



15

REVIEW OF THE CONTRIBUTION AND ROLE OF THE MANUFACTURING SECTOR IN THE SUDANESE ECONOMY

ADIL DAFA'ALLA

Airbus Operations Ltd
Pegasus House, Aerospace Avenue, Filton,
Bristol BS34 7PA, UK
Email: adil.dafaalla@airbus.com

ABSTRACT

PURPOSE: To investigate the contribution of the Sudanese manufacturing sector to the Sudanese economy, and assess its role as a driver for achieving sustainable development in Sudan.

DESIGN/METHODOLOGY/APPROACH: This paper reviews and analyses the contribution of the manufacturing sector to the Sudanese economy, based on the comprehensive industrial survey carried out with the assistance of UNIDO and UNDP in 2001. It then goes on to assess the role that this sector can play in improving its contribution to the Sudanese and regional economy and achieving sustainable development. Evidence from global industrial views, international economic reports and experience of other countries in similar situations to Sudan was used to support arguments.

FINDINGS: The Sudanese economy is agriculturally-based. A heavy injection of industrialization into the economy is essential in order to improve the trade balance and help the country out of the poverty zone. This paper argues that building a competitive manufacturing industry as an important element of sustainable development plan for Sudan is a shared responsibility of good governance, quality education and well-guided investment.

ORIGINALITY/VALUE: This paper gives a critical assessment of the role of the manufacturing sector in driving the Sudanese economy, which is seriously lacking in the literature. Additionally, the paper introduces the building of a competitive

manufacturing industry in Sudan as an important ingredient to boost the industrial sector as a whole, hence, improve the economy, fight poverty and move toward achieving sustainable development.

KEYWORDS: Sudan; industry, manufacturing, education; national development plan; sustainable development.

INTRODUCTION

The Sudanese economy can only be categorized as an agricultural economy. The country's industrial base is still at its infancy, although the increased discovery, extraction and economic exploitation of oil have increased the relative importance of this sector. However, the secession of the southern part of the country in 2011 (see map at Figure 1) carried away with it almost three-quarters of the existing oil fields at the time, which were designated to the newly formed independent state of South Sudan. This rendered this sector less prominent than it was for the Sudanese economy unless new discoveries and investment are urgently injected into it. Additionally, recent activities in the petroleum, motor vehicle and heavy machinery industries have covered only a small part of the local market and are yet to make any contribution to the global market. As such, their impact on the economic structure of the country is hard to notice.

Figure 1: Map of Sudan and South Sudan



Source: Reproduced from Enough Project, 2016

However, Sudan is not unique in this unfortunate situation as many other developing countries, particularly in Africa, are yet to find a development path that takes them outside the poverty zone and opens the gates of sustainable development in front of them. The current global economic downturn may, ironically enough, present these countries with a golden opportunity to play a crucial role in recovering the required balance to the global market. This is because the biggest multinationals and industrial companies, feeling the pinch of the economic downturn, are now seeking refuge in exploiting resources and cheap labour well beyond their traditional market zones, and exploring every opportunity to mitigate business risks and reduce their base costs through restructuring and off-loading cost to suppliers and strategic risk-sharing partners. However, in expanding globally, these companies would be looking for places with a developed infrastructure, skilled labour and appealing investment opportunities.

The aerospace industry is one good example in hand for such global expansion. It is predicted that the air transport market will grow by about 5% annually, generating an estimated demand of around 25,000 new aircraft for the next 15 years (Airbus, 2009; Statista, 2016). With this growth, there would be huge pressure on airport capacity and control systems would be stretched as never before, thus creating more opportunities for the aviation industry in general. This expansion will not be geographically limited as the market is growing globally and, consequently, creating more and more opportunities worldwide. As an illustration, there are currently more than 400 main aircraft component suppliers all over the world, including some developing countries (Dafa'Alla and Hussein, 2009a).

This paper reviews the contribution of the manufacturing sector to the Sudanese economy, discusses opportunities, assesses current obstacles and makes recommendations for improving the sector and enhancing its role in, and contribution to, the Sudanese economy.

