This is the peer reviewed author accepted manuscript (post print) version of a published work that appeared in final form in:

Christ, Katherine L & Helliar, Christine V 2021 'Blockchain technology and modern slavery: reducing deceptive recruitment in migrant worker populations', *Journal of Business Research* vol. 131, pp. 112-120

This output may not exactly replicate the final published authoritative version for which the publisher owns copyright. It is not the copy of record. This output may be used for non-commercial purposes. This version is licensed under a Creative Commons CC-BY-NC-ND 4.0 license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

The final definitive published version (version of record) is available at:
https://doi.org/10.1016/j.jbusres.2021.03.065

Persistent link to the UniSA Research Outputs Repository:
http://researchoutputs.unisa.edu.au/11541.2/146750

General Rights
Copyright and moral rights for the publications made accessible in the UniSA Research Outputs Repository are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the persistent link identifying the publication in the UniSA Research Outputs Repository

If you believe that this document breaches copyright, please contact us and provide details. We will remove access to the work immediately and investigate your claim.

Blockchain technology and modern slavery: reducing deceptive recruitment in migrant worker populations

ABSTRACT

Modern slavery, including forced labour, is a practice that impacts more than 40 million people, 20 million of whom are trapped in corporate supply chains. Migrant workers are disproportionately affected by this practice, who are often from developing countries and are vulnerable to exploitation through deceptive recruitment practices. With questions raised as to the efficacy of social audit and increasing pressure on governments and large businesses to identify and reduce the incidence of modern slavery in corporate activities, new approaches and tools are needed. The purpose of this paper is to offer a conceptual discussion as to how a relatively new technology, the blockchain, might be used to reduce vulnerability and risk in migrant worker populations. Limitations and directions for future research are also considered.

Keywords: Blockchain; Modern slavery; Migrant workers; Forced labour; Deceptive recruitment; Unethical recruitment.

Blockchain technology and modern slavery: reducing deceptive recruitment in migrant worker populations

1. Introduction

Modern slavery is a practice that incorporates various forms of exploitation including forced labour, the worst forms of child labour, debt-bonded labour and traditional slavery (Nolan and Boersma, 2019). With estimates suggesting there are currently more than 40 million people held in slavery-related conditions worldwide, and more than 20 million in corporate supply chains[1], recent years have seen an increasing number of legislative Acts adopted by countries with a view to addressing and minimising the problem. Such countries and regions include the United Kingdom, Australia, California, and more recently, Canada which currently has a Modern Slavery Bill before Parliament (Walk Free Foundation, 2018; Christ et al., 2020). A primary focus of legislation is enshrining into law the role that the business sector plays in facilitating and perpetuating slavery-related activities. To combat this problem existing Acts generally require large organisations to prepare an annual modern slavery statement outlining how they identify and manage the risk of modern slavery, not only in their own operations but also in those of their supply chains (New, 2015; Wen, 2016). These requirements have presented challenges to many organisations and new tools are needed to help businesses and governments identify and combat this practice (Nolan and Boersma 2019).

[1] The 40 million people estimated to be in modern slavery by the Walk Free Foundation includes people in situations like sexual servitude, forced marriage and other forms of slavery not relevant to the corporate sector. For the purpose of this paper the 20 million people trapped in corporate supply chains is the estimate of interest.

Modern slavery can be perceived as falling on a spectrum of working conditions (see Figure 1) from the extremes of modern slavery to fair and reasonable work - with a plethora of practices falling under the category of poor working conditions. Poor working conditions may include poor pay, unpaid overtime, retention of documents, excessive recruitment fees, long hours and dangerous working conditions. Poor working conditions do not necessarily lead to slavery and are not always illegal, but they are often perceived as an early indicator that the risk of slavery will be increased (Christ et al. 2020).

Combatting modern slavery in corporate supply chains is a far from easy task given its illicit and often hidden nature (Crane, 2013). One of the main tools traditionally used in this space and in relation to human rights due diligence is the social audit (Ford and Nolan, 2020). However, a growing number of academics have expressed concern that social audits are insufficient when it comes to addressing modern slavery in corporate supply chains. For example, in 2008 Barrientos argued that social audits were typically based on a single site visit by auditors who had a poor understanding of local employment conditions and failed to consider contract labour. More recently, Ford and Nolan (2020, p. 28) argued social audits for modern slavery often led to a "cosmetic, shallow or narrow, self-legitimating, compliance-oriented responses by firms". They note the superficiality of social audits and the focus on symptoms, not causes, as being especially problematic. This is consistent with LeBaron (2014, p. 245) who quoted a social auditor lamenting that "the vast majority of social or ethical retail audits are "not trying to find things out, they're trying to prove that something is not there."" In contrast, while Benstead et al. (in press) recently presented evidence that targeted audits could be effective at identifying and combatting modern slavery, they concede that their approach is not feasible on a larger scale.

Accepting evidence that the traditional approaches to modern slavery risk management are not effective it becomes clear that new, multifaceted solutions are needed that incorporate both top down approaches led by focal companies (usually multi-national enterprises-MNEs) and bottom up approaches that empower potential victims and reduce vulnerability. The nature of slavery itself is complicated, with different types of exploitation requiring different tools to identify and eradicate illegal practices and protect existing and future victims. This paper considers the way in which a relatively new technology, the blockchain, can be used to address an important area that contributes to modern slavery, especially in developing countries: deceptive and unethical recruitment. The focus on people as opposed to products is consistent with recent literature that suggests the labour supply chain is just as important as the product supply chain and needs to be investigated further to help address modern slavery concerns (LeBaron and Lister, 2015).

Migrant workers from developing countries are considered a high-risk category in relation to worker exploitation (Crane, 2013). In the process of seeking a better life for themselves and their families, these workers often fall victim to: (i) human trafficking (the process of moving victims from one place to another where they are ultimately exploited); and (ii) deceptive recruitment where the conditions and pay promised by the recruiting agent often turn out to be very different from the reality the victims eventually face (Stringer et al., 2016). The victims in such cases are generally poorly educated, have low awareness of their rights and are open to exploitation and manipulation (LeBaron et al. 2018; Phillips and Mieres, 2015).

