired medicines	7%	5%	2%	1%	1%
Rejected medicines for quality issues	9%	2%	1%	1%	0.3%
Registered medicines	73%	87%	72%	96%	99%
Number of staff participated in training	10	161	331	466	588

Appendix 1: continue

	Indicator	Description of indicator	NMSF	Standard	References
1	Selection	Percentage of medicine items received that are in the CMS list	99%	100%	WHO, 2011
2	Availability	Percentage of items available ÷ total number of items	92%	95%	MSH, 2013
3	Procurement Efficiency	Ratio between median price of products procured and the international median reference value (Target ≤ 1)	77%	All items	WHO, 2011
4	Emergency Procurement	Percent of emergency orders issued in the last 12 months Proportion of the value of emergency orders issued in the last 12 months	3%	less than 5%	WHO, 2008
5	Port clearance Performance	Percentage of orders to be cleared from port that were cleared before the deadline	%87	100%	WHO, 2011
6	Supplier Performance	Percentage of orders delivered in full and on time (as stated in the procurement agreement) from total number of orders in a defined period	NA	100%	WHO, 2008
7	Expiration Management	[Total value of expired items ÷Total value of products procured annually] X 100%	0%	0%	USAID 2013
8	Registration of items	[Registered items that are procured ÷ Number of items procured in a defined period] X 100%	99%	100%	USAID 2010; MSH 2012
9	Quality of items before release	[Medicines that met national quality control standards ÷ number of items procured in a defined period] X 100%	99.7%	100%	WHO, 2011
10	Post-marketing surveillance	Percentage of sample passing the post marketing surveillance test	%100	100%	USAID, 2009
11	Recall system	Percentage of batches of items recalled from the market	%0	-	MSH, 2013
12	Shelf life at the date of arrival	Percentage of medicines received with shelf life less than 75% at the time of arrival	11%	0%	MSH , 2013
13	Inventory physical count	[Absolute value of the difference between recorded quantities and counted quantities ÷ Physical quantity] X 100%	0%	0%	MSH, 1997
14	Value of expired items	[Total value of expired items ÷ Average inventory value] X 100%	1%	3 to 5%	MSH, 2013
15	Inventory Control	Percentage of quantities of each product lost per total quantities available for use (opening stock plus quantities received) in the past year.	0.4%	> 1%	WHO, 2011
16	Coverage	Percentage of coverage of CMS services among public institutions) Hospital)	68%	-	WHO, 2007
17	The quality of CMS services	Percentage of treatment sites that received all orders in full and on time during a defined period	80%	100%	WHO, 2011
18	Geographical accessibility	Percentage of patients taking more than one hour to travel to the facility	NA	-	WHO, 2007
19	Human Resources	Percentage of staff responsible of PSM who have been trained in PSM	74%	-	WHO, 2008

