

INDUSTRIALISATION OF SUDAN

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ASBTRACT

Purpose: The main aim of this paper is to kick start a discussion about industrialisation of Sudan and how this can be achieved. The author hopes that industrialists, engineers, economists, sociologists, etc. would engage in more in-depth discussions about the reasons of lack of industrialisation in Sudan and other underdeveloped regions.

Approach: Drawing lessons from the history of the Industrial Revolution focusing on the cultural traits that distinguished industrial societies.

Findings: Certain cultural traits are proposed as being responsible for impeding the industrialisation process in Sudan. The main causes lie at the foundations of the social pyramid not just at the top.

Value: The main value lies in emphasising the cultural reasons behind the underdevelopment of Sudan, something that is often ignored when diagnosing the problem of the country as many tend to focus on political and economic reform rather than cultural reform.

Keywords: Sudan; industrialisation; industry 4.0; cultural traits; industrial revolution; artificial intelligence

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INTRODUCTION

The aim of this chapter is to kick start a debate: Why didn't the Industrial Revolution take place in Sudan? What were the reasons for it to take place in Europe? What lessons did we learn from the history of the Industrial Revolution?

The reasons are the underdevelopment of Sudan and the lack of sustainable industry and industrial research in the country. Since solutions cannot be proposed without first making a thorough diagnosis, the author hopes that scientists, engineers, sociologists, historians, and scholars would join in the effort to discuss the reasons behind the lack of an industrial society in Sudan—and more importantly, the lack of an industrial culture.

INDUSTRIALISATION — A VERY SHORT HISTORY

Modern industrialisation was marked by the transition from muscle power to machine power (Schwab, 2017). Industrialisation has gone through three phases (revolutions) and the fourth is underway (Schwab, 2017):

1. The first phase started in the second half of the 18th century with the utilisation of steam power to drive machines.
2. The second phase began at the end of the 19th century; in this phase, electricity became the primary power source for driving machines.
3. The third phase started in the second half of the 20th century with the introduction of computers into production (automation).
4. The fourth phase of industrialisation started taking shape towards the end of the 20th and the start of the 21st centuries; this phase is characterised by the utilisation of artificial intelligence (AI) and machine learning (intelligent machines).

All of these phases (revolutions) have, in effect, taken place in the West, mainly in Northern Europe and North America (Japan has also contributed heavily to the third and fourth phases and currently both South Korea and China are joining the fold). In the next section, I would focus on the industrialisation of Europe and try to highlight the sociocultural factors behind it.

INDUSTRIALISATION OF EUROPE — FACTORS AND CAUSES

What are the traits that make some societies prone to industrialisation more than others? What are the factors that make some societies more open to innovation and reform than others? To answer these questions, this section makes a short excursion to explore the factors that made Europe a frontrunner in industrialisation. By understanding these factors, we might be able to draw some conclusions, and possibly create guidelines in regard to what is needed—socially and culturally—to promote industrialisation in Sudan.

Kiesewetter (1996) divided the factors that promote industrialisation into two categories:

1. The first category includes naturally occurring factors; these factors had been in existence before industrialisation and are not influenced by humans. The naturally occurring factors are:
 - Geography
 - Natural resources
 - Climate
 - Land fertility
2. The second category includes man-made factors, which were established at the outset of the industrialisation process. The man-made factors are:
 - Invested capital
 - Technology
 - Entrepreneurship
 - Education

In this chapter, the focus would be on the second category.

Invested Capital

Two important points to be taken from Kiesewetter (1996) are:

1. Ownership of a vast amount of money is not sufficient to start a process of industrialisation, it is rather the investment.
2. It is necessary to create a legal system to protect property rights.

Technology

The following factors promoted technology in Europe (Kiesewetter, 1996):

1. Invention spirit for financial gain, desire to solve technical and scientific problems or for the sake of invention.
2. Creation of legal framework to protect inventions.
3. Existence of socioeconomic systems that granted market freedom.
4. An important factor that promoted technology was social acceptance and tolerance of invention and rewarding it.