REVIEW OF THE MANUFACTURING SECTOR IN SUDAN

SUDANESE MANUFACTURING LANDSCAPE

The manufacturing sector in Sudan is very small in size and mainly dominated by small-scale industries. Historically, large-scale industrial establishments were limited to the manufacturing of food products and beverages and, with an approximate share of 55% of the gross manufacturing output and 56% of the manufacturing employment, this category still represents the main activity of the Sudanese manufacturing sector (Dissman, 2004). The sugar production and grain mills are the main activities in this category followed by vegetable oil. The Kenana Sugar Factory was built in 1976 to add to three older factories in Gunaïd, Khashm Elqirba and Maloot, and gave a real boost to the manufacturing sector in general and the food and beverages category in particular. With an annual production capacity of over 400,000 tonnes of white sugar, in addition to molasses, dairy

products, animal feeds and more recently (June 2009) ethanol as biofuel, Kenana is currently the largest integrated sugar company in the world (Kenana, 2016). An additional two factories in Asalaya and Sinnar were later added to make Sudan the second largest sugar producer in the African continent after the Republic of South Africa. On the other hand, the 1960s and 70s witnessed the flourishing of a large-scale textile industry, with the Sudanese Textiles Factory in Khartoum North, owned by the International Gulf Establishment, reaching the peak of its production. Unfortunately this factory was forced to shut down due to unreliable power supply on the one hand and a disruptive industrial relationship between the workforce unions and management on the other.

However, the last two decades have witnessed a big injection to heavy industry in Sudan, with the introduction of the manufacturing of heavy military and civil machinery, the motor vehicle industry, and significant expansion in the petroleum industry from extraction to refinery. Most notable is the construction of the Khartoum Refinery Company (KRC) with a total output capacity of 5 million tonnes per year. The refinery started production in May 2000 to process Sudanese indigenous crude oil to cover the need of Sudan for petroleum products (KRC, 2014). Needless to say, the recent secession of South Sudan in 2011 has interrupted the flow of crude oil to the refinery and hence set back its ambitious targets. Therefore, a new strategy to define the future place of KRC in the industrial map of Sudan is urgently required. More recently, Sudan has also entered the aerospace industry field by building the Safat centre for the maintenance and manufacture of lightweight aircraft in Karari.

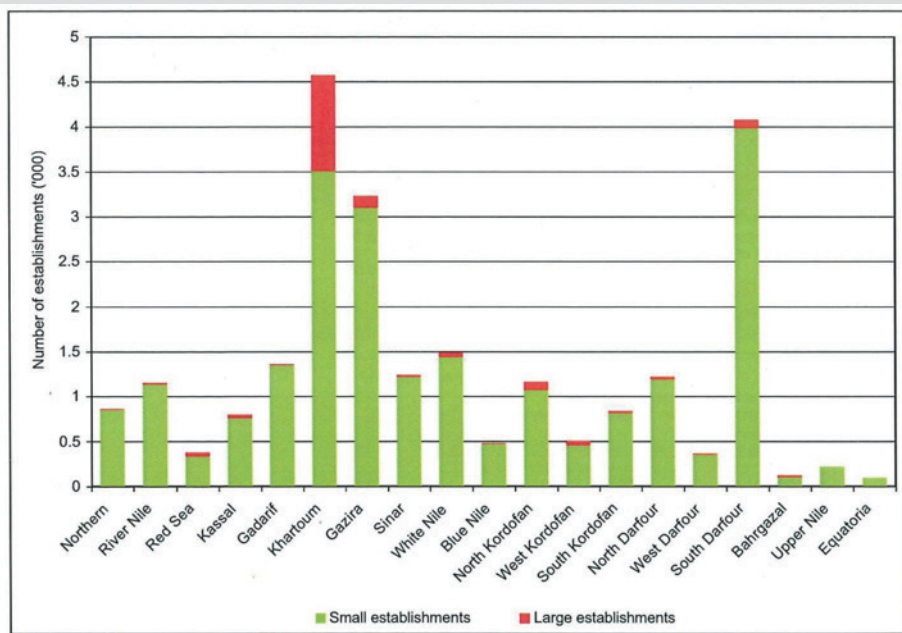
It is interesting that, apart from the petroleum industry, all these new additions were established under the auspices of the military establishment and fully controlled by the military industrial administration of the Armed Forces. Perhaps the logic at the time was that the military establishment was the only qualified institution to lead and manage such huge projects in a country like Sudan. However, the success of the petroleum industry, which was fully controlled by the Ministry of Energy, falsifies this assumption. Despite adding more than 15% to the manufacturing contribution to the gross domestic product (GDP), these recent additions to the industrial sector have so far contributed only 3% to overall manufacturing employment (Dissman, 2004). Nevertheless, they rank among the best in terms of compensation for employees, such as wages, supplements and social benefits, etc. Therefore, although a step in the right direction, their full impact on the economy as a whole is yet to be felt.

