



**THE POTENTIAL OF THE GUAR  
VALUE CHAIN DEVELOPMENT IN SUDAN  
AN EXPLORATORY STUDY**



The Hague, the Netherlands  
November 2015



**KUBITA**  
ECONOMIC EMPOWERMENT  
Reinforcing local economies

# **THE POTENTIAL OF THE GUAR VALUE CHAIN DEVELOPMENT IN SUDAN**

**AN EXPLORATORY STUDY**

KUBITA Economic Empowerment  
Sophieke Kappers

November 2015

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## **ACKNOWLEDGEMENTS**

This exploratory study on the potential of the Guar Value Chain Development in Sudan is a follow-up to the initiatives taken by the company Fair Organic Gum Arabic (FOGA), the Ministry of Agriculture, the National Guar Council and the Dutch Embassy, all in Sudan.

I am grateful to the government officials, the donor organisations, the companies and experts interviewed in Sudan and the Netherlands for their willingness to contribute and their open attitude towards the exploration of the potential of the development of the Guar value chain in Sudan.

The warm welcome at the national conference on Guar in Khartoum, May 2015, by Mr Abdel Jabar Husein Osman of the Ministry of Agriculture and by Mr Bader Eden Abu Zaid and Mr Abdelhmid Adam Mukhtar, Chairman and General Secretary respectively of the Guar Council, was especially memorable.

This report was funded by the Dutch Embassy in Khartoum, Sudan and the Dutch Enterprise Agency in The Hague, the Netherlands. I would like to thank Mrs Esther Loeffen for her continuing efforts to link the private sector to the development of the agricultural sector in Sudan.

Special thanks are due to Mr Abdelrahman Ibrahim Abdelrahman, Board Member of FOGA who advised and assisted me during all my visits to Sudan. FOGA's vision and experiences of involving farmers in Darfur in the development of the gum Arabic value chain can contribute significantly to the guar value chain development.

The contents of this report are my sole responsibility.

This exploratory study demonstrates the increasing worldwide demand for guar gum. It also reveals the relevance of guar for the improvement of farmers' livelihoods and those of pastoralists. The development of this value chain can also contribute to peace building in conflict areas and to the national economy. So it is my hope -as an agricultural development economist- that this report will be an important step towards joint engagement on the development of the guar value chain in Sudan.

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## 1 INTRODUCTION

This chapter describes the growing interest on the guar value chain in Sudan, the objectives and methodology of this exploratory study, and the structure of the report.

### ***Initiatives on Guar in Sudan***

In 2014, the company FOGA (Fair Organic Gum Arabic) in Khartoum, Sudan, explored the feasibility of the development of the guar gum value chain in the south of Sudan and the north of South Sudan. The idea was to set up a guar processing factory including the development of the entire value chain from farmers to the customers worldwide.

In May 2015, the Ministry of Agriculture, in cooperation with the Guar Council in Sudan, organised a national congress on guar involving farmers, farmer unions, traders, processors, researchers and government officials, totalling 400 participants. This national congress was a catalyst for the growing interest in guar. Up to that time, it was rather an unknown and underexposed crop.

The Dutch Embassy in Sudan aims to support the agricultural sector because it is important for the national economy. The guar sector is highly relevant for the development of smallholder farmers in Sudan. The Dutch Embassy works towards collaborative efforts and encourages the initiatives taken at national level on the development of the guar value chain.

### ***Objectives of the Exploratory Study***

Based on initiatives already taken, the Dutch Embassy supported further exploration of ways in which to develop the guar value chain. The main objectives of this limited, explorative study are:

- ✓ to map the worldwide market for the various applications of guar gum;
- ✓ to map the local market in Sudan for the various applications of guar and guar gum;
- ✓ to investigate whether and how the guar value chain development can contribute to peace-building in the south of Sudan and north of South Sudan;
- ✓ to investigate whether donors are prepared to support and finance a programme on the development of the guar value chain.