Entrepreneurship

Factors contributed to economic growth through entrepreneurship (Kiesewetter, 1996):

1. European entrepreneurs were characterised by being dynamic and profit oriented
2. Individual freedom created opportunities to gain wealth.
3. The will of European entrepreneurs to take risks.

Education

On the role of education and scientific research, Kiesewetter (1996) concluded:

1. There is a relationship between good education, better income and work performance.
2. Economic growth is firmly bound to quality of education.
3. Coupling science and productivity played a significant role in improving competitiveness in the second half of the 19th century.
4. To achieve efficient industry, it is necessary to couple scientific education with industrial internship.

According to Butschek (2006), the following cultural conditions led to the Industrial Revolution in Europe:

- The Christian work ethics of doing work in a rational and efficient way
- The European traits of:
 - Individualism
 - Responsibility
 - Self-initiative mentality
 - Self-reflection
 - Self-confidence
- Technical, scientific and rational approach to life
- Rule of the law that has led to freedom of thought and scientific research as well as unlimited flow of information
- Innovative mentality of business owners, who sought to improve production by lowering the costs and increasing the productivity; in the process, science and production were coupled.
- Formation of national administration
- The proliferation of culture that promotes applied science
- Recognition of the commercial side of technology

EXAMPLE OF BRITAIN

According to Kiesewetter (1996), one of the reasons behind Britain having had the lead in the Industrial Revolution was that the invention spirit was high in Britain. Further, protection of inventions started earlier in Britain (patents were granted as early as the 1690s). A legal frame work for invention protection was created in 1791, compared with Germany, which passed its Patent law in 1877.

After the English Civil War in the 17th century, a constitutional monarchy was formed in which individual freedom was guaranteed and the parliament was responsible for regulation of finance (Butschek, 2006). Due to the fact that taxes were levied with the approval of the parliament, confidence of the business sector increased as a result (Ferguson, 2004).

Other factors that led to the rise of the British Empire were reported by Ferguson (2004):

- Power and wealth was distributed but not concentrated.
- Development of a local market for commodities such as sugar, coffee, tea, fabrics and cotton, where high quantities of these commodities were imported, causing prices to become low enough to create a mass consumer market; hence, commodities that once had been only within reach of the wealthy now became available for the masses.
- Development of commercial and financial systems, such as the formation of the Bank of England in 1694.
- Alliance between science, technology and politics in building the British Empire.
- Public-private partnership, e.g. the private sector played a significant role in the construction of telegraph and railway networks.

Nevertheless, Britain eventually lost its industrial primacy in the second half of the 19th century. As the Industrial Revolution evolved during the 19th century, coupling science with productivity became necessary or, in other words, the influence of science on productivity became significant. This fact was recognised by Germany but ignored by Britain. Britain's industry ended up using old technology and processes and recruited less qualified engineers, allowing Germany to overtake her in industrial productivity.

Kiesewetter (1996) cited the following factors behind the decline of British industry:

Use of Old Technology and Processes in Industry

England depended heavily on industries, whose production technologies were not sophisticated in industries such as coal, steel, iron and textiles. As a result, the demand for higher education graduates was low. Scientific research and its commercial utilisation led to Germany overtaking Britain in chemical, electrical and machine tool industries.

Recognising the Importance of Scientific Research for Industry

During the early days of the Industrial Revolution, higher education played a minor role; instead, it was the principle of learning-by-doing that played a major role. Unlike the British industry, where the principle of learning-by-doing remained the dominant principle until the First World War, large companies in Germany appreciated the importance of engineering education, scientific experiments and research laboratories.

Lack of Dynamic Entrepreneurs and Social Mobility

People in Britain preferred secure careers such as teaching, medicine or law rather than risky entrepreneurship.

FACTORS IMPEDING DEVELOPMENT

Kiesewetter (1996) noted that within Europe, the level of industrialisation was not the same. Despite the fact that they share the same geography, Western Europe was ahead of

Southern and Eastern Europe because the latter regions did not develop the necessary man-made factors for industrialisation. We can conclude from this that in the absence of the necessary factors, the presence of the naturally occurring ones was not sufficient enough to kick start the industrialisation process.