The countries to which these workers are migrating often lack the means to confirm prospective employment arrangements or what has been agreed with the worker themselves. When exploitation occurs within MNE supply chains it is difficult for the MNEs

to trace workers and link different workers with different facilities and working conditions (LeBaron, 2014). In this context it has led some commentators to question the efficacy of social audits as noted above, as they are often expensive yet ineffective in identifying the problem they are designed to investigate (Boersma 2017; Ford and Nolan, 2020; LeBaron, Lister and Dauvergne. 2017). Furthermore, there are only a limited number of ways for workers or NGOs and similar organisations to raise and anonymously report issues in relation to specific cases of worker exploitation; prosecution of perpetrators is also very difficult as there is often a lack of worker documentation to substantiate any claims (New, 2015).

We propose that blockchain technology could be used as an important part of providing documentary evidence to protect workers against exploitation, forced labour and modern slavery. With its capability to record and provide an auditable trail of transactions associated with labour recruitment, such as employment contracts, migration details, passports and visa arrangements, blockchains could provide a valuable tool in fighting slavery. This paper presents a conceptual discussion in which the following research question is considered:

How can blockchain technology be used to reduce deceptive and unethical recruitment in migrant worker populations which is often associated with worker exploitation and modern slavery?

The rest of the paper is arranged as follows. Section 2 discusses the nature of deceptive recruitment and modern slavery as it applies to migrant worker populations. Details of blockchain technology are then introduced in Section 3. Section 4 brings these two areas together to directly answer the research question after which Section 5 covers the way forward and limitations. The paper then provides a brief conclusion in Section 6.

2. Deceptive recruitment and modern slavery

Migration for work purposes has become normal practice. Although not limited to developing countries this scenario is especially the case for workers from poor countries who seek opportunities beyond the border of their homelands, entertaining hopes of a better life and in many cases the opportunity to send money to loved ones who remain at home. One of the most common ways for individuals to obtain work this way is via the use of intermediaries, recruiters, or labour contractors (LeBaron, 2014). For example, evidence suggests that around "half of the estimated 30 million migrant workers in India [have been] recruited through labour contractors" (Phillips and Mieres, 2015). While there are companies and individuals committed to assisting workers in a legal and ethical way, many migrants end up in unacceptable and illegal situations, adding to the 20 million plus victims caught in modern slavery in corporate supply chains, with little hope of escape (Walk Free Foundation, 2018). While the focus in the literature is largely on developing countries there is also evidence of workers from developed countries being exploited in this way with exploitation occurring in both developing and developed countries (Crane, 2013). For example, Robinson (2013) notes that slave labour is evident in both the Australian and US foodservice industries.

Crane (2013) observes that the usual process of modern slavery involves three steps: recruitment; trafficking; and deployment. This process is largely driven by subcontracting practices along the labour supply chain and the use of labour contractors and recruiters. According to LeBaron (2014, p. 244) recruiters frequently contribute to modern slavery by engaging in "contract substitution, recruitment fees, passport retention, and restrictions on mobility and freedom of association". These practices can also occur at the deployment

stage where the 'employer' becomes the perpetrator. Retention of documents is especially problematic and LeBaron's observation is consistent with the position taken by the International Labour Organization (ILO) that states on its website in the section that deals with deceptive recruitment and coercion that:

> *"The retention of passports and other identity documents is one of the most common forms of coercion, restricting a migrant worker's freedom of movement, preventing them from seeking help and trapping them in forced labour" (ILO, 2020).*

It is noteworthy that in some countries the retention of passports as soon as a worker arrives at their final destination is considered normal and legal. For example, Bahrain, Qatar and the United Arab Emirates operate a visa sponsorship program known as the Kafala system in which migrant workers surrender passports to their employers on arrival and then require the permission of employers to leave their job or the country (Webb & Garciandia, 2019). This system has been criticised as leaving workers vulnerable and open to exploitation (LeBaron et al. 2018). While often thought of as a problem occurring in developing countries, evidence also suggests that developed countries are not immune from such practices even in cases where they are strictly illegal (Zirnsak et al., 2018).

Some workers also find that the costs associated with job placement and migration are recorded as 'loans' that they have to pay off in full before being receiving any pay for the work undertaken. Interest rates on the loans can be as high as 60% (and sometimes more) meaning many individuals work for years before having any disposable income that they can spend or save as a result of their 'employment' (Walk Free Foundation, 2019). Workers' bank cards and account details can also be confiscated and held by the employer until the debt is repaid.

Illegally withholding wages or cash is a common problem sometimes also linked with the withholding of documents (Gold et al., 2015). For example, a report commissioned by Nestlé to evaluate migrant labour conditions in its fishing supply chain in Thailand found that worker passports and other identity documents were often held by their 'bosses' until such time that recruitment fees and other often "illegal" costs relating to training, migration and placement were repaid in full (Verité, 2015). In practice document retention facilitates illegal forms of debt bondage that are endemic within migrant worker populations and only become apparent once the migrants have reached their final place of work (LeBaron, 2014) such as on fishing boats. With both employers and recruiters potentially involved in the process of deception and unethical practices workers quickly become trapped.

As noted above, evidence suggests that the use of labour contractors and recruiters is on the rise worldwide (Barrientos, 2013), and Stringer et al. (2016) note that strategies are needed to deal with the potential problems associated with this practice, spanning the full spectrum of employment, from recruitment to exit. The ILO (2018) also highlights the need for research into practices that protect workers from unscrupulous recruitment in the labour supply chain given these activities often lead to forced labour.