### ***Methodology of the Exploratory Study***

The exploratory study was implemented by studying available information and by participating in the National Conference on Guar on 25<sup>th</sup> and 26<sup>th</sup> May 2015 in Khartoum. After this conference about 25 donor organisations, government officials, investors and companies in Sudan were interviewed in order to ascertain their interest in supporting the development of the guar value chain. In the Netherlands, four importers of guar gum were approached as well as four experts in livestock, oil drilling and ammunition.

### ***Structure of the Report***

Chapter 2 describes the guar crop, its preferred growing conditions and the general use of the guar plant and the guar seeds that are processed into guar gum. In Chapter 3, the industrial applications of guar gum in the various sectors are described briefly. Chapter 4 shows the worldwide demand for guar gum and the national supply and demand in Sudan. The relevance of the guar for Sudan is described in Chapter 5. The obstacles mentioned for developing the guar value chain in Sudan and South-Sudan are listed in Chapter 6 as well as the interest shown by donors in developing the guar value chain in Sudan and South Sudan. Finally, a proposal for following up the development of the guar value chain is described in Chapter 7. In the two Annexes, the people interviewed are listed as well as background literature.

## 1 GUAR PLANT AND ITS USES

This chapter describes the recent cultivation of guar in Sudan, the plant and its growing conditions. The multiple uses of the guar plant and guar seeds is also described.

**The cultivation:** in Sudan, guar is considered to be one of the significant cash crops which has been incorporated into both domestic and commercial production recently. It is grown by smallholder farmers and on larger estates. Guar was only introduced into Sudan 50 years ago. It grows in several states in Sudan including Blue Nile, Darfur, Jazeera, Kordofan and Gedaref.

**The plant:** the guar or cluster bean (*Cyamopsis Tetragonolobus*) is an annual plant of the 'leguminosa' family. It is also known as gavar, guwar or guvar bean. The origin is unknown as it has never been found in the wild. The plant grows to one or two metres high with vertical stalks. The guar seed pods, about 15 cm long, grow on these stalks and hold 6-9 seeds which are about 2-3 mm in diameter. The guar plant is also known for its nitrogen fixing properties in soil which increases fertility. The guar can yield 5-8 tonnes of seeds per hectare and 40-50 tonnes of green fodder per hectare.

**Growing conditions:** guar grows best in sandy soils: it is extremely drought resistant and thrives in semi-arid regions where most plants do not. Guar requires reasonably warm weather and a growing season of 14-16 weeks. The optimum temperature required for its roots is between 25 and 35 degrees Celsius. It needs moderate intermittent rainfall with lots of sunshine. For effective guar cultivation, the crop needs two lots of rainfall before sowing, one when the crop buds and another when the crop develops and when it is flowering. It needs far less water compared to other crops. Too much precipitation can cause the plant to become more 'leafy' thus reducing the number of pods and/or the number of seeds per pod which affects the size and yield of seeds. Guar grows preferably in fertile, medium-textured and sandy loam soils that are well-drained: waterlogging decreases plant performance. In respect of soil acidity, guar grows best in moderate alkaline conditions (pH 7-8) and is tolerant of salinity. The crop is generally sown in July and can be harvested from November to January.

**Use of the guar plant for soil improvement and human and animal consumption:** the guar plant lives in symbiosis with nitrogen-fixing bacteria and improves the soil condition in a cost effective and natural way that can increase the yield of subsequent crops. During the growth phase, the guar plant protects other crops like sorghum from being grazed because the guar plant releases an unpleasant smell that keeps cattle and goats away from the fields. After harvesting, the green fodder is used as cattle feed: it is very suitable because of the high percentage of protein. The guar leaves can be used like spinach and the pods are prepared like salad or vegetables.

**Use of guar seeds for industrial uses and animal feed:** after harvesting, when the pods are dried out in the sun, the guar plants are beaten and during the process, the seeds come out. Guar seeds can be stocked for a long time under the right conditions. The guar seeds are de-husked, milled and screened to obtain the guar gum. The guar seeds consist of three parts:

- ✓ the seed coat and fibres which is around 14-16% of the guar seed;
- ✓ the germ, protein which is 40-46% of the guar seed;
- ✓ the endosperm or starchy material which is around 38-45% of the guar seed.