In addition to the inadequacy of necessary conditions, there is also the presence of factors that impede industrial development and modernisation. In the following paragraphs, I would endeavour to identify some of these factors or at least raise questions regarding certain factors. By identifying these factors, we would be able to pinpoint the issues we need to tackle to achieve sustainable development in underdeveloped countries, in general, and in Sudan, in particular:

- **Impractical culture:** As reported earlier, Christian work ethics were considered by Butschek (2006) as a factor that helped Europe industrialise; however, if this were the case, why then do we not observe a similar trend in the Christian parts of Africa? Considering Kiesewetter's remarks about Southern and Eastern Europe while noting that these two regions share Christianity with Western Europe, one could argue that the real difference lies in how different cultures understand the same religion. A possible explanation is that people tend to view, and subsequently understand, their religion through the glass of their local culture: A practical culture would easily recognise the practical aspects of religion; Western culture is a good example for a practical culture. Africans are more likely to understand and practise religion in pure spiritual or Sufi-like form. In the case of Sudan, a Muslim-majority country, Islamic values do contain work ethics that promote perfection, honesty, responsibility etc.; however, these practical aspects are not recognised and remain alien to daily life. Sudan has been heavily influenced by Sufi orders that tend to devalue worldly ambitions. It would be of great interest to see to what extent the culture has been promoted by Sufi orders and influenced the way with which the Sudanese approach life.
- **Ultra-conformist mentality and lack of individualism:** There is a strong push for individuals to conform to inherited traditions and customs in Sudan. This happens in rural, tribal as well as urban areas. Individualism is usually frowned on, particularly if it does not conform to the traditions. The ultra-conformist mentality considers self-critique—in terms of cultural traits—as unacceptable and possibly unpatriotic. Such an ultra-conformist mentality weakens the potential for social development.
- **Leadership:** Here, people tend to rely on a central figure around whom activities revolve. Leadership is prevalent in Sudan in all facets of the society: religious sects, political parties, sport clubs etc. This central figure thinks and decides on behalf of those around him. This has subsequently led to lack of institutionalism and passive individuals.
- **Low self-esteem:** Due to the weakness of individualism and proliferation of leadership, low self-esteem is further exacerbated by the schooling paradigm that favours passive children who function as a pure information sink. This problem is deep-rooted and needs to be further debated by sociologists.

- **The definition of freedom:** Freedom (as well as democracy) entails both rights and responsibilities. When a culture encourages seeking rights while ignoring responsibilities, it produces high demand with little supply and hence social conflict. The end of the Third Democracy (1985–1989) was a result of such social conflict. This social conflict manifested itself in political and militaristic conflicts where the warring parties demanded their rights to rule and ignored their responsibility to compromise and find consensus. Strikes, coup attempts in addition to an existing civil war, culminated in weak democracy and its eventual demise. The one-legged freedom is present vertically across the social pyramid. At the base of the pyramid it manifests itself strongly in the disrespect and misuse of public property. Further, the concept of a modern state is not well appreciated, as individuals value—hence, feel more responsible towards—their families and tribes more than their state.
- **Utopian and emotional mentality:** Such mentality looks up for unrealistic goals and tends to be rigid and uncompromising. Industrialisation requires a rational and practical approach towards life as well as readiness to compromise.
- **Preference of style over substance:** Time, effort and wealth are spent in activities that have no returns or sustainable value, e.g. weddings and funerals tend to be extravagant considering the economic situation in the country. Another form of preference of style is the technical jobs that require manual work; this is clear in the negative public perception of jobs such as technical worker or engineering technician. People view a university degree in engineering as a status rather than a profession. Once the status has been gained, there is no ambition or incentive for technical innovation.
- **Absence of an ethical and cultural ground:** Development goes hand in hand with rule of the law. And any law would not hold without supporting moral and ethical grounds. Abiding by laws and translating them from scroll of papers into reality require commitment and understanding of their importance by the public. In other words, rule of the law should stand on solid cultural foundations to be translated from articles to reality.
- **Weak team spirit and ethics:** All forms of institutions are essentially team based. Team work necessitates the ability to work with people of different backgrounds and possibly different interests. To achieve successful team work, an ability to view the bigger picture, will to compromise and ability to deal with potential conflicts are necessary. In addition to leadership, weak team spirit leads to weak institutions.
- **Preference for kin over competence:** People tend to recruit their kin in public jobs rather than competent candidates. The concept of kin here is expanded to include all types of kinship from blood kinship to political and ideological ones. The result is that public institutions are run by employees who are not competent. A clear example of this is the condition of public services, which had been in decline since independence, in 1956, then nose-dived after the 1989 military coup.
- **Lack of entrepreneurial culture and the negative attitude:** This is related to the predominant negative view of capitalism in Sudan. The generation of wealth is