A comprehensive national survey was conducted in 2001 by the Ministry of Industry with support from the United Nations Industrial Development Organization (UNIDO) and United Nations Development Programme (UNDP): the report on its findings (Dissman, 2004), was published in November 2004. It is the most comprehensive survey of the Sudanese manufacturing sector to date, and was an excellent opportunity to gather the much-needed information on the Sudanese industrial

sector. Hence, unless otherwise stated, the report has been used as a source of the industrial statistical data quoted in this paper.

The survey covered 24,114 small (of less than 10 employees) and large (of 10 or more employees) industrial establishments employing 162,682 people, and spread throughout the country covering 19 out of the 26 states of Sudan before the secession of South Sudan. As the survey covered the whole of Sudan before secession (see Figure 1), the figures quoted herein were adjusted as appropriate in order to reflect the reality of Sudan today. However, it was noted that the contribution of the three states that formed the new South Sudan, namely Equatoria, Bahr-el-Gazal and Upper Nile, in the overall number of industrial establishments was less than 2% (see Figure 2); 97% of them are small scale industries, mainly in the food and beverages or clothing sectors. Their combined contribution to the overall GDP was around 1%. This contribution was found to have little impact on the overall percentages quoted in Dissman (2004). The petroleum industry was the exception as 42% of its establishments are located in the state of the Upper Nile alone. The industry has a significant effect on GDP and one of only two industries that have a positive trade balance.

Figure 2: Sudanese Manufacturing Landscape



Source: Dissman, 2004

Note that the statistics pertinent to South Sudan were also reported in this paper where relevant in order to help academics and researchers in the field, who will continue to rely on data coming from the north, i.e. Sudan, to address issues pertinent to South Sudan until the time comes when the official statistics institutions in South Sudan are well established and fully functional.

However, in order to handle the huge volume of gathered data and facilitate reporting, the 2001 survey also classified the manufacturing establishments in 22 categories following the international standard for industrial classification of all economic activities (as defined in United Nations, 1989). These categories are shown in Table 1.

Table 1: The Sudanese Manufacturing Sector Classification as used in Dissman (2004)

Ser. No.	Category
1	Manufacture of food products and beverages
2	Manufacture of tobacco products
3	Manufacture of textiles
4	Manufacture of wearing apparel; dressing and dyeing of fur.
5	Tanning and dressing of leather, manufacture of leather products and footwear
6	Manufacture of wood, cork, plaiting and related products, excluding furniture
7	Manufacture of paper and paper products
8	Publishing, printing and reproduction of recorded media
9	Manufacture of coke, refined petroleum products and nuclear fuel
10	Manufacture of chemicals and chemical products
11	Manufacture of rubber and plastics products
12	Manufacture of other non-metallic mineral products
13	Manufacture of basic metals
14	Manufacture of fabricated metal products, excluding machinery and equipment
15	Manufacture of machinery and equipment (not exclusive category)

Table 1 (Continued)

Ser. No.	Category
16	Manufacture of office, accounting and computing machinery
17	Manufacture of electrical machinery and apparatus (not exclusive category)
18	Manufacture of radio, TV and communication equipment and apparatus
19	Manufacture of medical, precision and optical instruments, watches and clocks
20	Manufacture of motor vehicles, trailers and semi-trailers
21	Manufacture of other transport equipment
22	Manufacture of furniture, manufacturing (not exclusive category)

Source: Dissman, 2004

Figure 2 shows the geographical distribution of the establishments included in the survey. The figure shows that the largest three states in terms of the number of industrial establishments, both in the small and large-scale category, are Khartoum, South Darfour and Gazira states respectively. These three states have the lion's share, as each has more than double the number of industrial establishments in any other individual state.

CONTRIBUTION TO THE SUDANESE ECONOMY

The value added per capita of the Sudanese manufacturing sector, which is a measure of the contribution of the industry to the gross domestic product (GDP), is only \$89.92 according to the 2012 industrial statistics published by NationMaster (2012). This is very small relative, for example, to the corresponding average of the G7 countries of \$5,289.76 per capita, and hence ranked Sudan as number 147 out of the published 187 countries in the world. Sudan, therefore, ranks in the group of "countries with low industrial production" and can be seen as a mainly agriculturally-based economy. In fact, according to the comprehensive industrial survey of 2001, the total manufacturing share in Sudanese GDP is only 9.5%, of which 1% was contributed by the southern states (Dissman, 2004), confirming a relatively low importance in the Sudanese economy. The survey also showed that the agro-food industry, dominated by sugar production and grain mills, is the biggest contributor to the GDP with a share of 6.1%. The next largest sector in output is the relatively young petroleum industry, contributing 1.1% albeit being a relatively small employer. This is now largely assigned to the new state of South Sudan.