The processing of guar seeds gives three products: churi and korma and guar splits. Churi and korma (from the seed coat and the germ) are used as cattle and poultry feed and guar splits (from the endosperms) are processed into guar gum for industrial uses. Important parameters of guar gum for industrial uses are the percentage of protein, the solubility, viscosity, moisture, granulation and water thickening potency. Guar gum is classified under Mucilages and Thickeners as HS code 13032 and E 412.

## 2 INDUSTRIAL APPLICATIONS OF GUAR GUM

This chapter describes the various applications of guar gum in a multiplicity of industrial sectors. No information has yet been found on the worldwide demand for guar gum specified per sector. It is said that the food industry and the oil drilling industry are the main and largest customers of guar gum. A reasonable assumption is that no stakeholder in the guar value chain would want to support the weapons industry. So the use of guar gum in ammunition needs to be further clarified in a follow-up study.

**Cosmetics:** guar gum is used as a thickener and protective colloid in skin care products, creams, hair shampoos and conditioners, and lotions. It is also used in toothpaste, and shaving cream for easy extrusion from the container tube.

**Explosives and Munition:** guar gum is used because of its ability to efficiently thicken the nitrate salt solution which is the basic component of slurry explosive formulations as well as cross linking agents for gel and slurry explosives systems. Guar gum is also used as a thickener in flame-throwers and pyro-technical munitions.

**Food Industry:** in the food industry guar gum is used in many products, like in bakery goods, confectionary, sauces and salads, beverages, frozen food and dairy products. Guar gum reduces crystal formation, acts as a (water) binder and stabilizer to extend shelf life. Guar gum improves texture and smoothness, maintains uniform viscosity and colour. It is also used for viscosity control and reduction of calorific value.

**Metallurgical and Mining:** guar gum is widely used as a flocculent to produce liquid solid separation. Guar gum is also used in flotation. It acts as a depressant for talc or insoluble gangue mined along with valuable minerals.

**Oil Drilling:** industrial grade guar gum powder is used in oil well fracturing, oil well stimulation, mud drilling and industrial applications and preparations as a stabilizer, thickener and suspension agent. Guar gum products reduce friction in the holes, and so minimise power requirements. Some guar gum products act to minimise water loss should this occur in broken geological formations.

**Paper Industry:** guar gum is used as a wet-end additive. It gives more dense surface to the paper used for printing. Guar gum imparts improved writing properties, better bonding strength and increased hardness. Due to improved adhesion, it gives better breaking and folding strengths.

**Pharmaceutical Industries:** guar gum powder is used in the pharmaceutical industry in tablets as a binder; guar gum hydrates and forms a thick gel layer on the tablet surface. Guar gum is also an important non-calorific source of soluble dietary fibre and cleanses the intestinal system.

**Textile Industry:** guar gum gives film forming and thickening properties when used for textile sizing and printing to keep the dye stuff from spreading on the fabric. It reduces dusting while sizing and gives better efficiency in production.

**Variety of other industries:** guar gum powder is also used in a variety of other industrial sectors and products like battery electrolytes, carpet printing, ceramics, firefighting, fish farming, flotation, the paint industry, pet food, photography, printing inks, synthetic resins, water paint and water treatment.

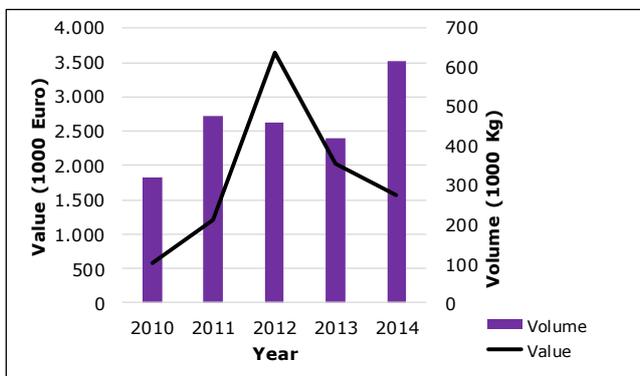
### 3 GUAR GUM: SUPPLY AND DEMAND

This chapter first describes the supply of guar gum worldwide, and in Sudan, as well as the price increase of guar gum in 2012. Demand figures are shown for guar gum worldwide and in the EU. This is followed by import and export figures for guar gum in Sudan.

