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# A Matter of Relationships – Actor-Networks of Colonial Rule in the Gezira Irrigation System, Sudan

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ABSTRACT: In the first half of the 20th century, colonial rulers, a British firm and Sudanese farmers changed the Gezira Plain in Sudan into a large-scale irrigated cotton scheme. Gezira continues to be in use up to date. Its story shows how the abstract concept 'development' is shaped through the agency of humans and non-humans alike in government offices and muddy fields. Gezira provides a well-suited starting point for moving into the networks of development without any pre-suggested division in terms of levels, contexts or relations. Hierarchies, arenas and institutions do exist. Such power relations are associations between humans and non-humans: relatively stable relations are typically produced when non-human agency is involved, for example through books, roads, and money. The Gezira case shows the potential of actor-network theory in building and understanding of conceptual and empirical links between water, infrastructure and political rule.

KEYWORDS: Actor-network theory, material agency, power, infrastructure, social relations, Gezira scheme, Sudan

## INTRODUCTION

In the first half of the 20th century, roughly between 1910 and 1950, British colonial rulers, a British firm, and Sudanese farmers changed the Gezira Plain – the triangle of land south of Khartoum between the Blue and White Nile in Sudan – into the Gezira Scheme, a large-scale irrigation system producing huge amounts of cotton. In the early 20th century, Gezira was the main road to economic development for Sudan. After World War II, its cooperative model was supposed to be the western answer to Soviet Communism and a major model showing how to include farmers in economic and social development. In the 1970s and 1980s, Gezira became a symbol of failed development, either because it did not behave according to Marxist theory (Barnett, 1977; Bernal, 1997) or because its infrastructure needed to be rehabilitated (Plusquellec, 1990). Gezira continues to be in use to date.

In current irrigation circles worldwide, Gezira refers to just one thing: the irrigation scheme starting in 1925 with 300,000 acres currently covering close to two million acres under gravity irrigation from Sennar Dam at the Blue Nile. I argue that we have to look anew at Gezira to see what it may stand for in terms of colonial control, farmers' actions and resistance, and the broader development debate. The colonial project cannot be understood as something that rolled over passive colonised landscapes and societies. Just as Cortez did conquer Mexico with many local collaborators, imperialism "worked on the ground because it relied on the vast support staff of clerks, technicians, teachers, and medics who handled the day-to-day tasks of colonialism", many of them local (Sharkey, 2003: 1).[1] Idea(l)s of planned irrigation and profit in Gezira had to be realised by African farmers and European officials.

[1] In establishing European power outside Europe, the capacity to bring disease (Crosby, 1993) and cure disease (see for example Crozier, 2007) has helped as well. Viruses acted as colonial agents.

For tenants and British company employees, working schedules were strict, to the frustration of many British staff, who entertained themselves in clubs and at home – including drinking heavily when visiting each other, not necessarily the standard image associated with top-down, forced efforts. The tenant farmers were not loyal, silent receivers of colonial wisdom nor just suppressed subjects, but had their own agendas and agency. Tenants responded to company control in various ways, but basically tried to minimise efforts in cotton. The British company personnel controlled the tenants, and was itself closely controlled by company management. After all, there were production goals to be met.

Continuous negotiations shaped the scheme's canals, cotton, and tenants' resistance, as well as the contested symbol of development itself (Ertsen, 2016). My interpretation of Gezira goes against the more traditional view of Gezira of a centrally planned effort by British colonialists, with close control over tenants and production being a key (Gaitskell 1959; Barnett 1977; Bernal 1997). That may be the case, but Gezira shows that although loads of planning efforts were involved by many people and institutions, we would do good in remembering (Captain) Jack Sparrow from the Walt Disney movie series 'Pirates of the Caribbean' when trying to understand Gezira's planned development: "Do you think he plans it all out, or does he just make it up as he goes along?". The Gezira was, as much as the colonial project as a whole, continuously in the making and as such unfinished (Darwin, 2012).

Gezira's story shows how development is shaped by daily actions in government offices and muddy fields, how actions are used in political debates, and how actions are continuously reinterpreted as symbols to support different views on what development should be. The Gezira Scheme results from many efforts by many agents, who not necessarily agree with all the outcomes of those efforts. This does not mean that everything that is acted out or negotiated upon by agents is always new – as such a position would assume that history would not matter. That would be rather simplistic, as if every agent encountered a level playing field all the time. That is clearly not the case: many of the "relations within which we may find ourselves, and the advantages or disadvantages they imply, pre-date our arrival" (Cudworth and Hobden, 2013: 440).

Actually, what predates agents is typically expressed in buildings, bank accounts, and pipe lines: material stuff, infrastructures, and other physical expressions. As Latour argued, social structures without a material component would have a hard time surviving, as these need to be renegotiated all the time (Strum and Latour, 1987; see also Latour and Strum, 1986). What I would like to stress, is that what agents produce with each other – for example class and gender relations, but also dams and canals – are not the explanatory forces for acts of those same agents. The outcomes are not coming from some kind of external structure or societal law.

Because of this position, Latour – actually the actor-network theory (ANT) approach in general – is typically accused of neglecting power relations. Obviously, Latour is not trying to establish a Marxist research agenda – nor a neoliberal one as far as I know[2] – and as such may not take an unequal world as a starting point, but I would argue that power is included in ANT specifically through the material. The focus on the material is also a main answer of ANT to the ever-returning criticism that it does not take into account social structure. When taking a closer look at power struggles, it becomes clear that power, rule or domination is heavily expressed in the material. Power expressed in material may sound rather fixed, but power is "never a capital that can be stored in a bank. It has to be deployed, black-boxed, repaired, maintained" (Latour, 1991: 118; see also Hoestaker, 2005). It is this notion that the

[2] Interestingly enough, accepting Latour's claim that modern society is as modern as non-modern (Latour, 1993) may even mean that essentially modernistic views like Marxism and neo-liberalism do not hold on theoretical grounds. This might explain the difficulty several Marxist scholars have in accepting ANT, even those who try and relate Marxism with ANT. Somehow, Marxism requires that there is always something left of (virtual) structures that behave like outside agents (see Castree, 2002; Hornborg, 2014; White, 2013).

entity 'Gezira' was to be acted out every day by human and non-human agents that I take up in this paper in more detail.[3]