stigmatised and often mixed up with accumulation of wealth. Capitalistic mentality is often associated with greed and exploitation of workers. The role of entrepreneurship and the private sectors was significant in the industrialisation of Europe and ignoring this can only slow down the industrialisation process in Sudan. Kiesewetter (1996) pointed that in Third World countries social attitudes towards entrepreneurship that is willing to take risks is characterised by cautiousness and preference to safe investments. This is in fact the case in Sudan where many prefer to invest in property development or small businesses that make quick returns on investment; the private sector in Sudan is less willing and not confident enough to participate in large-scale or long-term projects.

- **Failing education system:** Due to lack of industrialisation in underdeveloped countries, Kiesewetter (1996) argued that the education system in those countries is inadequate for the complex technologies of modern industry. Looking at the education system in Sudan, we find that it focuses more on memorising than in gathering information, analysing and making decisions. For instance, in science class, students are made to memorise scientific laws without understanding their physical background. I would like to recall an incident in middle school when the maths teacher instructed the students to memorise proofs of mathematical theorems and recite them from memory. This is not helpful for development towards an innovative society, where the processing of information and data is very important. There is also a focus on theory rather than on practice. For example, in Arabic language classes, emphasis is mainly on memorising grammar rules. Practice classes for composition and speaking are sacrificed to give more emphasis to Grammar syllabus. Pupils, as a result, never get to practice and tend to have difficulties expressing themselves. The school system also has a negative attitude towards failure, instead of treating it as an opportunity for learning from mistakes.
- **Politicised universities:** Sudanese universities are heavily politicised since independence. The atmosphere is usually so polarised such that staff and students are usually viewed in terms of their political affiliations rather than their competence and expertise. Political debates at universities are not informative, and they usually derail into low-level arguments. The climate in universities is poisoned by mutual intolerance, suspicion and stigmatisation (even of political staff or students); as a result, political allegiance is favoured over experience and innovation. Further, the dominant cultural attitudes of staff and students at universities exhibit more interest in political debates than in research, and students exhibit more interest in poetry and art (mostly music-based art) than in science and technology.

INDUSTRY 4.0 OPPORTUNITIES AND THREATS

The fourth phase of the Industrial Revolution, also known as Industry 4.0, is characterised by connectivity and intelligent technologies. The smart phone is an example of a smart technology; it functions as a wireless telephone, camera, notebook, book, to name but a few; at the same time, it connects all these functions with other smart phones or computer users. People are able to exchange books, share photos etc. in an extremely short time and

sometimes in real time. New intelligent technologies are emerging where AI is utilised such as in robotics and autonomous driving. The emergence of AI is expected to heavily influence the job market as machines are expected to take over more tasks than human beings.

What does that mean for Sudan? What opportunities are there for Sudan? And what are the threats?

OPPORTUNITIES OF INDUSTRY 4.0

In this subsection, let us go through some of the technologies and the possible advantages for Sudan. These technologies could provide investment opportunities for both private and public sectors. Further, they could be areas for scientific and industrial research at Sudanese universities and research institutions.