The other sectors add very little to the GDP. This is in line with the small contribution of 1.7% of the manufacturing sector to the overall employment market of 9.7 million employees; only 0.01% of them work for the petroleum industry. However, it is interesting that the petroleum sector has a very low percentage of manufacturing employment (0.5%) but, at the same time, is the second largest contributor in terms of the value added (11%) relative to the total manufacturing sector. This indicates a capital-intensive industry.

On the other hand, with a cost that is four times its output, the category of the manufacture of medical appliances and supplies is the only category that shows negative value added per capita and appears to be in some trouble. Generally, most of the value added comes from the largest establishments of more than 100 employees, which contributes 68% of the total manufacturing value added per capita. The small-scale establishments of less than 10 employees contribute only 16% (Dissman, 2004).

Additionally, Sudan's manufacturing industry is not very much exposed to export. Its export share in total merchandise exports is only 12.8%, with only 11 out of the 82 manufacturing sub-categories involved in export activity. Also, most of the exports are raw materials. No higher value chain – reflecting industry's weakness. The bulk of manufacturing exports (87.3%) comes from two main players, the sugar industry with 45.7% and the petroleum industry with 41.7%. This explains the down effect of the secession of the south on the Sudanese economy that has suddenly lost the majority of its petroleum export value. The only exporting industry in the group of small establishments is the vegetable oil producers with 0.1% of the total manufacturing exports. In fact, while the small-scale industry represents 93.14% of the total number of the Sudanese manufacturing establishments and employs 40% of the total manufacturing force, it produces only 18% of the manufacturing gross output. This shows that small-scale industry can indeed contribute significantly to the local economy, but is not yet a suitable driver to fund national development plans. Nevertheless, a strategic push towards small-scale industry is important in order to uplift rural economy and halt migration from rural to urban districts, which is now galloping at an estimated annual rate of 2.6% (Index Mundi, 2016).

Sudanese industry is much more dependent on imports. The share of manufactured imports of the industry in total merchandise imports is 21.2%. The biggest contributors to this figure are food production, motor vehicle assembly and the chemical industry, with shares of 47%, 17% and 10% respectively. The petroleum industry imports only about 0.3%. These percentages only take into account the direct imports of the manufacturing industry. If the indirect imports, which enter as raw materials and semi-finished goods through other sectors of the economy, were taken into account, the real import content of the manufacturing sector is expected to be even higher. Hence, when the net contribution of the manufacturing sector to the economy of 21.2% of imports and 12.8% of exports is considered, the net effect on the trade balance would be negative by about \$200 million.

The only two categories of industry that have a comparative advantage to the trade balance are the leather and petroleum industries. Deducting the 3.2% of the trade balance share coming from the petroleum industry increases the negative trade balance even further. The leather industry represents only 0.6% of the export share, and hence has relatively little impact. On the other hand, the motor vehicle industry has the most negative contribution to the trade balance of -1.4%. This industry seems to be disadvantaged relative to other categories because it has one of the highest import contents in intermediate inputs to production. However, it has an indirect positive effect on the economy as a whole by satisfying some of the local demand, and hence reducing the need for importing more vehicles, as well as contributing to the employment market. However, a bigger impact on the economy would have been more visible if it could export its product. However, this will require more local component manufacture to address the industry's trade imbalance, less protectionism, improved management, lean practices and aggressive marketing techniques.

EMPLOYMENT AND LABOUR SATISFACTION

It is worth noting that the Sudanese manufacturing average labour compensation per employee, such as wages, supplements, benefits, etc., for the whole of 2001 was about \$1,400. This average value has an upwards bias due to the exceptionally high averages for the petroleum and tobacco industries, which stand well above the others at 18.44 and 3.02 times the total manufacturing average respectively. Excluding these two categories, the overall average will come down to \$1,200, or less than \$0.5 per hour. This is extremely low when compared to the value of \$23.15 per hour of a US civil employee in 2002, a reasonably close time to the Sudanese national survey reported by High Beam (2002). Likewise, the industrial average share of compensation of employees in value adding of 14.1% is low, while the material intensity of total manufacturing of 56.2% is relatively high.

These figures indicate cheap labour and material intensive production. On the one hand, the figures are good news to investors as the average cost of labour to the industry is low. Indeed, the total manufacturing labour cost is only 6.2% of the gross output on average, while the average rate of return on investment in fixed assets is as high as 8.5%. This means that the return rate is nearly nine times the investment. A very rewarding value, indeed! On the other hand, the figures could also be interpreted as that the manufacturing sector may not be that rewarding for its employees. Also, the low average share of supplements to wages and salaries in employees' compensation of 5.5% does not help to improve the low morale resulting from low wages either. The fact that the highest labour productivity is in the high-waged petroleum industry reinforces this view. However, it should be emphasized that the high productivity of the capital-intensive petroleum industry is a reflection of a combination of high wages, high oil prices, material intensity, modern technology and good management.