## THIS PAPER

In this paper I will mainly work with material from Latour. Just as Scott's position in the wider theoretical debate on state power may need including more than the archetypical 'Seeing like a state' (Scott, 1999) – as the positions developed in 'Weapons of the weak' (Scott, 1985) and 'The art of not being governed' (Scott, 2009) are at least useful additions if not essential ingredients to the argument of 'Seeing like a state' – Latour's position on agency, structure, power, and matter needs including more than just a few of his better-known works. Despite the gradual shift in his work over the last decades – elegantly discussed by Harman (2009, 2011, 2014) (see also Hoestaker, 2005) – a major continuity in Latour's work is emphasising that things matter. Whether it concerns hotel keys (Latour, 1991), transport system Aramis (Latour, 1996b), social structure (Strum and Latour, 1987), or climate science (Edwards, 2010), we find that engagements between human and non-human agents shape society. Domination is built with non-human entities/agents/things/objects – that offer the possibility of holding the network together as a more durable whole. As such, Latour specifically links technology – infrastructure – to power. ANT does not entail that hierarchies, arenas, and institutions in society do not exist, but that we need to look at the material to find them.

After providing some historical background on the Gezira Scheme and its tenants, I will bring out three typical situations in Gezira in more detail, showing how Gezira's unequal playing field(s) was (were) shaped through the interactions between human and non-human agents.[4] My first details will be on crop rotations. In the original Gezira area, a three-year rotation was applied, with cotton, grains and fodder crops, and fallow as respective stages. In the early 1930s, dramatic decreases in cotton yields triggered a shift towards a four-year rotation, with two fallow years. My second situation deals with a major feature of Gezira infrastructure, its system of night storage. Nowadays seen as one of the outstanding design features, I will show how night storage was introduced when the irrigation infrastructure was already being built, as only then the disagreement between scheme management and irrigation engineers materialised. The third set of details presents the efforts that were needed to keep the irrigation system actually working. Weeds and silt competed with water for canal space.

These three stories allow me to argue that development is local and constructed within actor-networks which are continuously created and recreated by human and non-human agents engaging with other human and non-human agents. In such a process, micro and macro are irrelevant concepts, as the micro shapes the macro while being created by the macro. Social reality is continually constructed – performed – by agents who "violate 'levels' in their process of 'work'" (Strum and Latour, 1987: 784). Within the debate on agency (the micro) and structure (the macro), ANT is usually presented as a (right or wrong) answer to overcome the problem of the duality of structure. Is agency determined by social structure (for example power), or is agency producing that structure? Actually, ANT's "idea was never to occupy a position into the agency/structure debate, not even to *overcome* this contradiction. Contradictions should not be overcome, but ignored or bypassed" (Latour, 1997: 2).

As I already mentioned, by emphasising that "society explains nothing but has to be explained", Latour does not suggest at all that everyone moves in society being "composed, made up, constructed, established, maintained, and assembled" on equal footing (Latour, 2000: 113). Especially associations

[3] See Van Beusekom (1989; 2002) on interactions between colonial officials and farmers in the Office du Niger in French West Africa – with less focus on disagreements between colonial officials than I would give.

[4] I take the material for presenting Gezira details directly from Ertsen (2016). Please find an explanation on the archival sources at the end of the paper.

between humans and non-humans matter now. No one has ever seen – or been – a social relation by itself (herself), but whenever a relatively stable relation is uncovered, non-humans account for this relative stability (Latour, 1991).[5] Based on these ideas, I will zoom out from Gezira in the final paragraphs of this paper to reflect on potential consequences of a Gezira in ANT-terminology for understanding conceptual and empirical links between water, infrastructure and political rule.

## GEZIRA

The Gezira Irrigation Scheme is located in a very flat plain between the Blue and the White Nile south of Khartoum. The Gezira counts some five million *feddans* (one feddan is roughly equal to one acre) with as most outstanding feature "its crushing monotony" (Barnett, 1977: 1). For the British, Gezira's advantage – if not purpose – was the possibility to develop gravity irrigation from the Blue Nile, which would allow production of cotton for the British cotton mills in Lancashire. From 1911 onwards British pumping schemes had irrigated cotton on the plain, to test whether the crop would actually grow. In 1919, after years of negotiations, the Gezira tripartite partnership was agreed upon, stating responsibilities and gains of the three partners involved in the cotton scheme – although the third party had never been present at any formal negotiation table. The Sudan Government was responsible for the irrigation infrastructure and received 40% of net cotton profits. The concession to manage the Scheme and trade the cotton was given to the British firm Sudan Plantations Syndicate (SPS); it received 25% of the profit in return. The (absent) tenants were to provide labour and received 35%.

Perhaps because tenants were not involved in formal negotiations, Gezira had many characteristics of an imposed production regime (Ertsen, 2006). The plain was filled with straight canals and square plots, the area was divided into blocks of some 15,000 acres, each with three British SPS employees (inspectors). A group inspector supervised six to ten blocks. The SPS personnel were "superimposed like the canal system itself on the life of the Gezira" (Gaitskell, 1959: 99) to ensure that the tenants – more specifically male farmers regarded as family heads – grew cotton on ten feddans within a 30 acre tenancy. Indeed, if any image emerges from the scholarship on Gezira over the years, it is of a centrally planned, British colonial effort, with minor changes over time within a model of strong control over tenants.

In 1925, the Daily Mail celebrated the official start of the Gezira Irrigation Scheme. In roughly 15 years, the British had brought order to "puzzle-plots territory" and changed it into "regular chequer-board holdings" within a canal infrastructure. In Daily Mail language, all was planned, executed to plan, and basically inevitable. The main crop in the Gezira model, cotton, was taken for granted as the only logical choice. Obviously, Gezira and its cotton were in the interest of those "lucky inhabitants of the Gezira" who were envied by the "unirrigated" others. Tenants were part of "one of the greatest schemes of Imperial development in modern times" all done by "British energy".[6]

Such grand accounts built on one of the more enduring myths about Gezira: its image as an "empty wasteland" before British intervention, with Gezira inhabitants leading "very cheap and lazy" lives "attending weddings and funerals" and doing "odd jobs" like trading in oil or tobacco, with the production of some grain in (good) rainy seasons as the only exception.[7] In 1917, the Board of Trade actually provided a balanced image of the Gezira plain; it might have been relatively empty, but wet years allowed 'large crops of native maize'. Although in dry years only patches of crops were found, Gezira farmers did even grow some cotton when possible – the quality was just not high enough for

[5] See Schouten (2013) for the importance of infrastructure for maintaining state power in Congo. See Perry and Berry (2016) for a similar argument in Central America.