Appendix 2: List of subsidized medicines in 2013

	Description	UNIT	Purchase Price in SDG	Selling Price in SDG	Subsidy %
1	Human normal Immunoglobulin 5gm/100ml for i.v use	BOTT	2,675.48	700	-74%
2	Docetaxel 20mg/0.5ml vial	VIAL	583.74	200	-66%
3	Docetaxel 80mg/2ml vial	VIAL	2,018.77	750	-63%
4	Somatropin5 mg (15 IU) /1.5 ml Solution for S.C Use	VIAL	547.2563	200	-63%
5	Oxaliplatin 100 mg	VIAL	3,101.12	1,200.00	-61%
6	Methotrexate sodium salt 2.5mg tablet.	TAB	1.9458	0.9	-54%
7	Oxaliplatin For intravenouse injection 50mg/ Vial	VIAL	1,556.64	750	-52%
8	Iron dextran 50 mg/ml inj 2ml	AMP	30.4031	15	-51%
9	Oxaliplatin 100 mg	VIAL	1,767.64	900	-49%
10	Streptokinase 1.500.000 iu lyophilized for i.vinj	VIAL	971.6839	500	-49%
11	Recombinant human erythropoietin 4000iu/1ml for i.v,s.c	VIAL	128.9093	70	-46%
12	Terlipressin Acetate 1mg powder for i.vinj	VIAL	279.7088	150	-46%
13	lipid emulsion 20% 500ml iv infusion	BOTT	109.4513	65	-41%
14	Human albumin 20% w/v in 100ml	BOTT	413.4825	260	-37%
15	C.S.F Flow contoured Shunt High Pressure	PCS	1,580.96	1,000.00	-37%
16	C.S.F Flow contoured Shunt Small Medium Pressure	PCS	1,580.96	1,000.00	-37%
17	Ventricular Shunt Low Pressure	PCS	1,580.96	1,000.00	-37%
18	Human albumin 20% w/v in 100ml	BOTT	407.4019	260	-36%
19	Methyl Phenidate 10 mg tablet	TAB	1.5323	1	-35%
20	Rabies immunoglobulin 150IU/ml 2ml amp.	AMP	462.1275	300	-35%
21	Hepatitis B Immunoglobulin	VIAL	643.9382	430	-33%
22	Temozolamide 100 mg caps	CAP.	645.3975	450	-30%
23	Temozolamide 20 mg caps	CAP.	127.8147	90	-30%
24	Human albumin 20% w/v in 50ml	BOTT	206.7413	150	-27%
25	Monoclonal Anti-Rho-D immunoglobulin 300mcg/2ml (1500iu) for i.v	VIAL	304.0313	225	-26%
26	travoprost 40mcg/ml eye drop 2.5ml bottle	BOTT	118.5722	90	-24%
27	Acetyl cystine 200mg/ml in 10ml injection	AMP	279.7088	217.55	-22%
28	Amphotricin B USP 50mg powder for inj (lyophilized)	BOTT	48.645	37.9	-22%
29	Clomipramine HCl 25mg/2ml inj	AMP	16.2961	12.67	-22%
30	Digoxin 50mcg/ml Elixir		43.7805	34	-22%
31	Doxorubicin 10 mg	VIAL	23.5928	18.4	-22%

	Description	UNIT	Purchase Price in SDG	Selling Price in SDG	Subsidy %
32	Flupenthixol decanoate 20mg/ml, 2ml Amp	AMP	62.6304	49	-22%
33	Gelatin Polysuccinate 4%W/V solution for IV use 500ml /bottle	Amp	52.1462	40.5	-22%
34	Glucagon HCL 1gm powder for inj	VIAL	243.225	190	-22%
35	Interferon alfa-2a 3000000iu/ml for sc only		271.0937	211	-22%
36	Ondansterone HCL USP 2mg/1ml 2ml amp	AMP	30.4031	23.6	-22%
37	Topotecan HCL 1mg/ml in 2.5ml single dose for i.v use	VIAL	194.58	151.4	-22%
38	Vincristine Sulphate 2mg powder for inj, for I.V only	VIAL	61.6575	48	-22%
39	Zoledronic acid 800 microgm/ml, 5ml VIA	VIAL	1,903.24	1,480.00	-22%
40	Amino Acid 10% Solution (500ml) bottle	BOTT	100.9384	80	-21%
41	Amiodarone hydrochloride50mg/ml in 3ml injection	AMP	4.3829	3.5	-20%
42	Heparin sodium 5000 IU/ml in 5ml vial for I.V/ S.C use		43.7805	35	-20%
43	Paclitaxel 6mg /ml .50ml vial	VIAL	486.45	400	-18%
44	Vinoreline(as tartrate)50mg	VIAL	729.675	600	-18%
45	Haloperidol 5mg/ml(1ml) ampule	AMP	2.4201	2	-17%
46	Rabies vaccine single dose liquid 1ml/amp. (Human diploid cell)	AMP	76.6159	65	-15%
47	Tinzaprin Sodium 10000 IU/ml , 1 ml	PFS	87.8042	74.75	-15%
48	L.asaraginase powder for inj 10000iu/vial	VIAL	273.6281	250	-9%

Appendix 3: Examples of weekly reports presented to the meeting of board of directors

1. Sample of weekly sales reports

1.1 Weekly Sales to different customers and method of payment

1.2 Sample of monthly Lost opportunity report

1.2.1Lost opportunity in the governmental sector

Month	items requested	Items issued	% Items issued	Amount of items req.	Amount of items issued	Missed Amount	%age of amount missed to the total amount requested
January	147	142	97%	4,002,163.29	3,910,881.59	91,281.70	2%
February	154	145	94%	9,834,968.19	9,766,673.19	68,295.00	1%
March	152	150	99%	7,555,779.57	7,467,251.17	88,528.40	1%
April	152	151	99%	11,941,479.30	9,909,221.25	2,032,258.05	17%
May	155	154	99%	14,728,807.78	14,542,124.78	186,683.00	1%
June	145	145	100%	13,881,116.72	13,294,818.72	586,298.00	4%
July	182	166	91%	16,512,887.93	13,209,971.43	3,302,916.50	20%
August	181	173	96%	17,605,073.94	16,158,095.73	1,446,978.21	8%
Total	1268	1226	97%	96,062,276.72	88,259,037.86	7,803,238.86	8%