The process of recruitment of migrant labour can be broken down into various stages. These are displayed in Table 1. Each stage is associated with numerous issues that can lead to modern slavery as the evidence from prior research and work undertaken by NGOs and intergovernmental organisations shows. Several of the issues displayed are also explicitly classified as indicators of forced labour by the ILO (ILO, n.d.). Of interest is that many of these concerns relate to the absence of a historical trail of documentation and agreements. Workers frequently have their contracts and conditions of work changed retrospectively

and, importantly, infringe their human rights, when these changes are made without their consent (LeBaron et al. 2018). Some workers are never given a copy of the original contract they signed up to and, in addition, their travel and identity documents are confiscated on arrival to prevent them from leaving their "new" place of work (LeBaron et al. 2018, Piper & Withers, 2018). This makes it difficult for workers to contact authorities or charitable organisations for help when things turn sour as many are unable to even prove their personal identity (Wilkens, 2018). Language difficulties exacerbate these challenges which, when combined with the lack of documentary evidence, leave workers feeling trapped and unable to leave the slavery they unknowingly walked into (Marschke & Vandergeest, 2016). In the context of recruitment through to exit, the ability to access documents presents a solution that could hypothetically solve the problem of the confiscation and substitution of documents. A historical record of agreed contractual terms and conditions could be used to change the current power dynamic in the worker/employer relationship which often leads to worker vulnerability (Murphy, 2017). The need to change the power dynamic is explicitly recognised by the International Recruitment Integrity System (IRIS), an initiative supported by the International Organization for Migration (IOM), that has published its Standard for ethical migrant recruitment with a view to protecting the rights of migrant workers (see IRIS, 2020).

TABLE 1 About here

Some efforts have been made to combat unethical recruitment in migrant worker populations in developing countries and most explicitly recognise the role that documentation plays in relation to worker protection. For example, in 2013 Bangladesh announced it would begin issuing migrant workers leaving the country with 'smart cards'

that would contain information such as names, photographs and fingerprints of workers (Daily Prime News, available from Migrant Workers Rights, 2020). The purpose was that Bangladeshi embassies operating in foreign countries could quickly identify the worker without needing to access to their passport. This program, administered by the Bureau of Manpower, Employment and Training (BMET), is a mandatory requirement for all workers heading overseas from Bangladesh (largely to Arabic countries), at least officially. Since inception, the smart card has developed to include other information such as "passport details, license number and other details of the labour recruiting agency, and information on the overseas employers" (IOM, 2018). It has been argued that the smart card would help prevent deception in worker recruitment, but, there is limited evidence of this happening in practice. For example, Bhuyan (2018) argues that the cards remain largely unused despite millions having been distributed. It is not clear why this is the case, but it may be that as the card is a physical item it can be confiscated by unscrupulous employers or recruiters, limiting its utility and, again, leaving workers vulnerable. Thus, it can be argued these cards do little to help migrant workers who become victims of unethical practice, which often only becomes apparent after the migration process is complete. In addition, there is no guarantee that the information on the card is secure or whether it can be fraudulently changed without detection. This represents a weakness in the smartcard approach especially in migration to developing countries where the level of corruption is sometimes very high. It is clear this approach to protecting workers contains a number of fundamental flaws which cannot be resolved and new approaches are needed to address these shortcomings.

With millions of migrant workers trapped in modern slavery in corporate supply chains it is clear that research and associated tools are needed to identify and minimise the unethical

treatment faced by many migrants. Empowering potential workers at the point of initial contact would be beneficial, especially if encouraged by top down engagement by focal MNEs which, consistent with new forms of modern slavery legislation, can use their market power to enforce change. There is also a need to consider different jurisdictional contexts. For example, LeBaron et al. (2018) criticise the Kafala system in Gulf countries as fostering exploitation of migrant workers due to the fees paid to labour brokers, confiscation of passports on arrival and limited legal protections which are exacerbated by lack of access to documentary evidence concerning employment arrangements. Thus, tools that can assist workers across different legal jurisdictions are also needed. In this context it has been suggested by Farbenblum and Nolan (2017) that technological advances may provide a medium to protect migrant workers and this paper will now consider how blockchains could be used as a potential tool in the fight against modern slavery.

3. What is the blockchain?

Blockchains are the distributed ledger technology outlined in the Nakamoto White Paper of 2008 (Nakamoto, 2008) where transactions are recorded in a secure, immutable and chronological way without the need for any intermediaries (Swan, 2015; Tönnissen and Teuteberg, 2020). Digital information is recorded in blocks that are chained together and distributed across multiple nodes (computers) as blockchain records. Each block of information is validated in real time, creating a transparent transaction history (Kemp, 2015). The data usually cannot be censored, deleted or edited, with the data stored and encrypted on the blockchain, from cryptocurrencies to bottles of wine (Helliar et al. 2020). Transactions become open and transparent as anyone can view the historical data on a blockchain.

The first application of a blockchain was in 2009, that of the Bitcoin cryptocurrency, and since then two types of blockchains have diffused - permissionless and permissioned – that are uniquely different from each other in both their conceptual underpinnings and their adoption in practice (Behnke and Janssen, 2020; Helliar et al., 2020). Permissionless blockchains are the domain of cryptocurrencies and permissioned blockchains are those being implemented in business. Within business, permissioned blockchains can record the life history of a product, from source to final consumption, recording features that stakeholders may be interested in. For example, high-value goods such as diamonds are recorded on the Everledger blockchain with forty meta data points recording the colour, weight, and origin of each diamond (Kewell et al., 2017). Blockchains are increasingly being used in business supply chains for goods and products (Helliar et al., 2020), and there is now an increasingly wide literature on the use of blockchains within supply chains. For example, Rogerson and Parry (2020) demonstrate the use of blockchain in the fishing, agriculture, infant formula and wine industry. Helliar et al. (2020) also explore how a blockchain works in the wine industry; the My-Story blockchain carries the histories of bottles of wine, such as the grapes, where they were grown, and the wine production process. Using a QR code on an app, a consumer can scan a bottle of wine on the blockchain and know exactly where it came from and which year it was harvested and produced (Helliar et al., 2020). Providing assurance over the provenance of goods in the supply chain is a noted driver of blockchains (Queiroz & Wamba, 2019; Hanson et al., 2017; Behnke & Janssen, 2020; Tönnissen & Teuteberg, 2020) and the ability to provide traceability in supply chains is a key driver for permissioned blockchains (Behnke & Janssen, 2020; Kshetri, 2018). The facility to be able to track and monitor “things” on a blockchain would be useful tor tracking and monitoring humans.