[6] Sudan Archives (SA), 415/8/152, 'Cotton from a Wilderness', The Daily Mail, dated 14/1/1925.

[7] SA, 418/3/10; Letter from Bill to Manager SPS, dated 22/3/1928.

export.[8] Too much Sudanese prosperity in Gezira, however, would not fit the idea of British initiative required to make the area prosperous again. The "theory of decline and dislocation" was much better suited when proposing expensive irrigation works (Clarkson, 2005: 13). However, the area should not be too desolate and empty either. When proposing economic activities, having a population around to provide labour and/or consume the results was convenient.

Desolate as the economic perspective might have been from a British perspective, most of Gezira land had an actual Sudanese owner. In 1913, about 13,300 Sudanese owners were registered. In response, the Sudan Government rolled out a land tenure system based on a – compulsory – lease system of the land in the scheme area at a fixed annual rental for a period of 40 years. The idea was that in case Gezira would not turn out the economic success all British hoped for, the land could be handed back to the original owners with relative ease. During the lease, subdivision of registered holdings was not allowed. With land under Government control, tenancies were allocated to three different groups. 'Right-holders' – landowners and their sons – could claim tenancies first. A second group, 'nominees', included cultivators and relatives of right-holders who did not own land. The third group consisted of 'preferential tenants', holding 20 feddans or more, but who could not be right-holders.[9]

This system of lease certainly transformed the existing social reality in terms of landownership and associated economic power, but did not make it disappear from Gezira. The typical Gezira tenant may not have existed, as large socioeconomic differences were present. Nevertheless, for many Sudanese and non-Sudanese tenants alike, the Gezira scheme was more than an "exploitative and unwelcome economic structure": they could and did use Gezira "to achieve culturally embedded aspirations" (Clarkson, 2005).

When we are interested in such perspectives on the colonised – in this case the Gezira tenants – we have to reconstruct them from the perspectives left in the sources by the coloniser. Avalanches of British ideas and plans for Gezira tenants exist, all prescribing or claiming what they were and should be, but accounts from tenants themselves – or people who could report about tenants from first hand – are rare. What we do read about tenants is mostly stated in terms of what they did not do. The average tenant was granted knowledge on grain cultivation, but "carelessness in cultivation" of those grains was directly associated with "the average Arab" disliking "continual manual work". Tenants lacked "the qualities of attention to detail and perseverance". Strategic behaviour was recognised, but dismissed as "a childish tendency" to "'bluff' the Inspector".[10] Tenants did not work "easily after rain" and "seemed soon to melt away",[11] The British in Gezira – Syndicate and Government alike – preferred to view Gezira tenants as lazy and self-serving, not as people with aspirations (Clarkson, 2005).

However, even when the sources discuss tenants' failure, we actually do encounter bits and pieces of deliberate strategies of tenants in Gezira. Interestingly enough, those same colonial sources describe tenants as rational agents: SPS inspectors were informed that tenants did not like to work on cotton as they only received part of the profits. Resistance to cotton growing is probably best described as the tenants' version of using their weapons of the weak in order to maximise the goals and profits they themselves wanted to achieve (Scott, 1985). Another issue was labour. Despite the British ideal of the family farm, tenants used large numbers of hired labourers. Being a tenant opened possibilities to become a person who could actually hire external labour and rise in social status. Hiring labour was actually simply necessary as well, as the required labour during the picking season was much higher

[8] SA, 112/10/1; Minutes of Evidence Board of Trade Committee Growth of Cotton in the British Empire, dated 1/8/1917.

[9] SA, 408/1/5; The Gezira Scheme, Reference Division Central Office of Information, dated 21/6/1950.

[10] SA, 408/2/16; C.E.F. Morgan – Some notes on practical agriculture in the Gezira Irrigation Scheme.

[11] SA, 693/1/1; Hunt diary entry on 12/10/1934.

than what families could provide. Much of the evidence for this is from the 1970s, especially from Barnett (1977), but there is no reason to assume that labour requirements were less before WWII.

Workers in the picking season came from villages outside Gezira. In addition to pickers from close by, many seasonal labourers ('Westerners', as they came from Western Sudan, French Equatorial Africa or Nigeria) came in from areas further away to stay in the Gezira in picker camps. In 1934, 8000 Westerners lived across the Scheme, both in temporary camps as in existing villages. In 1940, this number had increased to 62,000, on a total population of 380,000 (Clarkson, 2005). Over time, labourers started cultivating tenancies as well. First this was on poor land far from a village, but in the economic crisis of the 1930s, vacant tenancies were offered to Westerners, who were more willing to work along SPS standards.

For Arthur Gaitskell, the first manager of the Sudan Gezira Board – the successor of the Syndicate – after a long career with the SPS, all these issues, changes, and other nuances were less relevant. It was clear to him, that the centrally planned Gezira was the model to go for when promoting development in African nations after 1945 (Gaitskell, 1959). For Tony Barnett, the sociologist who studied Gezira in the 1970s, Gezira represented failed development, as it had not supported a transition to capitalism (Barnett, 1977). In the 1990s, anthropologist Victoria Bernal discussed Gezira as an instrument and symbol of colonial oppression of Sudanese farmers (Bernal, 1997). To be fair, all three authors have a point, but not necessarily all at the same time. How can Gaitskell's model Gezira be defended when many tenants remained in debt? On the other hand, how can Gezira remain a symbol of strong oppression – or failure for that matter – when a large group of tenants did succeed in making significant economic progress? How can something be a failure anyway when it still exists and many people live in it? Gezira was many things at the same time; we will explore below some of these "things" that made Gezira in more detail.

## CROP ROTATIONS

In the first few years after opening the Gezira Scheme in 1925, there was definitely success in terms of increased cotton availability for export from Sudan to England. In 1919, total exports had a value of over 2.7 million pounds; in 1929, total exports were worth more than 6.5 million pounds of which almost five million came from cotton. However, cotton exports fell from over three million pounds to just over 600,000 pounds between 1930 and 1931. In Government circles, 'deep pessimism' was expressed – the "golden goose had more or less overnight become an albatross". In 1932, for the first time since 1913, the SPS could not pay dividends to its shareholders. In 1933, there was a small profit to be reported, but paying dividends had to wait until 1934 (Mollan, 2008). One major reason for lower profits was the economic crisis of the 1930s. On new fields, cotton harvests in 1929 were still good – but the cotton price was simply extremely low. On older fields, however, cotton yields had dramatically declined with up to 75% of the first years. Cotton was hit hard by diseases like Leaf Curl, caused by the White Fly, and Black Arm. Apart from the abundance of rain in the early 1930s, the fodder crop *lubia* was accused of being the source for White Fly propagation. The flies could grow on lubia and migrate into cotton fields. As an immediate response, lubia was banned and other non-cotton crops had to be grown on fields away from cotton.