Items contributing to the lost Opportunity in public sector

1- Lidocaine 2%	7- Anti scorpion	13- Ergometrine inj.	19- CO-Trimoxazole susp.
2- Atropine	8- Absorpent Gauze	14- Disposable syring 1ml,3ml,5ml	20- Multivitamine syp
3- Ephedrine	9- Polyamide sutures	15- Human albumin	21- All I.V Infusions
4- Metoclopramide inj.	10- Tetracyclin eye ointment	16- Anti haemophilic factor 8	22- Rabies vaccine ,single
5- Ringer lactate inf.	11- Chromic sutures	17-Verapamil inj.	23- Amiodarone HCl inj
6- Anti snake	12- Polyglycolic acid sutures	18-Salbutamol solution	24- Chlorpromazine HCl 50mg inj

1.2.2 Lost opportunity in the orders to the private sector

Month	No. of items requested	No of items issued	% of No. of items issued / No. of items requested	Amount of items required	Amount of items issued	total amount calculated as missed opportunity	% of amount missed to the total amount requested
January	182	172	95%	2,731,552.33	2,529,259.17	202,293.16	7%
February	158	150	95%	2,186,572.68	1,875,594.28	310,978.40	14%
March	187	183	98%	2,583,405.87	2,300,280.58	283,125.29	11%
April	193	179	93%	2,312,245.13	1,966,198.39	346,046.74	15%
May	179	169	94%	2,568,657.98	2,120,892.40	447,765.58	17%
June	208	202	97%	2,562,039.00	2,143,504.53	418,534.47	16%
July	218	208	95%	2,835,902.84	2,484,008.40	351,894.44	12%
August	256	244	95%	3,793,307.42	3,295,369.96	497,937.46	13%
Total	1581	1507	95%	21,573,683.25	18,715,107.71	2,858,575.54	13%

Items contributing to the loss opportunity in the private sector:

1- Artemether inj 40	12- Vancomycin 1g.	23- Cephalexin 125,250 susp	34- Erythromycin 250 tabs 250,125 susp
2- Mixtard Insulin	13- Verapamil inj.	24- Amoxicillin 500caps ,250,125 susp.	35- Thyoxine 100 & 50 tabs
3- Glimebride tab	14- Folic Acid .	25- Carbimazole 5 mg	36- Nstatin oral drops
4- Cefixime syp 100 ,200 mg sus & 400 caps .	15- Paracetamol syp .	26- Kanamycin inj.	37- O. R.S
5- Methotrexate tabs	16- Multivitamin syp	27- Hydrocortisone cream	38- Metocloperamide inj.
6- Metronidazol 200,500 mg tabs &syp .	17- Primaquine tabs	28- Doxazocin 2mg	39- Chloroxylenol
7- Dextrose 50%	18- Ceftazidime1g.	29- Enoxaprine 2000 IU, 400 IU,8000 IU	
8- Dextrose 10%	19- Quinine tabs	30- Tetracycline caps & eye ointment	
9- Normal Saline, Dextrose 5% & Dextrose + Normal Saline .	20- Carbamazepine 200 mg	31- Ethanol.	
10- Ringer lactate	21- Phenytoin 100mg tabs.	32- Formaldehyde solution	
11- Water for inj	22- Prednisolone tabs	33- Loratidine tabs.	

Missed value for both public and private sectors from 1/1/2015 to 31/8/2015 for the online orders