Blockchains are also starting to be used in social sustainability settings albeit only to a limited extent, for example, Tony's Chocolonely (Boersma and Nolan, 2020). Further, in a modern slavery context the World Wildlife Fund is conducting blockchain trials to stamp out human rights abuses in the tuna fishing industry of the Pacific Islands through the tracking of illegal fishing (WWF 2021). Further, the Mekong Club, a not-for-profit entity set up to combat modern slavery, has been experimenting with creating virtual identities on a blockchain, removing the need for paperwork and the possibility of forging documents. Individual workers' biometric information such as scans of the iris or the use of fingerprints, could be used instead of paper trails to verify workers' details which could be immutability added to a blockchain (Mekong Club, 2020). The above said, to date there is little other evidence of blockchain use in human labour supply chains that might be useful for reducing human trafficking and evidencing breaches of contract.

One problem that presents a barrier is that of off-chain processes as Helliar et al. (2020) note in the use of permissioned blockchains. In their wine industry case study a multinational enterprise certifies all the information as a gatekeeper before adding any information to the blockchain. Tian (2020) also outlines that processes are needed for off-chain certification, auditing and authorisations and that information on these processes needs to be added to a blockchain. In the Mekong Club experiment, a third-party organization verifies off-chain data too. Once information is on a blockchain it is immutable, but assurance of information before it is added to a blockchain is of concern. Rogerson and Parry (2020) identify boundary issues between off-chain data and on-chain data as needing resolving, as well as governance issues over who can add the data and solve the algorithms and the fact that immutability is not infallibility.

Overall, the use of a blockchain could potentially be a very useful technology in reducing modern slavery. Although the human supply chain cannot use QR codes or RFID scanners that are usually physically attached to product supply chains, the unique identity of each person could be used in the form of fingerprints or the iris in the eye as a solution. The potential for blockchain technology to be applied to problems that deal with people is a possible solution that should be explored.

4. How can blockchain technology be used to reduce deceptive recruitment in the migrant workforce?

4.1. Blockchain technology in preventing deceptive recruitment

The growing discussion concerning the potential for blockchain to identify and prevent modern slavery has ranged from arguments that present blockchain as a potential 'holy grail' to those who highlight the limitations associated with the technology and remain sceptical about its prospective efficacy. Of interest is that most commentators do not accommodate a middle ground position which acknowledges the complexity of modern slavery and the fact that no one tool, approach or regulatory design will ever be sufficient to deal with all situations. A recent exception is a short piece written by Boersma and Nolan (2020) who discuss select challenges associated with the technology but do not seek to apply the use of blockchains to a specific situation. Notwithstanding its limitations we argue that blockchains have the potential to prevent individuals falling into slavery conditions and in limiting the coercion that can be exercised over them in specific circumstances. Thus, within the framework of possible tools the approach taken is one of prevention and protecting worker rights.

Since its initial development interest has grown in how blockchain technology might be adapted and used in areas where transactional records are secure and tamper-free. Major advantages of blockchain technology that have attracted interest from multiple parties relates to transparency of information and that transactions are immutable and cannot be deleted or altered. New transactions and information are added to a block, and each block of information is added to all prior blocks using algorithms, becoming a digital chain of information, that is visible and transparent and immutable. Immutability could be of interest in preventing deceptive, unethical recruitment practices as contractual employment details cannot be changed, and any amendments to them are added to the blockchain as new information when they arise. Further, although businesses *per se* may not be interested in transparency, with a need to protect their proprietary information and maintain competitive advantage, their own self-interest in efficiency gains, reducing costs and meeting regulatory requirements may overcome this problem (Helliar et al. 2020; Papathanasiou et al. 2020).

The first consideration in relation to utilising blockchain technology for the purpose of preventing modern slavery is which type of blockchain is most appropriate. As mentioned earlier, blockchains can be either permissioned or permissionless. A permissioned blockchain is characterised by only allowing authorised gatekeepers to add information to a blockchain - rather than many parties, such as with the unpermissioned Bitcoin blockchain. Given the nature of deceptive recruitment and the type of information that would need to be entered onto the blockchain to protect workers, a permissioned blockchain where only trusted gatekeepers can add information, is a technology appropriate for this purpose.

The second consideration relates to the gatekeepers. In a proof of authority permissioned blockchain model a set number of known gatekeepers are documented in the governance arrangements for that particular blockchain (Helliar et al. 2020). Only these authorised gatekeepers can add information to the blockchain and only they need knowledge of blockchain technology. These authorised gatekeepers replace the function of the "miners" in an unpermissioned blockchain such as Bitcoin and, on a randomised basis, the authorised gatekeepers solve the algorithms to add blocks to the chain rather than any unknown number of miners (Helliar et al. 2020; VEchain 2019). Importantly, these are only gatekeepers in the sense of adding information to a block in the blockchain, they do not give permission for people to access the blockchain- the blockchain is open and transparent to everyone so there is no intermediary role.

A third consideration is checking the information before it is added to the blockchain. In a proof of authority model the governance features could require that the gatekeeper has all information assured before it can be added, resolving the off-chain issue.

Finally, the data needs to be visible to the general public, such as workers, border security, and NGO staff. Access to the blockchain data would be through especially developed apps that can specifically access the data on that particular blockchain (Helliar et al., 2020).

An alternative model would be a proof of stake permissioned blockchain where there are known "owners" of the blockchain who can add transactions and information to blocks and add blocks to the blockchain. Similar to a proof of authority model the number and identity of "stakeholders" is known and these can vary in number from one blockchain to another blockchain. Other governance models over blockchains are also developing reflecting the purpose of each blockchain.