The major response from the SPS, however, which took some years to fully develop, was creating more distance in time between cotton and other crops. A new crop rotation was agreed upon by Sudan Government and SPS in February 1933. One more fallow year was added to the existing one, resulting in a four-year rotation. Cotton was to be followed by two fallow years, after which a field was sown with the grain crop *durra*. A four-year rotation could reduce pests only if fallow land would not see regrowth from remaining cotton roots, as these had to be cut away to prevent White Fly from growing. Fully eliminating Leaf Curl, however, required removing the old cotton roots completely – from all

13,000 plants per feddan. The tenants had to provide the labour and were strictly supervised by the SPS personnel.

The downside of a four-year rotation was a decrease in the cotton area, as instead of 33% only 25% of the total area could be grown with cotton. As the irrigated area was still being extended, however, this was only a temporary problem. The overall business trade-off in the rotation change was going from a higher number of cotton fields in a three-year rotation towards higher cotton yields per field in a four-year one.

Whatever the rotation, plants need water. Between sowing and harvesting, the different Gezira crops had different irrigation rhythms. Cotton was to be irrigated up to 15 times between sowing in August and picking in March-April. In August and September, the young plants needed water about every 12 days. Towards December, cooler weather and mature plants allowed 14-day intervals. The interval during the picking months between January and April was 16 days. Durra was sown at the end of July or early August; before harvest in October or November, the crop was irrigated three to five times. Lubia did not really have a well-defined growing season; the crop was irrigated four to eight times each 21 to 25 days.

As in any other irrigation system, Gezira's infrastructure and people had to match all crop demands and associated rhythms through the same canal system. The irrigation engineers from the Sudan Irrigation Department (SID) were responsible for delivering water through the main canal infrastructure up to the so-called Minor Canals, which were supervised by SPS personnel. Given the size of Gezira – the main canal was 100 kilometres (km) long – the engineers aimed for as few changes as possible in waterflows in the main system. At various locations along the way between Sennar and Minor Canals, control structures were managed by SID staff. The irrigation engineers supplied water to SPS canals according to the weekly demands reported by SPS staff.

Minor canals brought water through pipes to field canals – *Abu Ishreens* – from which water was brought to fields. The SPS staff decided how to distribute water to different field canals according to crop needs. The water they distributed had been asked for by themselves one week ahead – every Tuesday to be exact. All the fields served by a single Abu Ishreen had the same crop, allowing closer supervision by British field staff and enabling larger-scale land preparation. Depending on the stage the crop was in, and which crop was actually on a field, water demands in Abu Ishreens could differ each day. This could require daily changes in minor canal settings as well.

British field staff managed more than one minor canal. Each week, an inspector had to send requests in $m^3$ of water per feddan per day for all his minor canals to the relevant irrigation engineer. This engineer collected all requests from SPS staff in his larger area and translated them into a volume per day for his area. Then he – always he – added the amount needed by the area downstream of his area to the total and informed his SID colleague upstream about the total amount needed on that point. Finally, the main SID engineer at Head Quarters in Wad el Nau reported the total of all requests to the Resident Engineer at Sennar. The total amount of water released from Sennar included water losses encountered along the 57 km of main canal between Sennar and the main distribution point.

This system of requests followed average water demands and irrigation rhythms, but frequent adaptations were needed – especially because of rainfall. Rain required short-term action. The start of the cotton season was also the start of the rainy season. Rain on fields basically meant that water asked for should not be used on these fields, as otherwise the young cotton plants would drown. As such, rainfall could make requests from the week before useless and even damaging. To accommodate some changes, SPS staff was allowed to adjust Tuesday requests on the following Saturday, as long as resulting flows in the main system would not change. This meant that flows between minor canals could be adjusted, but the total flow to the larger area would continue to flow to that area the whole week. Even in direct emergencies, requests for changes that were received after 2 p.m. by the engineer, were only included in water delivery on the following day.

Thus, SPS staff still had to find an immediate solution for excess water that same day. With Gezira drains not being available to remove excess canal water, all that the field staff could do was balancing water flows between minors and, especially, Abu Ishreens, by opening some pipes earlier than planned and others somewhat later. This was not ideal for the cotton crop, but still better than doing nothing. In case of acute danger of drowning a cotton plot, fallow fields were used as an escape. Occasionally, even fields of durra could serve as emergency destination for water. The main symbol of colonial power – the cotton crop – had to be protected at all costs.

## NIGHT STORAGE

Gezira's flatness was covered with a canal network making travelling in Gezira like "a sort of jigsaw puzzle to the stranger".[12] Even experienced drivers could easily lose their way and quite a few ended up in a canal – especially at night after a good party, when there were plenty of canals available to drive into and get wet. In the original design of the engineers, all canals in Gezira would flow continuously up to field level – this meant that all canals upstream of the Abu Ishreens would carry water for 24 hours each day. Fields were to be irrigated day and night. The engineers had planned the system following their well-known practices from India and Egypt. A paragraph in the 1919 Agreement stipulated that Gezira would be irrigated similar to perennial irrigation in Egypt. Along these lines, construction of the Gezira canal system started in 1913 with Sennar Dam and parts of the main canal. After a temporary delay because of World War I, construction resumed, but the basic design did not change.

With construction well under way, one can imagine that the irrigation engineers were rather unpleasantly surprised when the SPS refused to accept continuous irrigation. The company wanted to run Gezira as a larger version of the early pumping schemes that since 1911 had irrigated the cotton during the day, as pumps were switched off at night. Day-time irrigation allowed closer control of tenants and cotton – it also saved hiring much more British staff. In the original small pumping systems, starting the pumps and filling canals in the morning did not constitute an issue. In the large Gezira system, however, it did become one.