	Group Name	Order Amount SDG	Issue Amount SDG	Missed Amount SDG	% Missed Amount	% from total missed value
1	صيدليات الصندوق	10,947,135.43	9,547,787.65	1,399,347.78	13%	2%
2	علاج الأطفال دون سن الخامسة	35,789,261.90	31,961,612.81	3,827,649.09	11%	6%
3	حوادث الولايات	96,062,277.02	88,259,037.85	7,803,239.17	8%	13%
4	المستشفيات الحكومية	67,240,967.65	58,017,383.67	9,223,583.98	14%	15%
5	المراكز الصحية	19,765.00	19,765.00	0	0%	0%
6	الصندق القومي للتأمين الصحي	11,680,632.39	9,347,719.26	2,332,913.13	20%	4%
7	مراكز غسيل الكلي	28,450,110.16	28,403,856.28	46,253.88	0%	0%
8	وزارة الصحة	3,852,847.52	2,497,248.81	1,355,598.71	35%	2%
9	المراكز العلاجية الخاصة	1,595,613.02	1,338,309.96	257,303.06	16%	0%
10	المستشفيات والمستوصفات الخاصة	7,715,880.40	6,546,506.22	1,169,374.18	15%	2%
11	الصيدليات الخاصة	21,573,683.26	18,715,107.65	2,858,575.61	13%	5%
12	صناديق الامداد الطبي الولائى	109,411,139.54	81,267,995.30	28,143,144.24	26%	47%
13	الدواء الدائرى ولاية الخرطوم	12,966,140.75	11,104,389.74	1,861,751.01	14%	3%
14	الجامعات	554,883.95	512,279.25	42,604.70	8%	0%
Total		407,860,337.97	347,538,999.43	60,321,338.54	15%	100%

Weekly Report :Quality Control

Weekly Report: Quality Control (continue)

ملخص التقرير المالي الإسبوعي رقم (32) للعام المالي 2015

Financial Report: Weekly Balance

اليوم	التأريخ	بنك السودان			بنك المزارع			الجملة		
		الإيراد	المنصرف	الرصيد	الإيراد	المنصرف	الرصيد	الإيراد	المنصرف	الرصيد
الرصيد السابق				809,008			16,018,104			16,827,112
الإثنين	10/8/2015			809,008	2,409,189	920,067	17,507,226	2,409,189	920,067	18,316,234
الثلاثاء	11/8/2015			809,008	1,072,525	2,115,769	16,463,982	1,072,525	2,115,769	17,272,990
الأربعاء	12/8/2015	558,250		1,367,258	478,828	3,723,828	13,218,982	1,037,078	3,723,828	14,586,240
الخميس	13/8/2015		2,306,014	(938,756)	465,740	1,591,252	12,093,469	465,740	3,897,266	11,154,714
الأحد	16/8/2015			(938,756)	3,409,548	525,028	14,977,990	3,409,548	525,028	14,039,234
الجملة		558,250	2,306,014	(938,756)	7,835,831	8,875,944	14,977,990	8,394,081	11,181,958	14,039,234
الأسبوع السابق		15,109,975	15,126,553	809,008	7,692,555	13,007,430	16,018,104	22,802,530	28,133,983	16,827,112
الإنحراف		14,551,725	12,820,539	1,747,764	143,276	4,131,486	1,040,114	14,408,449	16,952,025	2,787,878
النسبة		96%	85%	216%	-2%	32%	6%	63%	60%	17%

Weekly Report: Availability of Medicines and Medical Consumables

تقرير الوفرة الدوائية لجميع أصناف الصندوق للإسبوع 19 من العام 2015

Category		Total		National Lab/ Under Test		Org. Doc. Received/ Local Delivery		L/C		Bank/ proforma		UP/ Under Process		No action		W 18	W 19
		N	%	N	%	N	%	N	%	N	%	N	%	N	%		
Total Items	W 18	W 19															
0 month	50	50	11%	0	0%	7	14%	36	72%	5	10%	2	4%	0	0%	89%	89%
1 month	44	41	9%	0	0%	20	49%	16	39%	2	5%	2	5%	0	0%		
2 month	27	29	6%	0	0%	7	24%	17	59%	4	14%	1	3%	0	0%		
>2 month	330	331	73%	0	0%	65	20%	46	14%	90	27%	4	1%	63	19%		
Total	451	451	100%	0	0%	99	22%	115	25%	101	22%	9	2%	63	14%		
Total Last Week	451	451	100%	0	0%	99	22%	113	25%	96	21%	8	2%	62	14%		
القائمة V	W 18	W 19															
0 month	8	6	11%	0	0%	0	0%	5	83%	1	17%	0	0%	0	0%	86%	89%
1 month	3	3	5%	0	0%	0	0%	3	100%	0	0%	0	0%	0	0%		
2 month	6	7	13%	0	0%	1	14%	5	71%	0	0%	1	14%	0	0%		
>2 month	39	40	71%	0	0%	1	3%	11	28%	9	23%	1	3%	0	0%		
Total	56	56	100%	0	0%	2	4%	24	43%	10	18%	2	0%	0	0%		
Total Last Week	56	56	100%	0	0%		0%		0%		0%		0%		0%		
اصناف العلاج المجاني	W 18	W 19															
0 month	10	8	14%	0	0%	1	13%	7	88%	0	0%	0	0%	0	0%	89%	81%
1 month	10	9	9%	0	0%	7	78%	2	22%	0	0%	0	0%	0	0%		
2 month	11	6	10%	0	0%	2	33%	4	67%	0	0%	0	0%	0	0%		
>2 month	64	36	61%	0	0%	5	14%	9	25%	11	31%	0	0%	0	0%		
Total	95	59	94%	0	0%	15	25%	22	37%	11	19%	0	0%	0	0%		
Total Last Week	95	95	100%	0	0%	17	18%	36	38%	12	13%	0	0%	0	0%		