**The supply of guar gum worldwide and in Sudan:** the worldwide demand for guar gum is still increasing. India is considered the largest producer of guar contributing about 80% of the total world production, Pakistan contributes 15% followed by Australia, Sudan and the United States with 5%. The roughly estimated area in Sudan under guar cultivation was about 27.000 hectares in 2014 with an average yield of guar gum of 300 kg/ha. In Sudan five processors of guar are operational. It is said that these companies all have about the same production capacity of 4,000 tons of guar gum yearly. A company active in the oil sector, however, mentioned that it had a request from a foreign company for 20,000 tons of guar gum which amounts to the actual total production capacity in Sudan. The demand from the customer could not be met.

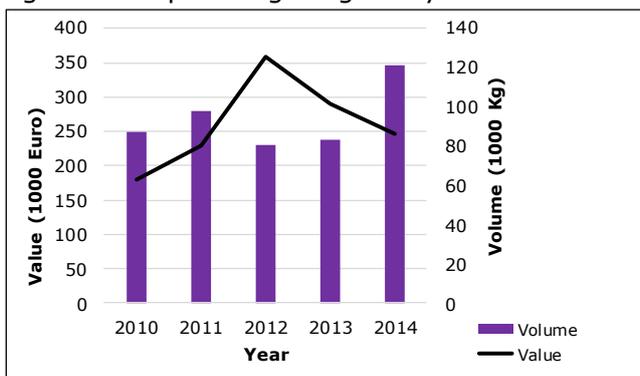
**Demand worldwide and the EU:** the average annual growth between 2010 and 2014 amounted 12% or 28% according to the statistics from the International Trade Centre (ITC) database. This increase in demand is confirmed by Dutch importers of guar gum, see Figures 1 and 2. This first look at the statistical information from the ITC database needs to be verified by comparing the information on prices, quantities and trends with that from other sources.

Figure 1: Import of guar gum world wide



Source: International Trade Centre, 2015

Figure 2: Import of guar gum by the EU

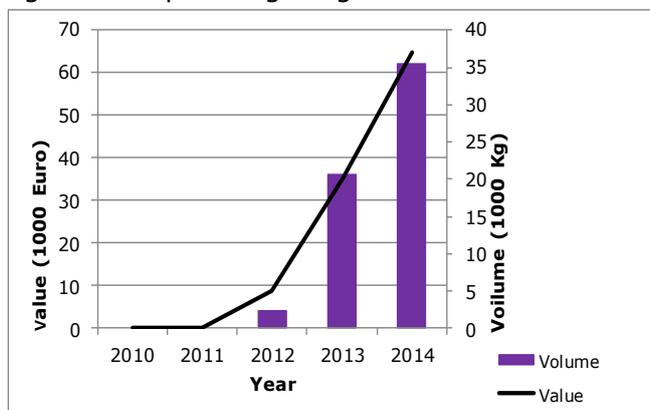


Source: International Trade Centre, 2015

**Development of price of guar gum:** in 2012, guar prices increased by 1000%. The main reason was the inventory build-up by the two companies Halliburton and Schlumberger amidst the fear of shortage of guar gum for drilling due to ongoing drought in Rajasthan in India. In 2013, the area of guar production grew by 21%.