Defining the exact moment when the SPS formally announced its problems with continuous irrigation is rather difficult, but the irrigation engineers made their disagreement perfectly clear in January 1924 – just 18 months before Sennar should start delivering water to the 300,000 feddan area! While acknowledging possible reasons for the SPS to maintain the pumping rhythm in the large Gezira system, the engineers did not accept them. Apart from their claim that reconstructing their ideal irrigation system would create problems with silt settling in the irrigation canals – an issue we will return to later – the engineers simply did not see why Sudanese farmers could not do what their colleagues over the world apparently could do fairly well: irrigate at night.

Although the engineers did not see the problem – and certainly did not feel the need to solve it, as they had not created it – keeping good relations with the SPS was very important for the Sudan Government. Therefore, a solution had to be found, which somehow had to include changing the design of the irrigation infrastructure and adapting canals that had been built already. Changing the original Gezira design from continuous flow to a system without water use at night was not straightforward, however. The option to discharge all water flowing in during the night out of the irrigated area, would save precious water and require many additional escapes. In June 1924, the Sudan Government invited Arthur Douglas Deane Butcher – Director of the Delta Barrage in Egypt – to study how to avoid night irrigation and deal with the consequences for water control in the larger canal system.

[12] SA, 428/3/22; Culwick diary entry on 26/4/1949.

Butcher's answer to the night irrigation problem was a rigid system of water control and distribution, in which parts of the canal system had to store night water. Butcher considered enlarging larger canals as too expensive. Therefore, he focused on the minor canals and transformed them into storage reservoirs at night. With the pipes to Abu Ishreens closed during the night, when irrigation had stopped, water levels in minor canals would rise to a maximum level in the morning, when pipes would be reopened and field irrigation would start again. During the day, the high water levels would drop, as the irrigated fields would use more water than the inflow into a minor. At the end of the day, the cycle would start anew.

Obviously, this approach did require changes in the physical shape of the minors. Water levels were to become higher at night, which would decrease the safety margins in minor canals that had already been constructed and required adapted designs for new minors. Each minor canal was divided into sections, to divide storage evenly and allow closer control. Sections were separated by a structure consisting of a weir with a pipe. During the day, the pipe would pass water to the next section. During the night, the pipe was closed. As a result, the water level upstream would rise with a section filling up. Once full, water would flow over the weir to the next section – keeping the water level in the upstream section constant.

In addition to these changes in the minor canals, Butcher designed a flow control system for the entire Gezira canal infrastructure. He defined a network of control points, dividing the Gezira into blocks between 17,000 and 20,000 feddans. Water flows to these blocks would be continuously monitored. Additional monitoring was considered necessary, as the shift to night storage meant that water levels could not automatically be used for monitoring discharges – the required standard relation between discharge and water level in a minor would not exist anymore.

Butcher stressed that his night storage system had to be seen as a temporary solution. It could be discontinued as soon as the Sudanese farmers had adapted to irrigated agriculture. His proposals would work fine anyway, but the Gezira canal system could be brought back to continuous flow any time desired. Temporary or not, the engineers of the Sudan Government were extremely busy in 1924 and 1925 to change large parts of Gezira irrigation infrastructure. The year before the opening of the Gezira system – which had already been announced to the SPS and so delay was not an option – was one of "agitated construction".[13]

At the start of the first irrigation season with water from Sennar, monitoring canal performance was one of the major topics for the engineers. The night storage system itself was implemented gradually on selected channels. In the first months after opening, some night irrigation was actually practised to avoid risking breaches in the new canal banks. During night irrigation, the outlets to the fields were open, but the tenants themselves went to bed – something the SPS wanted to avoid. In September 1925, the night storage arrangements worked satisfactorily according to the SID. Indeed, complaints about the water control required by the night storage system do not return in later SID documents of the 1920s – apparently the engineers started getting used to the actions required in Gezira.

Documents from the 1930s, however, suggest that the SID was still struggling how to consider all relevant issues when designing minors and drafting the design drawings. Working with standardised (representations of) minor canals was important to ensure that the large Gezira area would work under similar conditions of control, allowing easy transfer of information and engineers within the area. Even as late as the 1950s, however, the apparent necessity to standardise information on design procedures for night storage remained an issue.

Another recurring topic in engineering circles was the complaints about night storage. With night storage, Gezira would work against nature. Night storage created additional problems with sediment –

[13] SA, 498/9/22; Letter of MacGregor to Schuster, dated 16/8/1925.

which were brought in by the Blue Nile in bulk during the flood season – and complicated water distribution in the main system. What the engineers kept on stressing even more, however, was that night storage was fundamentally wrong. Night storage had been forced upon the engineers as a "Hobson's choice".[14]

## DAILY REALITIES

As much as a standardised representation of minors was important for SID working procedures in the Gezira area, keeping up daily irrigation operation proved to be more challenging than is often assumed in the literature on (colonial) irrigation.[15] Operational reality differed from what was prescribed in the standards – assuming the standards were correct. Measuring the Gezira terrain was done within a system of standard references – typically done to ensure that drawing canals on a map would be possible and that the correct spot in the field to actually dig the canal could be found. For this purpose, Gezira was covered with a grid of permanent marks. Unfortunately, however, the practice of the grid differed from its theory "in some unrecorded manner". The marks could have been put at the correct places, but many were occasionally moved or damaged.[16]

Despite the drive for standardisation by the SID, a standard irrigation infrastructure did not necessarily exist in Gezira either. Canals were frequently adapted, with the consequence that different parts of Gezira had slightly different canal properties. The original three-year rotation – with its more intensive cropping pattern – required more water for the same area compared to a four-year rotation. After the change in rotations in the 1930s, the main system carried more water than was strictly needed. A possible answer to this overdesign was extending the irrigable area, which actually did happen – but was only possible precisely because the change had been in the convenient direction. Had the change been from four to three years, the irrigation system would have been too small. Other, more local, adaptations in the canal system were not uncommon either. In 1935, the Efeina cotton area was transferred from one SPS area to another one. This change required new canals and adapting existing ones. In other areas, additional drainage was required, as effects of rain on cotton had become better known.

Despite being designed and constructed based on standards, certain parts of the system did not behave as intended or were not managed as prescribed. Each location with several canals branching off had its own target water level. For example, the main canal at 169 km had a design level of 6.35 metres (relative to reference). Daily experience by the SID had shown, however, that one could allow a water level up to 6.50 metres without harm. Actually, such a higher level was good, as it allowed keeping a little more water to divert if a shortage was expected. Maintaining higher water levels could also be good for canals that were supposed to serve areas that were relatively high compared to the water levels in the canal. Especially in times of low flows – and thus low water levels – such areas had trouble being served with the required amounts in the prescribed time.