Interestingly, the tobacco industry (in the private sector) is among the largest in average labour compensation but ranks at 10th position in the manufacturing sector with a contribution of not more than 0.14% to the GDP. This large labour compensation is not surprising considering the rate of return on investment of 1,487.12 of the tobacco industry, which is the largest by far among the whole Sudanese manufacturing sector. This, in turn, also explains the private sector interest in this industry and reflects the lack of strategic direction in the absence of appropriate state monitoring of the overall economy. It is also interesting to note that the public sector pays the largest compensation per employee in the large establishment sphere, followed by mixed public and foreign ownership. The Sudanese private sector with foreign partners, and the pure Sudanese private sector come third and fourth respectively, while those industries with pure private foreign ownership lies at the bottom of the list.

This shows that safeguarding employees' interests requires a level of public "policing" or monitoring of foreign investment. These issues can only be tackled by drawing a well-thought out industrial strategy and effective related industrial policy, which are lacking in Sudan (Dafa'Alla et al. 2016c).

DISCUSSION

To get out of the poverty zone, Sudan needs to adopt an integrated sustainable development plan, in which industry represents the pivotal point. The above analysis shows that Sudan is still far away from having an effective manufacturing sector. It should be remembered that all developing countries that have managed to get out of the poverty trap and significantly improved the standard of living of their citizens, such as the South East Asian countries, have adopted a clear industrialization path as part of their development models. Sudan will not be the exception. Therefore, the present industrial output of 8.5% of the GDP is not enough and a large increase in heavy industry is required. As argued by Dafa'Alla (2016), although the aerospace industry is not the panacea by itself, it can be one effective element of the anticipated increase. Developing infrastructure and improving other sectors, such as the services and tourism industries, will also be required.

The African continent economy, against all the odds, is growing. In fact, despite the current world recession, Africa is still expected to enjoy an average of over 4% real GDP growth per year over the next few years, compared with 3% average annual growth for the world as a whole (World Bank, 2016). Therefore, the regional demand, where Sudan can, in principle, play a role, will remain strong. Also, as argued above, the globalization of the industrial sector is driving major players to seek partners where the labour cost of manufacturing is relatively cheap. Research is another area, which is going global in order to reduce cost and fully utilize the global pool of talented researchers and academics. There is a real chance for the developing countries to complement or join such activities and benefit from training

and technology transfer opportunities. Developing countries, such as Sudan, should actively seek to maximize their gain of such opportunities. This can be achieved by developing their own capability and improve quality to be considered as preferred suppliers for targeted components manufacture, if not risk-sharing partners.

Sudan may find a lot of comfort in the success of the South East Asian development model, which Sudan aspires to replicate for some of its aspects. However, the model stands on the four pillars of quality education, self-reliance, heavy industrialization and good governance: for it to succeed, it needs to be transferred to other countries as a package. Sudan has good experience with self-reliance in developing its own motor vehicle, aerospace and petroleum industries. However, a comprehensive national industrial development plan is still sketchy.

Quality education and good governance, on the other hand, are real concerns for the whole of Africa, as shown by Dafa'Alla et al. (2016a, 2016b). Indeed, Dafa'Alla et al. (2016a, 2016b) have identified quality education as the root cause of the lack of development, not only in Sudan but Africa in general. They presented a strong correlation between accessibility to and quality of the education system on the one hand, and sustainable development indicators, such as human development, the ability to innovate, and economic competitiveness on the other. They concluded that education that builds capacity and fosters innovation is a means of catching up with lost opportunities, building an “innovation-based economy” and realizing the African dream.

Likewise, Dafa'Alla and Hussein (2009b) argued that the main barriers to the implementation of any national development plan in Africa would be the corruption, political instability and lack of investment. In fact, tackling these three issues is a prerequisite for economic success, as attracting investment requires political stability with a strong anti-corruption drive. It is therefore not surprising that the leading South East Asian countries, Singapore, Taiwan and South Korea, have all scored more than 50, the mid-point of the Corruption Perception Index (CPI) of 2014 published by Transparency International (Transparency International, 2014). Indeed, with an impressive score of 84 out of 100, Singapore stands tall at number seven in the world.