Weekly Report: Availability of Medicines and Medical Consumables

العلاج المجاني -المستهلكات	W 18	W 19																
0 month	12	12	12%	0	0%	2	17%	10	83%	0	0%	0	0%	0	0%	88%	88%
1 month	10	10	10%	0	0%	2	0%	7	0%	0	0%	1	0%	0	0%		
2 month	7	7	7%	0	0%	0	0%	6	86%	1	14%	0	0%	0	0%		
>2 month	70	70	71%	0	0%	13	19%	15	21%	2	3%	2	3%	36	51%		
Total	99	99	100%	0	0%	17	17%	38	38%	3	3%	3	3%	36	36%		
Total Last Week	99	99	100%	0	0%	17	17%	38	38%	3	3%	3	3%	36	36%		
أدوية الذرة الإمدادات	W 18	W 19															
0 month	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	100%	100%
1 month	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%		
2 month	1	1	2%	0	0%	0	0%	0	0%	1	100%	0	0%	0	0%		
>2 month	50	50	98%	0	0%	1	2%	1	2%	40	80%	0	0%	8	16%		
Total	51	51	100%	0	0%	1	2%	1	2%	41	80%	0	0%	8	16%		
Total Last Week	51	51	100%	0	0%	1	2%	1	2%	41	80%	0	0%	8	16%		
أدوية الذرة: م.الذرة+الإمدادات	W 18	W 19															
0 month	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	100%	100%
1 month	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%		
2 month	1	1	2%	0	0%	0	0%	0	0%	1	0%	0	0%	0	0%		
>2 month	50	50	98%	0	0%	2	4%	1	2%	40	80%	0	0%	8	16%		
Total	51	51	100%	0	0%	2	4%	1	2%	41	80%	0	0%	8	16%		
Total Last Week	51	51	100%	0	0%	2	4%	1	2%	41	80%	0	0%	8	16%		
بنك الدم	W 18	W 19															
0 month	1	1	5%	0	0%	0	0%	1	100%	0	0%	0	0%	0	0%	95%	95%
1 month	1	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%		
2 month	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%		
>2 month	18	19	95%	0	0%	0	0%	0	0%	0	0%	0	0%	19	100%		

Weekly Report: Availability of Medicines and Medical Consumables

Total	20	20	100%	0	0%	0	0%	1	5%	0	0%	0	0%	19	95%		
Total Last Week	20	20	100%	0	0%	0	0%	2	10%	0	0%	0	0%	18	90%		
أدوية و مستهلكات الكلى	W 18	W 19															
0 month	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	100%	100%
1 month	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%		
2 month	1	1	5%	0	0%	0	0%	0	0%	1	5%	0	0%	0	0%		
>2 month	21	21	95%	0	0%	0	0%	0	0%	21	100%	0	0%	0	0%		
Total	22	22	100%	0	0%	0	0%	0	0%	22	100%	0	0%	0	0%		
Total Last Week	22	22	100%	0	0%	0	0%	0	0%	22	100%	0	0%	0	0%		
القائمة العامة A	W 18	W 19															
0 month	27	23	16%	0	0%	4	17%	13	57%	4	17%	2	9%	0	0%	84%	82%
1 month	23	19	12%	0	0%	11	58%	4	21%	2	11%	1	5%	0	0%		
2 month	7	7	5%	0	0%	4	57%	2	29%	1	14%	0	0%	0	0%		
>2 month	107	95	66%	0	0%	45	47%	10	11%	7	7%	1	1%	0	0%		
Total	164	144	98%	0	0%	64	44%	29	20%	14	10%	4	3%	0	0%		
Total Last Week	164	164	100%	0	0%	64	39%	36	22%	18	11%	5	3%	0	0%		
القائمة العامة B	W 18	W 19															
0 month	5	7	11%	0	0%	7	100%	0	0%	0	0%	0	0%	0	0%	92%	89%
1 month	6	3	5%	0	0%	3	100%	0	0%	0	0%	0	0%	0	0%		
2 month	3	6	9%	0	0%	6	100%	0	0%	0	0%	0	0%	0	0%		
>2 month	51	49	75%	0	0%	49	100%	0	0%	0	0%	0	0%	0	0%		
Total	65	65	100%	0	0%	65	100%	0	0%	0	0%	0	0%	0	0%		
Total Last Week	65	65	95%	0	0%	65	100%	0	0%	0	0%	0	0%	0	0%		