These and other details of daily reality on the ground were reported by the responsible engineers in Handover Notes, which were drafted when an engineer would move to another area – or go on leave – to explain the particulars of the specific area to the successor. In the Notes, many suggestions can be found that being very accurate on water levels in daily canal management did not really work – it was

[14] SA, 498/15/32; Divisional Engineer Western Gezira to Director Sudan Irrigation Department 20/11/1925. Thomas Hobson (1544-1631, Cambridge, England) owned a stable of some 40 horses which he rented out. Although customers might have thought that they had a choice, customers had to choose the horse closest to the door. Hobson wanted to prevent that the best horses were always chosen, to avoid these horses becoming overused.

[15] Oorthuizen (2003) is one of the few studies focusing on everything government officials need to do to keep an irrigation system working.

[16] SA, 497/12/12; Letter to Griffin 17/10/1928.

much better to balance flows. Knowing the time needed for a change in water discharge made at Sennar to arrive 57 km downstream (point K57), allowed managing the changes required in the control settings at K57. As late as 1942 – so after 17 years of experience with the irrigation infrastructure – new arrangements at the structures at point K127 of the main canal should avoid "continual fiddling with the gates".[17]

Apart from enlarging the irrigated area, changing canals, and managing water flows, there was plenty of other work to do for SID engineers to keep Gezira going. The SID fought "a perpetuated war against weeds",[18] but even this major task, vital to keep the system going, was not free of negotiations. Most maintenance had to be performed in minor canals, where stagnant night water resulted in sedimentation and growth of weeds. In the original plans for operation and maintenance (O&M), the minors would be completely under SID responsibility for both tasks; SPS responsibility would start downstream of the pipes to the Abu Ishreens. Shifting responsibility for the water from SID to SPS staff had been arranged very quickly after 1925, as operating the minors and Abu Ishreens together made sense for irrigation purposes. Rational as the new division of tasks might have been for cotton production, for canal maintenance it created problems. Who was actually responsible for clearing weeds and repairing breaches?

Officially, the SID was responsible for maintaining all canals and structures, including everything in them, up to the downstream side of the pipes to the Abu Ishreens. Once operating minors and pipes had become the responsibility of SPS staff, it only made sense to shift all practical responsibility for daily O&M to the SPS. The financial responsibility for maintenance stayed with the SID, however. The SID made the budget available to the SPS for maintenance; SPS staff could ask for these funds through the company's management. The SID feared that SPS staff would not easily do that, as asking funds might be taken by the company as a sign that its staff could not do its work properly – something one does not want when one's wage depends on performance. The SID could not put too much pressure on SPS staff, however, as the outcome could be that the SID would have to do the work again – and there were many, many minor canals. Small repairs in minors were arranged by the SPS with (cheap) tenant labour. This model, however, did not work very well during busy periods, as in the cotton picking season. At such moments, SID staff still needed to come in.

Within all those formal and informal negotiations, something like regularity did actually emerge. Day-to-day decisions kept requiring improvisation and flexibility, new standards were drafted every now and then, but all in all Gezira irrigation became quite predictable after the start-up years in the late 1920s and the major changes of the early 1930s. Flexibility had become rather predictable. As one can imagine, World War II and Gezira's lack of personnel, budget and equipment put additional stress on the machinery of SID and SPS. Much of the silt and weeds could not be removed from Gezira canals. Disposing of excavated silt became a problem in itself, as space to do so became scarce. Roads were sometimes blocked with silt, which blocked the draglines that had to clean the canals. Reserving certain parts of the irrigated fields was a temporary answer, but redesigning each local canal system was seen as the better option. Again, the existing infrastructure was to be changed. Given the amount of SID labour required for this, the large post-World War II projects in Gezira – especially the so-called Managil extensions (see Shaw, 1965) – could only be realised because much of the work was done by external contractors. Quite a few of those external engineers were British: colonial engineers became expatriate engineers.

[17] SA, 500/19/22; Handing-over Note Torr to Smith June 1942.

[18] SA, 497/13/50; Director of Irrigation to Divisional Engineers and Resident Engineer 23/4/1939.

**PERSISTENCY**

The three stories of Gezira show that production of spaces like Gezira is not a smooth process in which social structure is stamped out just like that onto a landscape (Soja, 1985). Space is produced and reproduced, in a process of cooperation, struggle, conflict, and contradiction. This process is shaped through many engagements between the human and the non-human – between agents of different kinds. In the Gezira model desired by the British, cotton could only grow well with diseases, tenants, and water under close control by SPS inspectors and SID engineers, even though the exact meaning and execution of 'control' was not always clear. As we have seen, arranging exactly something like control was hard work, and not just because its meaning was not clear. Even when the meaning of an issue was clear for (some) British, each and every day the actor-network of Gezira's irrigated cotton agriculture had to be reconstructed and reconfirmed by agents as different as SPS staff, SID engineers, tenants, canals, White Flies, sediments, and water.

The introduction of night storage in Gezira was the materialisation of the disagreement between SPS and SID – and they kept disagreeing about the temporality of the system. Once constructed in the 1920s, maintenance of Gezira's canals, particularly the night storage system, proved to undergo a continuous debate and become a challenge – especially after World War II with SID budgets under pressure. There are indications that in the 1960s and 1970s, Gezira farmers were actually irrigating at night. Many of the foreign consultants who came to Gezira actually recommended restoring the night storage system, as they claimed it had worked so well in the past. We can safely conclude, however, that a 1990 World Bank report was not entirely correct when stating that night storage had been introduced in Gezira "when it was realised that tenants were opposed to irrigation at night" (Plusquellec, 1990: 21).[19] Sudanese farmers were not the ones asking for night storage, but they had to work within it as long as SPS staff managed to enrol Gezira's infrastructure more successfully than the tenants could do.

In these and other exchanges between agents in Gezira, we discovered persistency in infrastructure, in policies, and in institutions. Tenants, engineers, and inspectors encountered the continuous presence of (former) others through the material and the procedures – in canals and handbooks. The material itself (both canals and books) expressed its own agency continuously in its diverse meanings as well: canals silted up, books became infested with mildew. With all the details emerging from the many documents on Gezira, we have excellent opportunities to move into actor-networks of imperial development. The Gezira Scheme was a product of continuous negotiations shaping the scheme's canals, cotton, and tenants' resistance, as well as the contested symbol of development itself. Cars were being driven into canals by drunken inspectors after a good night's drink – a pretty common phenomenon in Gezira's history, especially during nights when rain had turned Gezira's roads into mud. Such cars may be as relevant to a story of development as grant government policies or capitalistic enterprises like the SPS. In Ertsen (2016) I argue indeed that wet vehicles are very important, but as one does not know beforehand how they would become relevant, our study of Gezira needs to be flat in terms of explanations that we seek: indeed a major concept of ANT.