The Economist noted that Africa's economy has grown much faster since 2000, but fears regarding corruption have also risen (Economist Intelligence Unit ViewsWire, 2008). Likewise, Transparency International noted that 20 out of the 48 (41.7%) Sub-Saharan countries ranked in its CPI 2014 survey scored less than 30 out of 100, a level that, according to Transparency International, indicates “rampant corruption”. Another 23 scored between 30 and 50, indicating that country's experts and businessmen perceived corruption as a “serious challenge” (Transparency International, 2014). Only four countries, Botswana, Cape Verde, Seychelles and Mauritius, scored more than 50. With a score of 11 out of 100, Sudan was ranked at 173, second from bottom, followed by North Korea and

Somalia, who, at 174, were the joint least ranked countries in the world: both have their own substantial internal problems. With a score of 15 out of 100 and ranked at 171, South Sudan is not much better than Sudan either. The two countries were only separated by Afghanistan, which was ranked 172.

Using the four indicators of safety and rule of the law, participation and human rights, sustainable economic opportunity and human development, the more specific Ibrahim Index of African Governance (IIAG) for 2009 ranks Sudan at 49 relative to the 53 countries in Africa, followed by the democratic Republic of Congo, Zimbabwe, Chad and Somalia respectively (Ibrahim, 2009).¹ It is also noticeable that all countries that scored below 25 out of 100 in the CPI 2014, and below 40 out of 100 in the IIAG 2014 (Ibrahim, 2014) have identifiable internal political, social or economic problems. This indicates a strong positive correlation between internal conflicts, good governance and public satisfaction on the one hand, and corruption and human rights abuses on the other. It should also be reiterated here that one should not dismiss such widely available information in the public domain out of hand, as it is instrumental in shaping the world's perception of the country and hence influence the flow of foreign investment.

Finally, competitive manufacturing is a highly technological as well as capital and labour intensive industry. Therefore, a flourishing manufacturing sector requires a supportive efficient infrastructure and good quality education. These, together with securing a renewable, clean and environmentally friendly source of energy, represent a prerequisite for sustainable development. Once they are in place, the manufacturing sector will help Sudan to diversify its economy, create job opportunities and should, therefore, play its role in putting the country on course towards achieving sustainable development.

RECOMMENDATIONS

- An injection of heavy industrialization into the Sudanese economy, with particular focus on higher value chain products for export, is required in order to improve the trade balance and lift the country out of the poverty zone. A competitive manufacturing sector is one key element of this, but by no means the only one. Developing infrastructure and improving other sectors, such as services and tourism, etc., are also required.
- From an economics viewpoint, good governance is required in order to establish the correct path for sustainable development, draw up effective national plans, and legislate for supportive policies and regulations to monitor and guide fair and strategic public and foreign investments, as recommended in the "Employment and Labour Satisfaction" section above. However, regulation is only one of the means by which society ensures that its values and priorities are reflected in the national development plan. It is equally important for investors to see the implementation of these

regulations in practice before they have full confidence in the system. This means achieving political stability and creating a true investment-attractive climate.

- Additionally, a competitive manufacturing sector is a high technology and capital-intensive industry. For Sudan to gain the required expertise, it needs to gradually, but steadily, build its capacity, embark on heavy investment in building its infrastructure, technology transfer and training initiatives, as well as securing the right environment for sustainable development that allows local talent to flourish and contribute towards building a real, competitive, manufacturing sector in Sudan. This requires a complete overhaul and upgrade of the current facilities and a fresh look at the basis of establishing new ones.
- It is worth noting here that training is key in technology transfer and is seriously lacking in the developing world. There is still a huge gap between demand and supply for a qualified technical cadre to support expansion in the industrial sector in general and manufacturing in particular. Also, and more importantly here, a strong drive towards the quality of education, rather than its quantity, is required to support sustainable development in general and industry in particular. These can only be achieved through high quality education and rigorous training to improve skills and nurture innovation. It should be remembered that investment in people and technological learning empowers the ability of a society to sustain development through the creation of new knowledge and diffusion of appropriate technologies, which are important determinants for building capacity to sustain development (Al-Roubaie, 2013). Simply, as Dafa'Alla et al. (2015, 2016a, 2016b) argued, quality education is the basis for all forms of development and the key to building “innovation-based economy”.
- Also, in order to meet tough industrial requirements, technical education should pay special attention to all levels of training, from vocational training for skilled labour to middle ranked technicians through to engineers. Training for management and marketing staff is equally important. Remember, as Brace et al. (1999) put it, technology cannot be contained in a machine or a piece of software; it has an element of motivation and personal “know how”. Likewise, technology does not automatically yield innovation; imagination and first class marketing skills are also required.
- Additionally, customers today are quite knowledgeable and extremely demanding. They insist on independent verification of the product's quality and supplier's credentials. To satisfy these requirements, industrial establishments have to encourage their staff to obtain internationally recognized professional qualifications, such as the Chartered Engineer (C.Eng.) status offered by the British Engineering Council, or European Engineer (Eurlng) offered by the Federation of the European National

Engineering Associations, or any other equivalent internationally recognized award. There are also equivalent qualifications for technicians and skilled labour. For Sudan, this should be a priority before launching its own brand.