Renewable Energy

- Independent (off-grid) power generation for remote areas
- Reduces costs of infrastructure for a national grid
- Independence in power generation allows different regions to develop without being held back by others.
- Mobile solar power stations for charging mobile phones, laptops and other electrical gadgets; this is mostly useful in rural areas.

3-D Printing

- Distributing manufacturing over a wide geographical area to achieve growth over a wide area
- Allowing remote areas and communities to be self-reliant in achieving growth
- Useful for manufacturing school laboratory equipment at low prices
- Areas suffering from landmines could start an industry for Prosthetics (preparing artificial limbs).
- 3-D printing could be a suitable sector for start-ups and young entrepreneurs.

Communications and Transportation

- Connecting remote areas (Sudan is a large country)
- Spread of knowledge and information
- Exchange of experiences between remote areas
- Ease of mobility
- Distance education, particularly for remote areas or possibly in nomadic communities
- Uber style transportation as a safe means of transport for goods and individuals
- Sudan could develop and manufacture affordable vehicles for transportation from countries such as India.

Robotics and Mechatronics in Agriculture

- Using drones and robots to grow crops in remote areas where labour is scarce
- Using smart sensors for monitoring crops in remote areas
- This is an opportunity for young entrepreneurs and agriculture graduates to form ventures and hence sow the seeds for the establishment of a future strong private sector.
- This helps to revitalise the devastated agricultural sector in Sudan

Robotics in War-torn Areas

Robots could also be used 24/7 to scan, identify, localise and remove land mines and other types of unexploded ordnance. This is useful particularly in arable lands that have been driven out of the production cycle due to the presence of unexploded ordinance.

Smart Buildings

Public areas where high consumption of water and energy is expected, such as schools, restaurants, mosques, etc., could be equipped with smart sensors and actuators to manage and optimise the level of consumption. For example, water taps in mosques could be equipped with aerators or suitable atomiser nozzles to lower water consumption during ablution.

Internet of Things

Wikipedia (2019) defines the Internet of Things (IoT) as “the extension of Internet connectivity into physical devices and everyday objects.” Smart sensors, buildings and other mechatronic devices such as robots can be connected via the Internet for monitoring, maintenance and gathering statistics. For instance, power and water consumption could be monitored and the areas of unexploded ordnance could be updated instantaneously on the Internet.

Open-source Software and Hardware

These are useful for education and research in particular. Sudan could begin development of software tools by using existing open-source software packages to increase the efficiency of its institutions and related services as well as in education and research. Hardware development such as electronic controllers is a potential area of research and development.

THREATS OF INDUSTRY 4.0

Due to the use of intelligent technologies and machine learning, many jobs currently performed by humans would be taken over by machines and robots in the future. This means loss of jobs. The third phase of industrialisation has affected blue-collar jobs, mainly due to the control of the computer. When AI and machine learning are fully deployed in the fourth phase, the effect would extend to white-collar jobs. Proponents of AI claim that loss of jobs

in some sectors would be compensated by newer jobs in the emerging sectors in computing and robotics. Opponents of AI see no supporting evidence for that claim and expect mass unemployment with all the negative aspects associated with it. What is likely to happen in the near future is loss of jobs, particularly routine and unskilled jobs. These kinds of jobs are easily replaced by further automation. The scale of disruption would depend on the ability of the affected sectors to adapt to the new changes. Examples: What alternatives would taxi drivers have when autonomous taxis are deployed on the streets? What are the available alternatives for administrative staff when intelligent algorithms are used to process administrative tasks? These issues would affect even underdeveloped countries as technology now is spreading faster than before. Developing countries, which rely on labour-intensive factories offshored by Western companies, would also be affected as cheaper production due to robotisation could lead to reshoring of these factories. Advanced countries, as a result, would possess a higher competitive advantage, making it difficult for developing and underdeveloped countries to gain access to the global market.