Gezira practices were – and are – used to (re)construct desired images of development, to claim that the glorious future was around the corner if only we were prepared to act in the correct way. This hijacking of practices for a political agenda happened as much in Gezira as in the many other development projects that continued their work rituals despite changing development policies of donors.[20] The changes and continuities in Gezira-related policies and actions – and how these were

[19] See also Wallach (1988), who makes a similar remark on page 422. The myth had grown strong!

[20] One could ask how practices could have changed, being executed by many of the people that had colonial working experience, who trained new development workers. See Ertsen (2010) for a discussion on how this worked within education of Dutch irrigation engineers at Delft University of Technology.

seen by contemporary and future scholars and stakeholders within the 20th century – not only shed light on (irrigation) development within the Gezira Scheme itself, but also in the general debate on development – in Sudan, Africa and elsewhere. The Gezira project is a prime example of *contested development*. Development activities "are not born successful (or unsuccessful); they become so over time and for many different reasons in different places" (Barron et al., 2011: 250 and 261). This concept of development relates very well with notions of ANT: Gezira development was continuously (re)created by human and non-human agents. The immense Gezira Plain provided the dramatic stage for a pas-de-deux of Captain Jack Sparrow and Bruno Latour. Gezira was planned out and made up as human and non-human agents went along.

## AGENCY AND STRUCTURE

Building and running Gezira definitely constituted an act of close control by the colonial state,[21] but as with all state control, the agency of humans and non-humans had to produce and carry through that control. Within social theory, relations between entities on different 'levels' of abstraction – individual agents, social relations, the state, power – are often discussed within the framework of agency and structure. I will not offer a full discussion with exhaustive lists of contributors in this paper, but the champion of the discussion on agency and structure is likely to be Anthony Giddens (1979, 1984, 1990a, 1990b). His theory of structuration claims that structure and agency are a duality that cannot be conceived of apart from one another: people make society and are at the same time constrained by it. Action and structure cannot be analysed separately, as structures are created, maintained and changed through human actions, while these same actions are given meaningful form only through the influence of the structure.

In a response to Giddens, Margaret Archer – another key scholar in the debate – presents her central notion of "morphogenesis": the idea that processes of change for agents and social structures occur in interlocking and temporally complex ways (Archer, 2003). That may be all fine – and not at all that different from Giddens (or actually ANT), see below – but once the descriptions of the more detailed mechanisms start, problems arise. Archer claims that there is an analytical need for distinguishing between 'agency' on the one side and 'structure' and 'culture' on the other, without really sustaining that claim in any other terminology than that it is needed to be able to separate them – a circular reasoning par excellence. An important assumption of Archer seems to be that one needs to – and can – distinguish between 'subject' and 'object', or subjectivity and objectivity (Archer, 2003; see also Healy, 1998; Porpora, 2013). Such separation is even a matter of intentionality, as Archer discusses the role of projects in society as expressions of agential human enterprise. Apparently tigers do not act intentionally and as such cannot be agents. However, once we remove such assumption about humans and non-humans – with the support of work for example by Strum and Latour (1987) and De Waal (2009, 2013) – there is not much left of tigers not having agency.

Actually, Giddens and Archer share much. They both stress how difficult it is to distinguish between the agent and the context/structure, how quick these are merged in reality (King, 2010). I would agree with these merging realities, but precisely because of such merging I do not understand any desire to distinguish between concepts that only a few sentences before have been described as closely intertwined – even inseparable. The intriguing demand to explain human agents by what is outside of them in combination with the insistence that what is outside of them cannot exist without those same human agents, is untenable.

Social theories separating agency and structure have the same problem as many social modellers have: properties of collective institutions – states, companies, class, gender – are used to represent

[21] Although it is good to note that the presence of the private firm SPS makes this notion actually problematic.

individual agency (see Barton, 2014; Wilkinson et al., 2013). Obviously, states, companies, and gender differences do exist, but I would argue they result from agency. Assigning predefined institutional features to humans creates the problem of circularity: (model) results are similar to input (data) – a problem social theory that builds on duality does have as well. Therefore, to paraphrase one of Archer's terms, 'conflation' is the only option left. This is also the reply of Giddens to Archer: "Structure and action *cannot* form a dualism, save from the point of view of situated actors, because each is constituted by and in a single 'realm' – human activity" (Giddens, 1990b: 299; quoted in Piiroinen, 2014: 87).

I would argue that situated (historical) actors do not encounter any overarching structure that determines their actions. There are simply too many factors that can explain actions and choices – as any good historical study will show (see Arnold, 2013; Biggs, 2010; Pritchard, 2011; Winiwarter, 2013). How to deal with the historical actor is therefore a choice of the observer. Do we assume overarching structures that prepare choices, and how can we defend the selection of relevant structures? Or do we start with the messy and short-term actions of the historical actor? Actually, a much more realistic approach is to ignore the whole issue of agency and structure. "The antidualistic solution to what Archer (…) sees as '*the* central sociological problem' – 'the problem of the relationship between individual and society' – is more dissolution than anything else: there *is no* such (general) problem" (Piiroinen, 2014: 90).

The problem of how "society developed" or how children grow up "dissolves if we grasp that the newcomers never interacted with any super-human structures in the first place, but with other people (their parents, playmates, teachers, etc) (Piiroinen, 2014: 90). Parents and teachers, however, are not the only sorrow for the newcomers; they struggle as well with the material: chairs that are too high, streets that cannot be crossed, stoves that burn fingers. Many of those materialities express relations that matter to agents and pre-date their arrival (Cudworth and Hobden, 2013).