- Finally, regular appearance at international stages, such as industrial exhibitions and international conferences, will raise the Sudanese industrial profile, highlight capability and improve networking. This, in turn, will attract foreign investment and improve the chances of collaboration with global industrial players.

CONCLUSIONS

Despite the recent additions in the fields of heavy machinery, motor vehicle assembly, aerospace and oil industries, the Sudanese economy can only be described as agriculturally based. The industrial contribution of 8.5% to the GDP and 1.7% to the employment market is significantly small. A heavy injection of industrialization of the economy is essential in order to improve the trade balance and help the country out of the poverty zone. A competitive manufacturing sector is a key element of this.

Building a competitive manufacturing sector requires heavy investment in infrastructure, technology transfer and training. Additionally, a flourishing industrial sector in Sudan requires a clear development plan, good governance, and supporting legislations. This will create a true investment climate in the country and secure the right environment for sustainable development including a renewable, clean and environmentally-friendly source of energy.

The education system and institutions should play a key role in providing the right quality of education and training to meet the industrial requirements at all levels, from skilled labour and technicians through to engineers, marketing personnel and managers. External training and international qualifications are also important to satisfy customer's requirements of the independent verification of a product's quality and supplier's credentials.

In summary, this paper argues that building a flourishing competitive manufacturing sector in Sudan to complement its sustainable development ambition is a shared responsibility of good governance, quality education and well-guided investment. This should all be within the framework of implementing a well-thought out industrial strategy and relevant effective industrial policy.

BIBLIOGRAPHY

- Airbus (2009): *Global Market Forecast 2009-2028*, Airbus Report, UK.
- Al-Roubaie, A. (2013): Building Knowledge Capacity for Sustainable Development in the Arab World, *International Journal of Innovation and Knowledge Management in Middle East and*

- North Africa* (IJKMMENA), Vol. 2, No. 1, pp.7-20.
- Brace, G., James-Moore, M., Broughton, T. and Raja, V. (1999): *Artificial insemination breeds sterile technology – Innovation needs people*, TTI conference, Melbourne.
- Dafa'Alla, A.A., (2016): Prospects for the Aerospace Industry in the Sudan as a Means for Achieving Sustainable Development, paper submitted to the *World Journal of Science, Technology and Sustainable Development*, WJSTSD.
- Dafa'Alla, A.A. and Hussein, E.S. (2009a): Building an Efficient Air Transport System in the Developing World: Challenges and Opportunities, in *Proceedings of the 1st Sudanese Diaspora Conference on technology Transfer entitled "The Role of Diaspora in Technology Transfer and Achieving Sustainable Development in Sudan"*, Brighton, UK, 24-25 Jan 2009, pp.113-123.
- Dafa'Alla, A.A. and Hussein, E.S. (2009b): Towards Building an Efficient Air Transport System in Africa, in Ahmed, A. and Nwankwo, S. (Eds) (2010): *Achieving Sustainable Development in Africa: Science, Technology and Innovation Trajectory*, Africa Book Series, Inderscience, UK, pp.206.220.
- Dafa'Alla, A.A., Hussein, E.S. and Adam, M.A.A. (2015): Critical Review of the Education System in the Sudan from Independence to Date, in Ahmed, A. (Ed.): *Proceedings of the 2nd Sudanese Diaspora International Conference entitled "Connecting Universities with the discourse of sustainable Inclusive Growth in Sudan"*, University of Sussex, Brighton, UK, 11-12 June 2015, WASD, UK, ISBN 978-1-907106-36-1, pp.31-51.
- Dafa'Alla, A.A., Hussein, E.S. and Adam, M.A.A. (2016a): Education in Post-Independence Sudan: A Critical Assessment, *Int. Journal of Sudan Research*, Vol. 6, No. 1,, pp.1-19.
- Dafa'Alla, A.A., Hussein, E.S. and Adam, M.A.A. (2016b): Impact of Education Quality on Sustainable Development in Africa, in Ahmed, A. and Nwankwo, S. (Eds) (2016): *Managing Knowledge and Innovation for Business Sustainability in Africa*, Palgrave Studies of Sustainable Business in Africa Series, WASD, Brighton, Sussex University, UK, in press.
- Dafa'Alla, A.A., Hussein, E.S. and Adam, M.A.A. (2016c): Enablers and Inhibitors for Effective Industrialisation Process in the Sudan, in Ahmed, A. (Ed.): *Proceedings of the 3rd Sudanese Diaspora International Conference entitled The Critical role of diaspora in International Scientific Cooperation with the Country of Origin*, London, UK, 25-26 July 2016, WASD, UK.
- Dissman, B. (2004): *Report on the Comprehensive Industrial Survey*, 2001, Central Bureau of Statistics, Federal Ministry of Industry, The Republic of Sudan, with Support from United Nations Industrial Development Organisation (UNIDO) and United Nations Development Programme (UNDP), November 2004.
- Economist Intelligence Unit ViewsWire (2008): *Growing More Corrupt*, available at http://www.economist.com/agenda/displaystory.cfm?story_id=12448676&fsrc=rss
- Enough Project (2016): *Sudan and South Sudan*, available at <http://www.enoughproject.org/conflicts/sudans>
- High Beam (2002): Average compensation \$23.15 an hour, *Labor Month in Review*, High Beam Research, available at <http://www.highbeam.com/doc/1G1-94129172.html>
- Ibrahim, M. (2009): *Ibrahim Index of African Governance*, Mo Ibrahim Foundation, available at <http://www.moibrahimfoundation.org/en/section/the-ibrahim-index/scores-and-ranking>