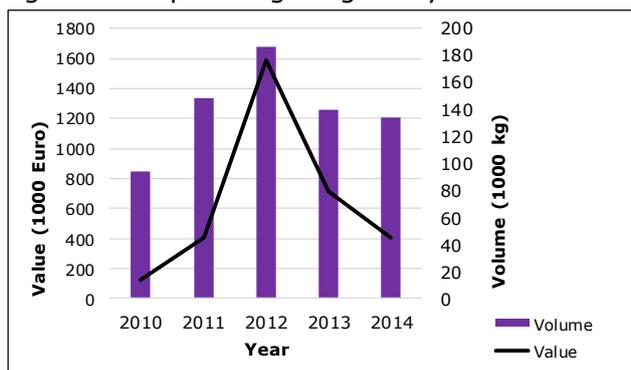
**Import and export of guar gum in Sudan:** figures 3 and 4 show respectively the export and import of guar gum in Sudan and South Sudan. This first look at the statistical information from the ITC database needs to be verified by comparing the information on prices, quantities and trends with that from other sources. The International Trade Centre doesn't make any distinction yet between the two countries Sudan and South Sudan. It is suggested that the figures below refer to Sudan mainly as the guar is actually hardly grown in South Sudan and therefore not exported yet from South Sudan. It is unknown when the statistics for Sudan and South Sudan will be submitted separately.

Figure 3: Export of guar gum in Sudan and South-Sudan



Source: International Trade Centre, 2015

Figure 4: Import of guar gum by Sudan and South-Sudan



Source: International Trade Centre, 2015

Although Sudan and South Sudan are exporting some guar gum, it is still a net importer and in 2014 Sudan and South Sudan imported 134,000 tons (403,000 Euro) of which 99% came from the Netherlands (2015, ITC database). The decrease of import might be explained by a lack of foreign currency in Sudan that is needed to pay the import of guar gum.

## 4 RELEVANCE OF THE GUAR VALUE CHAIN IN SUDAN

This Chapter first describes the multiple positive effects of the guar (gum) in Sudan. It is followed by a discussion about how the guar value chain can contribute to peace building. Then the impact of the guar value chain on different levels is described.

**Positive effect of the guar and its gum in Sudan:** the positive effects of the development of the guar value chain are many and can be specified as follows:

- Human consumption: the green leaves of the guar plant are important for human consumption because of the high protein content.
- Cattle feed for farmers and pastoralists: the Churi and Korma as well as the green fodder are used as cattle and poultry feed because of the high protein content. The Butana project financed by the International Fund for Agricultural Development shows the importance of the guar plant as fodder because of a proven increase in the weight of goats, increase of lactation and reduction of kidding interval.
- Improvement of nitrogen fixing properties thus improving the soil condition in a cost effective and natural way and preventing soil degradation.
- Increased cash income for fe/male farmers: guar seeds can be sold to the processing factories in Khartoum and as fodder to the pastoralist. In addition, the sale of heavier animals creates more cash income.
- Improved position of women: in the processing factories women can be engaged for skilled labour like laboratory control and for unskilled labour like sorting the guar seeds and cleaning the factory and offices. In the regions where guar is grown, women are involved in farming and cultivation.
- Job creation: increased processing of guar creates jobs and cash income/profit in Khartoum.
- Revenues for the government: increased revenue of the government by income tax system.

**Contribution to peace building:** all the people interviewed said that the development of the guar value chain will contribute positively to peace building in the conflict regions. At first the increased income is mentioned which reduces poverty and improves livelihoods. Cash will also enable the construction of schools and hospitals. Trade in guar will also open access to remote areas where people feel neglected. Guar can also contribute to conflict prevention between pastoralists and sedentary farmers. When the pastoralists are migrating, the fields of the farmers can be protected by the guar plant as it releases an unpleasant smell that keeps cattle away from the fields; and the farmers can also sell the green fodder to the pastoralist.