Considering the aforementioned concerns, many questions need to be answered: To what extent should automation and robotics be deployed in Sudan? What measures are needed so that the work force in Sudan can adapt to the new changes and challenges imposed by Industry 4.0? Should a robot tax be considered in the future? How can Sudanese entrepreneurs develop new and innovative solutions to increase their competitiveness in the global market? For sure there are no unique answers for these questions; nevertheless, it is important for decision makers in the public and private sectors to understand that the process of rebuilding of industry in Sudan should be based on completely different assumptions and models to those used decades ago. The same goes for education, which needs to be rebuilt on a paradigm that considers the ongoing technological changes.

NECESSARY MEASURES

There are many social, cultural, economic, political and organisational measures that should necessarily be taken to improve Sudan's industry. In the following paragraphs, a list of some necessary measures is suggested; this list is certainly not comprehensive but could serve as a stimulant and food for thought for those interested in the topic.

Family

The mentality that values rationality and substance starts at home. Families should resist the temptations and social pressures to spend time, effort and money on social shows such as extravagant weddings, birthday parties and funerals.

The role of parenting is very important in developing the child's view of the world. Instead of indoctrination, children should be allowed to explore and discover their environment, e.g. instead of telling a child that they are expected to be a medical doctor when they grow up (to raise the social status of the family), as is usually the case in Sudan, parents should allow their children to discover their own skills and aptitude. They should also encourage their children to value work regardless of its nature.

Reform of the Education System

Given its current state and the challenges of Industry 4.0, how should the education system in Sudan look like? Considering the diversity of Sudan in terms of culture, race, geography, religion, etc., should the education system be decentralised and tailored to the needs of each region within Sudan? For instance, what about mobile schools for nomads that focus only on literacy and vocational training (veterinary skills, animal farming etc.)? What about the funding of public schools given the financial state of country? Locals should be encouraged to support local public schools to compensate for the shortage of public funding. Education should also promote mutual respect and tolerance, something that is necessary in a diverse country such as Sudan. Other reform measures to be considered are:

- The school curriculum should be designed such that sufficient time is given for children to practice; this is better than cramming the syllabus with information, which is likely to be forgotten after exams.
- Analytical skills: School children should be trained from an earlier age to be able to search for the required information, analyse the available ones and make decisions.
- Learning from failures: School children should be taught that failure is not a shame; it is an opportunity to learn new lessons.
- Practical and experimental skills: More focus is required on practical indoor and outdoor activities, so that kindergarten and school children could learn to use their senses to explore the environment around them.
- Encouraging self-initiative and proactive attitudes among school children.
- Communication and team work skills and ethics should be an integral part of the school curriculum.
- The way school children are assessed should be re-examined, particularly for their first years in school.
- Promotion of technical innovation through competitions and school exhibitions instead of the current excessive focus on sport, poetry and music.

Promotion of Civil Responsibilities and Not Just Rights

Without the comprehensive understanding of freedom and democracy, a citizen cannot be proactive enough to develop the country. It is important and vital for the country's development that people understand that freedom entails responsibility towards society and that every citizen has responsibilities in addition to their rights. Media and schools should have a significant role in promoting these values.

Cultural Development

As mentioned earlier, rules of the law cannot be achieved without supporting ethical foundations that focus on its importance. The same thing goes for industrialisation, which cannot

be achieved and sustained without cultural foundations that highlight the importance of technology.

Universities

The atmosphere in universities needs to be changed by promoting tolerance and respect for expertise and competence; this is a collective responsibility of staff and students. Engineering students' societies should engage in promoting extra-curricular activities related to technology and engineering. There are many themes for industrial research for universities to make themselves busy with instead of political in-fighting:

- Agricultural research to improve and protect crops
- Food processing
- Veterinary research
- Education system for nomadic communities
- Renewable energy, particularly solar energy
- Water management
- A substitute for alcohol for use in food and pharmaceutical industries
- Building materials that are strong and suitable for the climate in Sudan
- Software development
- Cost-effective and efficient automotive systems (automobiles, boats, light trains, light planes) for an internal market
- Transportation infrastructure
- Diseases pertinent to underdeveloped countries
- Collaboration with other underdeveloped countries

Coupling Science, Technology and the Market

There is a utopian view of academia towards science and technology, whereby academics try to distance themselves from the commercial utilisation of science and technology. This utopian view should be replaced by a more practical one. As reported earlier, the coupling of science, technology and the market contributed significantly to the industrialisation of Europe.