It is not clear at this time and without further research who is best positioned to fill the role of authorised gatekeeper/ stakeholders but it would need to be a party/ parties who are both independent and trusted. Recent evidence from Benstead et al. (in press), in an action-based case study of a targeted modern slavery audit in a South East Asian textile and garment supplier, suggests that NGOs are in a unique position as being trusted by society and can build up trust between different parties in a non-confrontational way. This suggests that NGOs could constitute suitable gatekeepers of a modern slavery blockchain, adding transactional data as workers are recruited and employed. Another possibility is an international worker-based organisation or an international union. The International Labour Organization (ILO) or International Organization for Migration (IOM), both of which have a global mission to protect people - workers in the case of the ILO and migrants in the case of the IOM - might also be suitable organisations to take on this role. However, for the purpose of the argument and discussion presented here a recognised NGO will be used to fill the role of the authorised gatekeeper.

Although this could be deemed to be a private blockchain with one gatekeeper, the essential difference is that permission need not be sought from the gatekeeper to access the data on the blockchain. Apps would be developed that can be downloaded by anyone to access the information so the gatekeeper is not in an intermediary role but is in a role of verifier and certifier of the data. The use of public keys and private keys (such as fingerprints/ iris recognition) would ensure the confidentiality of personal data meeting for example, GDPR compliance requirements.

Figure 1 illustrates the use of blockchains. A recruitment agent might find 10 potential workers in a village and the villagers agree the verbal terms and conditions which the

recruiter (or the worker) sends via an app to the authorised NGO. The NGO then checks that the terms and conditions of employment meet internationally acceptable employment standards. If these are acceptable, the NGO adds the contract terms and individuals' names and information to the blockchain. There could be an arrangement that the visa and passport for the worker issued by the villager's country of residence is also sent via an app to the gatekeeper NGO. The NGO would check the visa against the employment contract- such as that the country of work is the same as for the visa - before adding this information also to the blockchain.

FIGURE 1 about here

Once the villager arrives in the new country of employment, border security of the inbound country can verify the visa conditions and place of work on the blockchain via an app. Once in situ, local NGOs and verifiers on the ground, that could involve government agents, can check the contract against the actual work, pay and conditions of the individual. Thus, terms and conditions cannot be changed unilaterally and travel documents cannot be confiscated. In addition, even in jurisdictions where passport retention is considered legal (at least initially), for example in many Gulf states, workers will always be able to access their official documents such as contracts and passports, addressing some of the jurisdictional challenges and concerns raised by previous researchers (e.g. see LeBaron et al. 2018). At all times workers will have access to documentation relevant to their employment. The design of apps that use workers' biological data, such as fingerprints or iris recognition to access their contracts and other information would assist where there are language barriers or illiteracy. These apps do not add data to the blockchain, they just access information on the blockchain, such as in successful blockchains already in use (Helliar et al. 2020). Thus, those

accessing information on a blockchain do not need to understand any of the technology- only the gatekeepers need to have any understanding of the technology. Importantly, apps would need to be developed in different languages so that the digital information on the blockchain would be in the language of the user. Over time it would be of interest to also build the capacity for audio read outs and translations to assist workers who are illiterate who could then answer questions from the App verbally and have this information sent to the gatekeeper to be recorded and entered.

There can be many permissioned blockchains recording this information. One question would be whether one NGO or an intergovernmental agency is responsible for all workers in all countries around the world, or a separate NGO or government agency in each country, or an NGO as an authorised gatekeeper recording the outward-bound details, and a different NGO accessing the information (not as an authorised gatekeeper) in situ and checking against actual conditions. Alternatively, the NGO could be specific to an industry supply chain rather than a country - such as the fishing industry, or fruit and berry picking industry, or agriculture more generally. As indicated above, government agencies might also be able to fill a role in this space.

Further, it may be possible that at the individual level each worker has their own blockchain where only they can add information, using for example an iris scan or fingerprint as authorisation. However, the technical knowledge to be able to do this may be too difficult unless a blockchain was developed that could be easily be understood in all languages and by people who may be relatively illiterate. For example, the use of pictures and icons, fingerprints or eye-recognition software could enable villagers with only limited education

to add their information to a blockchain as in the Mekong Club example above. The mechanics of how these blockchains would work needs some thought and development.

4.2. Demonstration of a blockchain in practice

Unethical recruitment relates to different stages of the migration and recruitment process as shown earlier in Table 1. Of note is that most of these areas involve some form of agreement and/or documentation that may be a physical document or a verbal agreement. Issues may arise and deception may occur in any one, or many, of these stages.

The first stage of recruitment is initial contact. Prospective migrant workers usually do not have any contacts in other countries to assist them with gaining employment. As a result, many workers seek assistance from labour contractors, recruitment agencies or intermediaries. At this stage the initial contract of employment is discussed and agreed including information relating to location and type of work, required training, hours of work, pay and conditions, and any fees payable. Relevant visa documentation is also arranged at this time. The contract of employment is of crucial importance to ensuring worker rights are protected and adding these to the blockchain in their entirety would help protect them, especially as the evidence suggests that many workers do not receive a copy of their initial contract, or that it is altered retrospectively to their detriment (Stringer et al. 2016). The ability to track and trace initial contracts and agreements is important both for the workers themselves who can use them to enforce and protect their rights and to leave an employer if needed, and also to third-party corporate buyers who are under increasing legislative and social pressure to improve labour standards in their global supply chains (Barrientos 2008; Christ, Burritt and Schaltegger 2020). The blockchain provides a way to ensure the initial contract terms are permanently, immutably recorded for anyone to see. Any employer can

clearly observe the conditions agreed upon and confirm the offer of employment or contract work. Social auditors can verify the original contract terms against current employment conditions using an app to access the blockchain information whenever they want to that may go some way to reducing the sometimes-observed decoupling of worker rights from producer abuse. Thus the blockchain enhances accountability and facilitates the supply chain audit process (Barrientos, 2013) with no intermediary necessary.