**Impact:** the impact of developing the guar value chain can be analysed on different levels as follows:

- *Village level:* increased cash income, increased yields, improved soil quality, increased access to fodder increased animal productivity, increased capital available for investment in schools and hospitals; increased health; diversification of farming;
- *Company level:* increased employment; quality improvement, increased profits;
- *Society level:* improved communication between rural areas and cities; linkages established between farmers, processors and international market; increased access to schools and hospitals; reduces conflicts between sedentary farmers and pastoralists;
- *Sector level:* jobs created in the processing industry and trade; cooperation for developing this entire value chain, increased product quality; improved position on the world market;
- *National level:* increased positive interest in regions known for their conflicts; reduced conflicts in the Southern regions; increased revenue of the government by tax income system.

## 5 OBSTACLES TO AND INTEREST IN DEVELOPING GUAR VALUE CHAIN IN SUDAN AND SOUTH-SUDAN

This chapter first lists the obstacles to a well-functioning guar value chain. Then the question of whether a joint guar value chain development in Sudan and South-Sudan is raised. Finally, the interest of donors in contributing to the guar value chain in Sudan and South-Sudan is described.

***Obstacles to a well-functioning guar value chain in Sudan:*** if there is so much potential for the guar value chain, the important question arises as to why the cultivation of the guar plant and the production of guar gum do not progress. At the National Conference and in the interviews, many obstacles were discussed including (in random order): a missing link between smallholder farmers and processors; fe/male farmers lack knowledge of cultivation, disease prevention and market requirements; lack of training facilities for the fe/male smallholder farmers; the distance between researchers and smallholder fe/male farmers; poor export price in Sudan; low prices paid to farmers; lack of clarity in the role of the Agricultural Bank; government fees too high; and lack of cooperation along the value chain. The Dutch importers and experts stated that each industrial sector requires specific, high and stable quality standards for guar gum consistent with official European directives. The food sector has especially high quality standards including food security requirements along the whole value chain. It is the experience of the Dutch food ingredients sector that Sudan cannot meet these requirements yet and therefore the importers buy the processed guar gum from India. If Sudan is developing the guar value chain it has to compete with the world market on quality and price. These obstacles demonstrate the risk for investing in the guar by farmers, processors and other stakeholders if the development of the entire value chain is not properly addressed.

***Joint Guar Value Chain Development in Sudan and South-Sudan?*** The guar is grown in the south of Sudan and north of South-Sudan. So a cross-border development of the guar value chain might be very interesting. Guar can be grown well in South-Sudan as there the climate and rainfall are even better than in Sudan. It is however said that guar is actually hardly grown in South Sudan because of the war; in the past it was well known, for instance, in Al-Rank. Cross border trade between South-Sudan and Sudan is actually dangerous and costly and Sudanese traders state that they are unable to import agricultural products from South-Sudan, even though they are allowed to officially. Due to the conflicts, investing in a processing factory is not advisable in South-Sudan because of the risk of it being destroyed: investors are therefore not interested. So in general, the idea of a joint guar value chain development in Sudan and South-Sudan is welcomed but the reality requires a more peaceful situation.

***Interest by donors in developing the guar value chain in Sudan and South-Sudan:*** All seven (international) donor organisations interviewed showed strong interest in the guar value chain development, being convinced of its relevance and multiple advantages. As written information is not available yet, the donor organisations would appreciate a thorough value chain analysis and a joint workshop with all stakeholders. They could then decide how guar could be integrated into their programmes. As most interviewed donor organisations are working in both Sudan and South-Sudan, they are prepared to study the possibilities to develop the guar value chain in South-Sudan as well when the security situation improves.

## 6 FURTHER DEVELOPING THE GUAR VALUE CHAIN IN SUDAN

This chapter first describes the positive conclusion to develop the guar value chain further. It is followed by an explanation of the need for a Value Chain Analysis and a description of important elements for such a study. Finally, a workshop is proposed to get the commitment of all stakeholders.

**Positive conclusion about the development of the guar value chain in Sudan:** the demand for guar gum in Sudan and worldwide is still rising rapidly and the guar plant is being introduced into new areas. The actual production capacity for guar gum in Sudan is too limited for both internal and external demand. As described, the guar plant is also very relevant for pastoralists and smallholder farmers and their families. There is so much potential for the guar value chain. Taking into account the sincere interest by the stakeholders and donor organisations, further development of the guar value chain in Sudan is strongly recommended.