## MATTER

In general, social theory struggles with including the material, which is seen to be a world outside the social realm as it were.[22] The material matters for Foucault (1988, 1995), who convincingly shows the importance of material expressions of power, but he does not leave much room for (human) agency. Giddens' attempt to relate agency and its resulting larger societal fabric(s), which would be "virtual order" (King, 2010: 254), ignores the material, even though the structuration approach would offer clear possibilities to include it – as Sewell (2005) shows when presenting how he incorporates resources as physical entities in his own perspective.[23] Interestingly enough, Giddens differentiates between systems and structures: systems may display structural properties but are not structures themselves. Following my line of reasoning, we might equal Giddens' 'systems' with 'material structures' and as such with (expressions of) power relations. Archer does not mention the material much, but when she does it, it is usually in dismissive terms: "[s]tructural and cultural influences cannot be modelled on hydraulic

[22] The German philosopher Gabriel (2013) argues in his New Realism that the whole idea of the world is problematic. We can know things and facts, but that those things and facts – that cannot exist on their own – do not belong to one 'object domain'. Meaning is mobilised within different several perspectives ('Sinnfelder'). Therefore, 'the world' does not exist, as nothing exists on its own. Although Gabriel and Latour would not necessarily agree with each other's exact phrasing – Gabriel uses the forbidden word 'context' – they do both argue that the knowledge that humans develop concerning the objects that shape their world, depends on how humans connect to those objects. In shaping connections, objects have agency and are multiple in the sense that different modi can connect to similar objects in different ways (Latour, 2013).

[23] The approach developed by Sahlins (2004) would offer similar options, but he tends to offer less room for agency – even though he claims he does include it, but read his account of the baseball matches where the outcome of the historical process determines to what extent individual agency is allowed to have a role when explaining that same baseball process, something not done in a Latourian perspective.

pressures" (Archer, 2003: 1). I might even agree with that statement, but only because there are many more material agencies that would matter. We need to add more expressions of material agency, not necessarily replace hydraulics with concepts of 'structure' and 'culture'.

When materiality is discussed within social sciences, there is often the call to avoid "conflation between the idea of the properties and powers of beings and things, and the notion of action and the idea of agency" (Cudworth and Hobden, 2013: 446). However, their argument that "ANT considers agency simply as a quality of material existence" (Cudworth and Hobden, 2013: 446) is off track. ANT defines agency in relation to other agents and not from any intrinsic quality of matter – at least not in any specific way different for any agent. If matter has intrinsic properties, humans would have them too. Throughout their text, it seems that Cudworth and Hobden themselves argue for intrinsic capacities of matter, for example when they suggest that agents already incorporate predefined types of agency from the start – comparable with the 'possible agencies' from Archer (2003).

In traditional social sciences, landscapes typically remain the static backgrounds of human agency: the "non-human forms the landscape of decision-making and human endeavour" (Cudworth and Hobden, 2013: 449). What irrigated landscapes like Gezira suggest, however, is that it is actually hard work to assemble those same landscapes – and to create lasting institutions relating to that landscape – "through the redistribution of agency over networks composed of human and non-human 'actors'" (Schouten, 2013: 9), precisely because the landscape and its non-human colleagues strike back. Matter and objects "are not merely the screens or the retroprojectors of our social life" (Latour, 1996b: 118).

When infrastructure as in (or perhaps like) Gezira was designed and realised, future agents were typically active, as they were "inscribed there as a category of user" by the designers (Latour, 1996b: 118). Gezira was built anticipating tenants and inspectors – and again, this notion does not mean that the designers agreed on those roles, as the night storage example shows. Nevertheless, rules and daily routines in design and operation were important. Indeed, those routines were important predecessors for new agents, as it was the 'plan' that was continuously (to be) reconstructed through the agency of all actors. That did not mean, however that human agents behaved as they were supposed to. Tenants chose to act for their benefit, as much as SPS inspectors decided to do the same. We can reason along similar lines for material agencies: when Gezira was designed and realised, future material agencies were "inscribed" through certain behaviour (water flows, sediments, weeds) by the designers (Latour, 1996b: 118). The material agents translated the designers' wishes as "faithfully" as the human ones (Latour, 1996b: 118); as much as many Gezira tenants, matter was "naturally recalcitrant" (Latour, 2000: 116), as anyone who had to deal with Nile sediments, canal weeds, and White Flies could confirm.

Indeed, Gezira's social structures required Gezira's matter to survive and stabilise (Strum and Latour, 1987). Policies as well as instruments were products of the agency of (non) human agents – including calculation routines, sediments, and engineers. In Gezira we do not observe 'social structure' or 'capitalism', or something like 'the world'. What we discover once we look into daily encounters between agents, is a set of material arrangements that are relations of power. We find canals, apartments, banks, and letters: material stuff, infrastructure, and objects. We encounter unequal opportunities to enrol other (non-human and human) agents. Any conceptual distinction between the social and the material does not hold. Simply put, the social needs to be produced through engagements with the material and vice versa. The Gezira landscape was made into an assemblage "of gathering, of 'thinging' entities together" (Latour, 2007: 140) weaving a fabric that promised "the possibility of holding society together as a durable whole" (Latour, 1991: 103), at least for moments. Enrolling other agents has been shown to be extremely hard work: domination and resistance continuously need to (re)produce their own support, as much as "[u]nicorns, bald kings of France, black holes, flying saucers, appearance of the Virgin, chromosomes, atoms, Roger Rabbit" and capitalism, structure, culture and agency need to produce theirs (Latour, 1991: 128).

In building understanding of conceptual and empirical links between water, infrastructure and political rule, ANT's 'network' element does not replace the notion of 'structure'. "ANT is not a theory of the social, it is a theory of a space in which the social has become a certain type of circulation" (Latour, 1997: 3). Continuous circulations – negotiations – among and between human and non-human agencies shaped and continue to shape Gezira as permanent entity and contested symbol at the same time (Latour, 2013, 1996a). In the circulations of agent-networks, any human agency encounters (pre-existing and emerging) material agency. Gezira proves the importance of "material underpinnings of rule" (Schouten, 2013: 21). First, the material matters when understanding why things go as they go. Second, the material is the temporal link between different agents. Third, the material is the spatial link between agents. Once we have these temporal and spatial links, do we need any (other) social structures? I am not sure yet whether I want to argue that 'structure' should be replaced with 'infrastructure' – but I am prepared to suggest that such replacement would be a fruitful move to explore the consequences. We may discover that we do not need something as ambiguous as 'social structure' anymore when thinking from an ANT perspective.

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## ARCHIVAL SOURCES

References to the huge amount of archival material from the collections within the Sudan Archives in Durham (SA) and (to a lesser extent) the National Archives, Kew, London, both in the United Kingdom, are not included in this paper, unless concerning a direct quote.

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