Weekly Report: Availability of Medicines and Medical Consumables

أصناف التأمين الصحي	W 18	W 19															
0 month	20	20	4%	0	0%	16	80%	4	20%	0	0%	0	0%	0	0%	96%	96%
1 month	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%		
2 month	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%		
>2 month	432	432	96%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%		
Total	452	452	100%	0	0%	16	4%	4	1%	0	0%	0	0%	0	0%		
Total Last Week	452	452	100%	0	0%	16	4%	4	1%	0	0%	0	0%	0	0%		

Weekly Report: Availability of Medicines and Medical Consumables

الأطفال دون الخامسة	Q 1	Q 2															
0 month	2	1	5%	0	0%	0	0%	1	0%	0	0%	0	0%	0	0%	89%	95%
1 month	2	3	16%	0	0%	3	0%	0	0%	0	0%	0	0%	0	0%		
2 month	1	1	5%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%		
>2 month	14	14	74%	0	0%	1	7%	0	0%	0	0%	0	0%	0	0%		
Total	19	19	100%	0	0%	4	21%	1	5%	0	0%	0	0%	0	0%		
Total Quarter	19	19	100%	0	0%	1	5%	0	0%	0	0%	0	0%	0	0%		

Weekly Report: Access to Medicines at States and Health Facilities

تقرير الإشراف

الأسبوع 42

التاريخ:25/10/2015

تغطية المرافق الصحية بالأدوية

البرنامج	المرافق الصحية	الولايات الموقعة			الأسبوع السابق
		المطلوب	المنفذ	النسبة	
الأدوية بالقيمة	المستشفيات	249	187	75%	75%
	المراكز الصحية	1168	335	29%	29%
	وحدات طب الأسرة	1834	244	13%	13%
	الجملة	3251	766	24%	24%

البرنامج	المرافق الصحية	الولايات الموقعة			الولايات غير الموقعة			كل الولايات			الأسبوع السابق
		المطلوب	المنفذ	النسبة	المطلوب	المنفذ	النسبة	المطلوب	المنفذ	النسبة	
أدوية الأطفال	المراكز الصحية	1205	1033	86%	962	639	66%	2167	1672	77%	77%
	وحدات طب الأسرة	1922	1547	80%	976	526	54%	2898	2073	72%	71%
	الجملة	3127	2580	83%	1938	1165	60%	5065	3745	74%	73%
الدعم العالمي	مرافق الملاريا	3138	2844	91%	2085	1876	90%	5223	4720	90%	90%
	مرافق الدرن	214	186	87%	139	133	96%	353	319	90%	90%
	مرافق الايدز	23	23	100%	15	15	100%	38	38	100%	100%

Weekly Report: Access to Medicines at States and Health Facilities

Availability of medicines at central, state and health facilities (supervision and active reporting system)