Visa documents can also be entered onto the blockchain providing workers with a clear outline of their rights and obligations under entry into the country of eventual work. This can help prevent fraud in relation to visas on the part of recruiters and ensure workers are not put in a position where provision of a visa, that they never see, is later used against them as a form of blackmail to enforce unethical working conditions and prevent them from being able to freely leave their employer under threat of reporting them to the authorities. As visa documents are processed, approved or amended, each record of this would be added to the blockchain as a separate transaction together with the date of the amendment. Thus, the chain of information from the initial genesis block of the blockchain all the way through to the current block are maintained and recorded throughout its life. One issue to be resolved is how these are actioned. Specific applications would need to be developed, possibly for each country, to send the information to the authorised gatekeeper to add to the blockchain.

Actual migration and arrival are the next steps in the process of migrant worker recruitment. In the first instance relevant travel and identification documents, such as passports, can be added on to the blockchain and provide workers with a clear record of their identity which can then be linked back to their visa and contract of employment. Such

evidence will provide protection against confiscation of identity documents which can be used as a form of blackmail to prevent workers from leaving unacceptable working arrangements and lead to forced labour addressing shortcomings in existing systems such as the Bangladesh smartcard that is a physical item that can be removed. This may also provide an element of protection in countries like Qatar where it is usual practice for an employer to remove travel documents at point of entry, with workers only permitted to leave the country with their employer's permission (LeBaron et al., 2018). In the event the worker is subject to exploitation it will make it easier for them to approach their respective embassies and consular assistants can use information contained on the blockchain to verify any malpractices. App based technology, outside the blockchain, could also include a whistleblowing or reporting function straight to the worker's embassy without them having to leave their place of employment which may be difficult for some. Thus, the blockchain is useful in conjunction with other technologies- however, it is not the panacea to all modern slavery problems.

Arrival and the actual conditions of work that eventuate are the next stage of migrant worker recruitment that requires attention. It is at this stage of the recruitment process that most workers who fall into modern slavery realise they have in effect been deceived when the conditions they experience are not what they agreed to or expected. Early on, altered or substitute contracts are presented revealing hidden charges, debts, and different arrangements related to work such as pay, hours worked and overtime and it is only then that the actual deception becomes apparent.

It is notable that much of what occurs at this stage relates to issues that were discussed and agreed at previous stages in the migration process. With each stage of the process being

added to a blockchain, as outlined here, it becomes more difficult for those in charge of the workers to retrospectively change conditions or prevent workers from leaving as a way to exert control over them. With its ability to provide a trail of evidence related to worker identity and workplace agreements in a secure and immutable way the blockchain protects workers at the final stage of the working arrangement as identified by Stringer et al. (2016) by providing victims with the evidence to seek help and, importantly, to leave. Workers, as well as embassy staff, intergovernmental organisations like the IOM and ILO and NGO workers, through the use of apps, can view employment contracts on the blockchain (see Emin, 2020) and compare them to reality.

This subsection considered the stages of the migrant worker recruitment and deployment process in which blockchain could be used to prevent deception and improve worker protection. However, as with all new technologies potential is one thing but it is also necessary to consider how the technology could be applied in practice. The way forward and limitations are therefore covered next.

5. The way forward and limitations

The potential for blockchain technology to assist in preventing unethical recruitment of migrant workers and the eventual fall into forced labour is clearly outlined in the previous sections. However, the question remains as to how this technology can be rolled out to protect workers in a situation that is characterised by deception. The key here relates to several areas. First, the power of MNE buyers and employers to enforce change throughout the human supply chain and enforce solutions such as a dedicated blockchain. Second is the potential for blockchain to assist in the process of social audit and forensically track labour contract terms and conditions down through the supply chain. This can occur at tier 1

(direct suppliers) or tier 2 and beyond (suppliers of suppliers - both subcontracted and secondary). This may prove especially insightful given evidence which shows that even when companies use a consistent code of conduct for suppliers it is often applied differently in different locations (Locke et al., 2013). Third is ensuring the governance of the blockchain identifies acceptable parties to administer and verify the data. Fourth is informing prospective workers about apps that can access their information on the blockchain and assist them in seeking remedies. The role for NGOs, international unions and governments in this space in particular requires investigation. As noted by Barrientos (2013), any approach to improving conditions for migrant and contract workers will need to be coordinated at multiple levels to ensure joint liability and accountability. There are also questions as to what 'apps' should be designed for accessing worker information on the blockchain from, say, a mobile phone, an ipad or a laptop.

It must also be acknowledged that the risk remains that NGO staff or union members may be subject to corruption in select jurisdictions. However, as shown in a recent study by Benstead et al. (in press) the combination of different groups like international and local NGOs in addressing modern slavery in practice can be very powerful. Future research is needed to consider additional safeguards that are needed, for example, segregation of duties and different NGOs or intergovernmental parties working together to reduce corruption and collusion.