Democracy and Good Governance

Good governance requires democracy. But for democracy to be sustainable, a democratic culture is necessary. The lack of mutual acceptance and tolerance, well entrenched in Sudanese cultures, has led to the failure of three democratic experiences, in addition to bloody civil wars. To avoid the repetitive mistakes of the past, diffusion of values of tolerance and mutual respect is imperative to achieve sustainable democracy and good governance.

Decentralisation

Kiesewetter (1996) suggested decentralised social systems, where regions within a state are given authority to decide their own economic policies. Kiesewetter (1996) further

suggested that countries larger than 50.000 sq.km. should adopt a federal system. Industrialisation of Europe has shown that (Kiesewetter, 1996):

- Success of economic growth tended to be at a regional level.
- Decentralised states achieve more growth compared with central states.

Local Technocrats

The Sudanese society needs to appreciate the importance of local technocrats. For instance, the local committees responsible for administration of residential districts should cooperate and enlist the help of technocrats living in their districts to sort out issues such as collecting statistics, street lighting, and rain water drainage, while coordinating with the local authorities.

Diaspora

Thousands of Sudanese expatriates with diverse industrial and academic experience should be encouraged to contribute to the country through:

- Consultancy
- Public lectures
- Visiting positions
- Investment in industry

Foreigners of Sudanese Origin

There are many highly educated people who are of whole or partial Sudanese parentage who were born in Europe or North America. This section of the “Sudanese” diaspora possesses the nationalities of the countries in which they were born. Some might not have visited Sudan or have least knowledge of the local Sudanese languages. This section of diasporas could be benefited from in several aspects:

- Foreign language skills, especially English and French, could be taught in schools or universities during their gap years or year-out.
- Cultural exchange: by providing injection of the dynamism distinguishing the Western culture.
- Investment
- Visiting or public lectureships
- Consultancy
- Connections with their adopted/birth countries: in particular links with countries such as the United Kingdom, the United States and Canada, in addition to other European countries such as Sweden, the Netherlands, France and Germany.

Empowering Citizens

Mobile and smart technologies such as mobile phones and tablets are good measures to empower citizens, particularly to fight against corruption. Citizens could use cameras in

mobile phones and tablets to record public-related offences and possibly broadcast it live to authorities. Example: using these videos as evidence against corrupted officials or against people speeding in residential areas. Caution must be exercised, however, as such devices could also be used for blackmailing.

Small Towns

The focus of sustainable development in Sudan should be small towns. These towns could easily be re-planned and modernised since they are less complex compared with large cities such as Khartoum, Nyala or Omdurman. For instance, sewage systems could be developed for these small towns and due to their small size, maintenance would be easier. Development of small towns would also help in reversing the trend of immigration to the capital region, Khartoum State. Further, small towns could be the springboard for establishing urban planning and civil engineering industries. Local engineering human resources could be employed for the purpose of modernising the infrastructure of small towns. This would be a valuable opportunity to train local engineers as mistakes in small towns and villages are less costly and easier to rectify.

By embracing technologies and development plans particularly in rural areas and small towns, job and business opportunities would help accommodate the masses of unemployed people in the country as well as attract expatriates, skilled foreigners proper or those of Sudanese background. These jobs are not restricted to engineering; jobs from other sectors such as gastronomy, retail, real-estate etc. would also appear in industrialised regions.

Institutionalism

Formation of financial and legal institutions is a requirement for future industrialisation of any developing country (Kiesewetter, 1996). Learning from the industrial history of Britain, strengthening the financial and commercial institutions would restore confidence in the Sudanese economy. To strengthen the financial, legal as well as other institutions, the following are necessary:

- The institutions should revolve around a vision that has clear goals and should not revolve around a person, as is usually the case.
- Rule of the law should be observed and respected within each institution.
- Strong institutions can only flourish through a culture that respects team working ethics and tolerance of values within the institution itself.
- Politicising should strictly be avoided.