الوفرة الدوائية في الولايات

الولايات	القوائم	رئاسة الإمدادات الطبية			رئاسة الولاية			مراكز التبليغ الإيجابي				المراكز التي تمت زيارتها			
		المطلوب	المنفذ	النسبة	المطلوب	المنفذ	النسبة	عدد المراكز	المطلوب	المنفذ	النسبة	عدد المراكز	المطلوب	المنفذ	النسبة
الوفرة في الولايات الموقعة	أدوية الملاريا	12	7	58%	168	87	52%	42	168	95	57%	0	0	0	#DIV/0!
	أدوية الدرن	10	8	80%	140	124	89%	28	280	254	91%	0	0	0	#DIV/0!
	أدوية الإيدز	39	34	87%	546	297	54%	14	546	338	62%	0	0	0	#DIV/0!
	أدوية الأطفال	41	25	61%	266	233	88%	42	798	510	64%	0	0	0	#DIV/0!
	أدوية الحوامل	1	0	0%	14	13	93%	42	42	28	67%	0	0	0	#DIV/0!
	الأدوية بالقيمة	27	17	63%	378	343	91%	42	1134	813	72%	0	0	0	#DIV/0!
	أدوية الحوادث	194	149	77%	2716	1700	63%	13	2522	1264	50%	0	0	0	#DIV/0!
	المجموع	324	240	74%	4228	2797	66%	223	5490	3302	60%	0	0	0	#DIV/0!
	الأسبوع السابق	324	243	75%	4034	2774	69%	223	5490	3291	60%	0	0	0	#DIV/0!
الوفرة في الولايات غير الموقعة	أدوية الملاريا	12	7	58%	48	27	56%	12	48	30	63%	0	0	0	#DIV/0!
	أدوية الدرن	10	8	80%	40	33	83%	8	80	62	78%	0	0	0	#DIV/0!
	أدوية الإيدز	39	35	90%	156	125	80%	4	156	104	67%	0	0	0	#DIV/0!
	أدوية الأطفال	41	25	61%	76	55	72%	12	228	153	67%	0	0	0	#DIV/0!
	أدوية الحوامل	1	0	0%	4	4	100%	12	12	11	92%	0	0	0	#DIV/0!
	الأدوية بالقيمة	27	17	63%	108	27	25%	12	324	0	0%	0	0	0	#DIV/0!
	أدوية الحوادث	194	151	78%	776	526	68%	4	776	482	62%	0	0	0	#DIV/0!
	المجموع	324	243	75%	1208	797	66%	64	1624	842	52%	0	0	0	#DIV/0!
	الأسبوع السابق	324	243	75%	1181	842	71%	64	1624	840	52%	0	0	0	#DIV/0!

Weekly Report: Access to Medicines at States and Health Facilities

Coverage of health facilities with medicines (Geographical Accessibility)

تقرير تغطية المرافق الصحية بالولايات بالأدوية

أدوية الإيدز			أدوية الدرن			أدوية الملاريا			أدوية الأطفال			الأدوية بالقيمة			الولاية
%	المنفذ	المطلوب	%	المنفذ	المطلوب	%	المنفذ	المطلوب	%	المنفذ	المطلوب	%	المنفذ	المطلوب	
100%	1	1	100%	11	11	100%	243	243	85%	217	256	6%	18	286	الشمالية
100%	2	2	93%	14	15	99%	307	310	101%	297	293	49%	151	311	نهر النيل
100%	2	2	100%	14	14	100%	238	238	100%	266	266	55%	143	261	سنار
100%	1	1	100%	9	9	100%	147	147	86%	119	139	15%	23	150	النيل الأزرق
100%	3	3	100%	22	22	99%	275	277	88%	268	306	83%	274	331	كسلا
100%	1	1	95%	20	21	97%	401	412	75%	332	441	6%	22	385	النيل الأبيض
100%	3	3	74%	14	19	59%	282	475	67%	284	422	10%	45	442	شمال كردفان
100%	2	2	50%	7	14	100%	137	137	100%	141	141	23%	35	154	جنوب كردفان
100%	1	1	80%	8	10	91%	96	106	68%	113	165	3%	6	181	غرب كردفان
100%	1	1	100%	6	6	100%	46	46	29%	22	77	7%	6	84	شرق دارفور
100%	1	1	89%	16	18	76%	182	240	79%	197	248	5%	12	261	شمال دارفور
100%	3	3	78%	18	23	82%	78	95	89%	81	91	15%	15	99	غرب دارفور
100%	1	1	76%	16	21	100%	366	366	86%	190	220	3%	6	237	جنوب دارفور
100%	1	1	100%	11	11	100%	46	46	85%	53	62	14%	10	69	وسط دارفور
100%	2	2	100%	18	18	100%	98	98	86%	156	182	0%	0	186	البحر الأحمر
100%	24	24	86%	193	221	91%	2699	2993	80%	2519	3053	23%	748	3151	المجموع
100%	7	7	100%	57	57	97%	644	665	28%	181	651	0%	0	673	الخرطوم
100%	2	2	90%	38	42	79%	722	910	74%	601	809	0%	0	861	الجزيرة
100%	4	4	91%	20	22	100%	412	412	77%	227	296	0%	0	322	القضارف
100%	**13**	**13**	96%	**115**	**121**	90%	**1778**	**1987**	59%	**1009**	**1938**	0%	**0**	**1856**	المجموع