**The need for a Value Chain Analysis:** as the guar market in general is known to be constrained by a lack of transparency and market information: this applies also in Sudan. Solid information is hard to come by and the improvement of the guar value chain requires more knowledge and insights. A value chain analysis aims to analyse chains and networks to understand the linkages in a complicated structure of processes, the rights and incentives, the potential interventions, and how to implement successful changes in chains and networks in a professional and systematic way.

**Value Chain Analysis:** a value chain analysis comprises the following elements:

- ✓ size of current worldwide demand (volume, value) and trend over the past five years;
- ✓ opportunities and conditions for local use and for export growth;
- ✓ product requirements to realise export growth;
- ✓ developing opportunities in different states and regions;
- ✓ mapping the actors, supporters and influencers in the chain from a gender window;
- ✓ stakeholder analysis along the chain from (smallholder) fe/male farmers to end-users;
- ✓ potential capacity of (smallholder) fe/male farmers to produce sufficient quantity and quality in time;
- ✓ the capacity of processing and export companies and the level of quality standards;
- ✓ identification of the main bottlenecks that hinder local production and export;
- ✓ identification of stakeholders in the position to remove the bottlenecks;
- ✓ risk assessment that the bottlenecks cannot be removed on short-term.

**Workshop and commitment by all stakeholders:** the value chain analysis can also be the basis for an extensive programme of improvement and it strongly supports an iterative approach to improvement of chain and networks. A workshop is recommended involving all stakeholders: smallholder farmers including women farmers, processors, researchers, training and financial institutes, government officials and donors. This participatory workshop would aim to verify the findings of the value chain analysis and at fostering a commitment to cooperate on reinforcing the guar value chain. It should be held preferably in February at the latest so that all stakeholders can integrate their commitment to the guar value chain development into their annual plans and concrete activities can be undertaken before the guar growing season 2016/2017.

## ANNEX I OVERVIEW OF INTERVIEWEES

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9	Dutch Embassy – Juba, South-Sudan	Mr Henk van Trigt	First Secretary	Henk-van.trigt@minbuza.nl	+211 912117961
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22	Ministry of Agr. High Council Agr. Revival	Mr. Abdel Jabar Husein Osman	General Secretary	abdulgabar.osman@gmail.com	+249 123005319
23	Ministry of Defence in the Netherlands		Munition Expert		
24	Monchy International	Mr Gert van Santen	Trader	gvansanten@monchy.com	+31 104130320
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## **ANNEX II BACKGROUND INFORMATION**

Australian Guar Company. Website: <http://www.australianguar.com>

Elsafi Mustafa Mohamed, 2015. Characterization of guar diseases and their effect on the crop yield in Northern and Southern geographical areas of Gedarif State in seasons 2013 and 2014. National Conference on Guar Crop in Sudan, Khartoum, Sudan

Fair Organic Gum Arabic, 2014. Feasibility Study on Guar Factory Project at South Sudan, Khartoum, Sudan

Gitaf Gum Production & Marketing Company Ltd, Leaflet 'Guar Gum'. Website: [www.gitaf.com.sd](http://www.gitaf.com.sd)

International Trade Centre, website, 2015

NCDEX, Guar Outlook 2015, CCS National Institute of Agricultural Marketing, India

Petrocon, 2015 Guar Gum in Oil Field Applications, Speech at National Conference on Guar Crop in Sudan. Khartoum, Sudan

Sakshi Mittal, Guar Seed and Guar Gum: A Fundamental Report, NCDEX, undated

Solafa A.A. Hamad and Abdel Halim R. Ahmed, 2015. Effect of Production Location and Addition of Guar Gum on the quality of a Sudanese Wheat Cultivar for Bread Making, Ministry of Science and Communication, National Food Research Centre, Department of Cereal Technology, National Conference on Guar Crop in Sudan, Khartoum, Sudan