Economic Measures

Kiesewetter (1996) suggested the following measures for Third World countries:

- Mechanisation of agriculture and carrying out agricultural reforms such that agricultural and food supply is proportional to a population's growth.
- Protectionism through customs to allow for Third World countries to be competitive.

- Adoption of a multilateral production structure instead of relying on one or two products.
- Development of an industrialisation process that is sustainable and matches the requirements of the time and the nature of the region.
- A flexible policy should be adopted such that products and production processes respond and adapt to market demands.
- Expansion of transport and communication infrastructure to allow for the expansion of the trade network; the following factors are to be considered in this process:
 - Economy of the country
 - Investment opportunities
 - Area and geography of the country
 - Population size and distribution
- Establishment of associative development between agriculture and industry to maintain growth.

African Market

The African market is still not fully explored. The geographic location of Sudan is wedged between the Sahel and Sudan regions; the horn of Africa, North Africa and Central and East Africa exposes it to a large market. Taking as an example Egypt, Ethiopia and Nigeria, we find that their total population is more than 300M, which is more than seven times the population of Sudan: This is a huge market, which means that any surplus in Sudan would have a market value. Therefore, any strategy for the development of Sudan should consider the location and relation to those areas and countries. Paths such as roads, railways, etc. to the markets have to be included in the infrastructure strategy. Sudan should also consider increasing its export capacity by utilising seaports of countries such as Cameroon, Eritrea, Kenya and Egypt.

Immigration

Sudan has a low population density and if development progresses at a high rate, there is room for immigration and reverse immigration for the Sudanese diasporas. Nonetheless, Sudan should learn from the experiences of other regions that have attracted immigrants such as Europe. In the past, Sudan did attract immigrants from Nigeria, India, Greece, Armenia, Egypt, Ethiopia, Eritrea and the Levant. Therefore, immigration is not something new to Sudan.

Which countries have the potential to be sources of immigration to Sudan? What conditions should Sudan set for potential immigrants? What rights could they have? How would this immigration affect the diversity of Sudan? The most important point is to learn from the experience of Europe with immigration.

Identity

In a democratic Sudan, identity should be an individual's choice and not a constitutional article; the constant discussion about whether Sudan is African or Arab is absurd and not necessary. Further, why should a Sudanese of Indian or Armenian background choose between Arab or African identity? Sudan has been open for immigration since nearly hundreds of years without imposing an identity on immigrants and this should remain the case.

CONCLUSIONS

Industrialisation is not just about building factories but also about establishing a strong and influential engineering community protected by a culture that appreciates industry and engineering. Industrialisation is a long and agonising process that requires planning and strong cultural foundations. Sudan has been missing from the industrialisation map for more than two centuries, with terrible costs. Industrialisation is essential for Sudan to benefit from the vast resources it possesses. This chapter has aimed at highlighting the importance of the combination of the technical, legal and cultural aspects in initiating and sustaining the process of industrialisation. Without cultural changes, industrialisation would be significantly impeded. Finally, the author hopes that this chapter helps in initiating a serious discussion and research on the topic.

BIBLIOGRAPHY

- Butschek, F. (2006) *Industrialisierung: Ursachen, Verlauf, Konsequenzen*. Vienna, Austria : Böhlau Verlag.
- Ferguson, N. (2004) *Empire: How Britain Made the Modern World*. London: Penguin Books.
- Kiesewetter, H. (1996) *Das einzigartige Europa*. Göttingen, Germany: Vandenhoeck und Ruprecht.
- Schwab, K. (2017) *The Fourth Industrial Revolution*. London: Portfolio Penguin.
- Wikipedia (2019) *Internet of Things* [Online]. Available at: https://en.wikipedia.org/wiki/Internet_of_things (Accessed: 05 May 2019).
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