- Ibrahim, M. (2014): *Ibrahim Index of African Governance*, Mo Ibrahim Foundation, available at <http://www.moibrahimfoundation.org/iiaag/>
- Index Mundi (2016): *Sudan Urbanisation*, available at <http://www.indexmundi.com/sudan/urbanization.html>
- Kenana (2016): Kenana Sugar company website, available at <http://www.kenana.com/broadband/kenana1.htm>
- Khartoum Refinery Company (KRC) (2014): KRC website, available at <http://www.krcsd.com/English/about.asp?levelNo=54&id=209>
- NationMaster (2012): *Manufacturing, Value Added statistics – Countries Compared*, Industrial Statistics published by NationMaster and available at <http://www.nationmaster.com/country-info/stats/Industry/Manufacturing%2C-value-added/Current-US%24-per-capita>
- Statista (2016): *The Statistics Portal*, available at <http://www.statista.com/statistics/269919/growth-rates-for-passenger-and-cargo-air-traffic/>
- Transparency International (2014): *Corruption Perception Index 2014*, available at <http://www.transparency.org/cpi2014/>
- United Nations (1989): *International Standard Industrial Classification of All Economic Activities, Revision 3 (ISIC, Rev.3), Statistical Papers, Series M, No. 4 Rev.3*, United Nations Publications, Sales No. E.90.XV11.11, New York, available at <http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2&Lg=1>
- World Bank (2016): , available at <http://www.worldbank.org/en/publication/global-economic-prospects/summary-table>

ACKNOWLEDGEMENTS

Thanks to my dear friend, Ustaz Mustafa Basheer, Assistant Professor at the Gazira University, for making available to me his own personal copy of the report on the Comprehensive Industrial Survey, 2001 (Dissman, 2004), which formed the backbone for the statistical data on the Sudanese industry used herein.

BIOGRAPHY

Dr Adil A. Dafa'Alla (PhD; C.Eng.; Eurlng) graduated in Mechanical Engineering from the University of Khartoum, Sudan in 1981. He then did his postgraduate studies at the University of Manchester Institute of Science and Technology (UMIST) in England, where he was awarded his PhD in 1988. Currently, Dr Dafa'Alla is a specialist member of the Aero Data for Loads Group at Airbus UK Ltd. Prior to his employment at Airbus in 1996, Dr Dafa'Alla had vast academic and industrial experience. As part of his quest for continuous development, Dr Dafa'Alla became a Chartered Engineer (C.Eng.). The C.Eng. designation is granted by the British Engineering Council and recognized worldwide. It is proof of a high standard of professional experience and conduct. Dr Dafa'Alla followed that up to become Eurlng, the European sister of the C.Eng., granted by the European Federation

of the National Engineering Associations (FEANI). His current research interests cover aircraft safety as well as airport capacity planning issues. His research activities are reported in a number of journals and conference papers in addition to many technical reports. Coming from a Sudanese background, Dr Dafa'Alla also has a special interest in topics related to industry, education and sustainable development in Africa. He is an active member of the World Association for Sustainable Development (WASD) and Associate Editor of the *Journal of World Review of Science, Technology and Sustainable Development* (WRSTSD) since its inception in 2003.