Section 1 highlighted the need for both top down approaches to addressing modern slavery in global supply chains led by focal companies, as well as bottom up approaches that empower potential victims. Blockchain technology is unique as it presents a tool that can potentially encompass this full spectrum. Unlike spreadsheets that are owned and private to

one person or entity and can be changed at any time, blockchain information through its distributed ledger technology is publicly accessible to everyone and every change to the information is recorded through time stamps in the blocks. MNE buyers are powerful entities in the global economy and the 20 million people currently trapped in forced labour in corporate supply chains (many of them migrant workers) are as a result of MNEs either knowingly or unknowingly contributing to this problem (Christ et al., 2020). As recognised by the increasing number of legislative Acts around the world, MNEs need to be part of the solution. One way in which they can do this is to promote and require suppliers to ensure all workers' contracts are on the blockchain. Through collaboration the use of blockchain technology could be pushed further down the supply chain beyond tier 1 so that suppliers of suppliers are involved. As workers begin to have their details recorded they will likely feel empowered and less open to coercion. For the MNE buyer, promoting the use of blockchain technology in the supply chain is not just about human rights, it could also have economic and reputational benefits. For example, the audit and assurance process in relation to modern slavery in supply chains is generally complicated, ineffective and costly (Benstead et al., in press). This is demonstrated by research from Sedex showing that only one third of companies are currently seeking supply chain transparency below tier 1 due to the complexity and difficulty of the process – despite the fact this information is required by a growing number of jurisdictions (LeBaron, 2014). Anonymous, aggregate information obtained from the blockchain might provide a way to circumvent some of this difficulty and facilitate a forensic analysis of supply chain modern slavery risk. Suppliers who ensure all workers' contracts are on the blockchain could benefit from fewer intrusive requirements and possibly even more profitable contracts. This will also provide a way for organisations to fulfil increasingly stringent global modern slavery laws.

There is also a need to consider the party or parties best placed to administer the blockchain and act in the role of gatekeepers. As mentioned in the previous sections, it is important that the organisations chosen are independent and NGOs have been suggested as a suitable option. However, the IOM would also be an appropriate choice as it is an intergovernmental organisation operating under the auspices of the United Nations with a mission dedicated to assisting migrants, including those seeking employment opportunities. The IOM also took a leading role in development of the IRIS standard that it hopes to shortly develop into a certification scheme (IRIS, 2020). Given that a number of criteria noted in the IRIS standard are consistent with the issues discussed here, the use of blockchain technology could be highly useful in the context of the certification suggested. If blockchain technology is to be an effective solution, research is needed to identify a suitable gatekeeper, or gatekeepers.

Related to each of the points above is how to educate workers about the role this technology could play in protecting them and their rights. Upon seeking employment many workers initially only have contact with recruiters or their agents. Although many are scrupulous in the way they conduct their activities, as previously discussed, some are not. Thus, research is needed which incorporates the opinions and views of scrupulous recruiters, as well as local NGOs and government entities, to find the best way forward. Recruiters who become early supporters of blockchain technology could then be recognised as 'recruiters of choice' and MNEs could then place a requirement on their suppliers that only these are used via standardised contractual codes of conduct and standardised global contracts. MNEs also operate in, and source products and services from, a myriad of countries and are well positioned to understand how blockchain technology can overcome jurisdictional deficiencies related to lack of worker protection.

Finally, blockchain is a technology that can take different forms. It has been suggested, for example in the Mekong Club blockchain pilot, that a mobile phone app could be the best way forward in relation to providing workers with easy access to their information. However, more research is needed to determine what this should look like. Other issues involve the fact some workers have limited education and so it may be necessary to consider the development of apps that can provide verbal and audio records of the blockchain information– another area that future research could address.

5.1 Limitations

Although it is the purpose of this paper to explore and highlight the potential for blockchain technology in combatting the problem of unethical migrant recruitment it should also be recognised that the blockchain is not a panacea. Instead it is just one tool in many designed to address a specific problem that ultimately contributes to modern slavery and it is important to consider under which circumstances the blockchain is likely to prove ineffective as well as effective.

Although most workers who migrate for work purposes do so through legal channels it cannot be denied that illegal trafficking and recruitment still occurs as evidenced by the report prepared for Nestlé by Verité (2015) noted above. As with many illegal activities workers who *knowingly* enter illegal work arrangements are unlikely to engage with tools designed to protect them; their activities would essentially remain 'off chain'. Thus, even if blockchain technology was developed and implemented, employers who seek to entrap vulnerable workers via illegal forms of migration would be unlikely to adopt the technology, and certainly not willingly. This suggests that other tools are needed to protect those who end up in slavery by seeking migrant work via irregular and often illegal means. It will be

incumbent upon global companies to verify their labour supply chains and ensure that any blockchains that are developed are used in practice by local employers on the ground or on the seas. With the potential for improved supply chain monitoring and the increased pressure being created by new modern slavery laws, MNEs and large corporate buyers have the potential to turn what was once considered a race to the bottom, where cheap labour was preferable at any price, to a race to the top in which human rights are protected and embedded within all consumer products and services.

6. Conclusion

This paper sought to present a conceptual discussion concerning the potential for blockchain technology to assist in reducing modern slavery within one specific population: migrant workers. In doing so the following research question was considered: *How can blockchain technology be used to reduce deceptive and unethical recruitment in migrant worker populations which is often associated with worker exploitation and modern slavery?* The discussion highlights the unique properties of blockchain in addressing this problem which until recently were not technologically feasible. However, to realise the potential of protecting workers outlined here more research is needed. As with most 'wicked' sustainability problems it is recommended that research designed to consider the use of blockchain in this context be transdisciplinary, incorporating companies, recruiters, potential gatekeepers and academics from different disciplines. Taking a problem-centred, as opposed to a discipline-centred approach, will help and pilot projects should be developed with this in mind. Of particular interest in relation to developing the technology and the roll out of pilot projects will be who is best placed to fill the role of gatekeeper, how many gatekeepers are needed, and how to incorporate the needs of all workers including

those who may be illiterate and poorly educated. The design of apps and other platforms which provide access to the blockchain also require consideration to unsure both utility and functionality. It is also necessary to consider the other types of information that could be built into these platforms to enhance the efficacy for workers and the MNE buyers, NGOs and governments seeking to protect them.

The discussion presented here is not without limitations due to restrictions both in space and the current state of knowledge. An issue that was not considered here, but that will require research in the future is finding ways to protect worker privacy. One way to address this might be through the use of public keys that de-identify data to those accessing the blockchain in general, but private keys are given to certain users for specific parts of the information that are needed by, for example, border security or NGO social auditors. However, this is a topic for additional research. It is hoped the discussion presented here will encourage research into this and other areas where blockchain technology might assist with addressing the human rights abuses in relation to modern slavery and in particular unethical recruitment in migrant worker populations.