Weekly Report: Access to Medicines at States and Health Facilities

Medicines Availability of different programmes at state and health facility levels

تقريروفرة الأدوية بالولايات

البرنامج	أدوية الملاريا			أدوية الدرن			أدوية الإيدز			أدوية الأطفال			أدوية الحوامل			الأدوية المستهدفة			أدوية الحوادث		
الولاية	المخزن	التبليغ	الإشراف	المخزن	التبليغ	الإشراف	المخزن	التبليغ	الإشراف	المخزن	التبليغ	الإشراف	المخزن	التبليغ	الإشراف	المخزن	التبليغ	الإشراف	المخزن	التبليغ	الإشراف
الشمالية	67%	58%	0%	90%	90%	0%	41%	56%	0%	89%	88%	0%	100%	100%	0%	78%	86%	0%	47%	38%	0%
نهر النيل	58%	58%	0%	90%	90%	0%	82%	79%	0%	95%	70%	0%	100%	67%	0%	74%	53%	0%	64%	46%	0%
سنار	33%	42%	0%	80%	80%	0%	31%	51%	0%	95%	79%	0%	0%	33%	0%	85%	80%	0%	52%	51%	0%
النيل الأزرق	25%	50%	0%	100%	90%	0%	46%	74%	0%	79%	44%	0%	100%	67%	0%	100%	79%	0%	93%	52%	0%
كسلا	25%	67%	0%	80%	95%	0%	28%	72%	0%	89%	56%	0%	100%	33%	0%	100%	86%	0%	97%	63%	0%
النيل الأبيض	42%	50%	0%	90%	90%	0%	64%	41%	0%	89%	19%	0%	100%	67%	0%	78%	81%	0%	33%	38%	0%
شمال كردفان	42%	50%	0%	90%	90%	0%	67%	67%	0%	100%	67%	0%	100%	33%	0%	100%	81%	0%	40%	44%	0%
جنوب كردفان	42%	58%	0%	100%	95%	0%	26%	64%	0%	95%	77%	0%	100%	67%	0%	100%	74%	0%	47%	46%	0%
غرب كردفان	42%	83%	0%	40%	90%	0%	62%	92%	0%	79%	84%	0%	100%	100%	0%	89%	67%	0%	100%	45%	0%
شرق دارفور	67%	42%	0%	100%	80%	0%	26%	28%	0%	95%	61%	0%	100%	67%	0%	85%	79%	0%	0%	0%	0%
شمال دارفور	75%	50%	0%	70%	90%	0%	72%	46%	0%	42%	21%	0%	100%	67%	0%	96%	70%	0%	75%	82%	0%
غرب دارفور	83%	67%	0%	120%	100%	0%	79%	49%	0%	84%	77%	0%	100%	67%	0%	93%	43%	0%	61%	45%	0%
جنوب دارفور	100%	67%	0%	100%	90%	0%	82%	74%	0%	100%	95%	0%	100%	100%	0%	100%	65%	0%	82%	51%	0%
وسط دارفور	25%	50%	0%	90%	100%	0%	56%	72%	0%	95%	56%	0%	100%	67%	0%	93%	57%	0%	85%	49%	0%
الخرطوم	58%	58%	0%	60%	65%	0%	59%	46%	0%	84%	79%	0%	100%	100%	0%	0%	0%	0%	90%	86%	0%
الجزيرة	42%	75%	0%	90%	60%	0%	92%	67%	0%	11%	74%	0%	100%	100%	0%	0%	0%	0%	51%	57%	0%
البحر الأحمر	83%	42%	0%	100%	85%	0%	92%	64%	0%	100%	65%	0%	100%	100%	0%	0%	0%	0%	69%	46%	0%
القضارف	42%	75%	0%	80%	100%	0%	77%	90%	0%	95%	51%	0%	100%	67%	0%	100%	0%	0%	62%	59%	0%
المتوسط	53%	58%	0%	87%	88%	0%	60%	63%	0%	84%	65%	0%	94%	72%	0%	76%	56%	0%	64%	50%	0%

P.O.Box 297, Khartoum South,
Alhuriya St., Khartoum, Sudan

+249 183 461765/ 574195

+249 183 491008/ 460723

info@nmsf.gov.sd

www.nmsf.gov.sd

Newlife P.P - T.: +249 185 334244