REFERENCES

Barrientos, S. (2008). Contract Labour: The 'Achilles Heel' of Corporate Codes in Commercial Value Chains. *Development and Change*, 39(6), 977-990.

Barrientos, S. W. (2013). 'Labour Chains': Analysing the Role of Labour Contractors in Global Production Networks. *The Journal of Development Studies*, 49(8), 1058-1071.

Behnke, K. & Janssen, M. F. W. H. A. (2020). Boundary conditions for traceability in food supply chains using blockchain technology. *International Journal of Information Management*, 52, 101969.

Benstead, A. V., Hendry, L. C. & Stevenson, M. (in press). Detecting and remediating modern slavery in supply chains: a targeted audit approach. *Production Planning & Contro*l.

Bhuyan, M. O. U. (2018). Smartcards issued to migrant workers remain unused, New Age, retrieved from:https://www.newagebd.net/article/48111/smartcards-issued-to-migrant-workers-remain-unused, Accessed August 24, 2020.

Boersma, M Changing approaches to child labour in global supply chains: Exploring the influence of multi-stakeholder partnerships and the united nations guiding principles on business and human rights. *University of New South Wales Law Journal*, 40(3), 1249.

Boersma, M. & Nolan, J. (2020). Can Block Can Blockchain Help Resolve Modern Slavery in Supply Chains? *AIB Insights*, *20*(2).

Chantavanich, S., Laodumrongchai, S. & Stringer, C. (2016). Under the shadow: Forced labour among sea fishers in Thailand. *Marine Policy*, *68*, 1-7.

Christ, K. L., Burritt, R. L. & Schaltegger, S. (2020). Accounting for work conditions from modern slavery to decent work. *Accounting, Auditing & Accountability Journal*, *133*(7), 1481-1504.

Crane, A. (2013). Modern slavery as a management practice: Exploring the conditions and capabilities for human exploitation. *Academy of Management Review*, *38*(1), 49-69.

David, F. (2010). Labour Trafficking, AIC Reports, *Research and Public Policy Series*, 108, Australian Institute of Criminology, Canberra, Australia.

Emin (2020). *Combatting Modern Slavery.* Retrieved from https://www.eminproject.com/ Accessed September 15, 2020.

Farbenblum, B. & Nolan, J. (2017). The Business of Migrant Worker Recruitment: Who Has the Responsibility and Leverage to Protect Rights? *Texas International Law Journal*, 52(1), 1-44.

Ford, J. & Nolan, J. (2020). Regulating transparency on human rights and modern slavery in corporate supply chains: the discrepancy between human rights due diligence and the social audit. *Australian Journal of Human Rights*, 26(1), 27-45.

Gold, S., Trautrims, A. & Trodd, Z. (2015). Modern slavery challenges to supply chain management. *Supply Chain Management: An International Journal*, 20(5), 485-494

Helliar, C. V., Crawford, L., Rocca, L., Teodori, C. & Veneziani, M. (2020). Permissioned and permissionless blockchain diffusion. *International Journal of Information Management*, 54, 102136

Hanson, R.T., Reeson, A., & Staples, M. (2017). Distributed ledgers, scenarios for the Australian economy over the coming decades, Data 61, CSIRO, Canberra.

ILO (n.d.). *ILO Indicators of Forced Labour.* Retrieved from https://www.ilo.org/wcmsp5/groups/public/---ed_norm/---declaration/documents/publication/wcms_203832.pdf Accessed September 15, 2020.

ILO, (2018). *Ending forced labour by 2030: A review of policies and programmes.* Retrieved from http://www.ilo.org/wcmsp5/groups/public/---ed_norm/---ipec/documents/publication/wcms_653986.pdf, Accessed January 28, 2021.

ILO, (2020). *Info Stories: Deceptive Recruitment and Coercion*. Retrieved from https://www.ilo.org/infostories/en-GB/Stories/Forced-Labour/Deceptive-Recruitment-and-Coercion#retention-of-passports, Accessed August, 24 2020.

IOM (2018). *Towards an Effective and Integrated Labour Market Information System for Bangladesh' International Organization for Migration*, *Bangladesh*. Retrieved from https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-dhaka/documents/publication/wcms_697535.pdf Accessed August 26, 2020.

IRIS (2020). *IRIS Standard, International Organization for Migration*. Retrieved from https://iris.iom.int/iris-standard Accessed September 12, 2020.

Kemp, L. (2015). *London Blockchain conference. Blockchain for the diamond industry*. Retrieved from www.youtube.com/watch?v=8tc8m1LMWTg/ Accessed June 20, 2017.

Kewell, B., Adams R. & Parry, G. (2017). Blockchain for good? *Strategic Change*, 26(5), 429–437.

Kshetri, N. (2018). Blockchain's roles in meeting key supply chain management objectives. *International Journal of information management*, 39, 80-89.

LeBaron, G. (2014). Subcontracting Is Not Illegal, But Is It Unethical? Business Ethics, Forced Labor, and Economic Success. *The Brown Journal of World Affairs,* 20(2), 237-249.

LeBaron, G. & Lister, J. (2015). Benchmarking global supply chains: the power of the 'ethical audit' regime. *Review of International Studies*, *41*, 905-924.

LeBaron, G., Lister, J., & Dauvergne, P. (2017). Governing global supply chain sustainability through the ethical audit regime. *Globalizations*, 14(6), 958-975.

LeBaron, G., Howard, N., Thibos, C. & Kyritsis, P. (2018). *Confronting root causes: forced labour in global supply chains*. Open Democracy and the Sheffield Political Economy Research Institute (SPERI), University of Sheffield, England.

Locke, R. M., Rissing, B. A. & Pal, T. (2013). Complements or Substitutes? Private Codes, State Regulation and the Enforcement of Labour Standards in Global Supply Chains. *British Journal of Industrial Relations*, *51*(3), 519-552.

Mak, J. Abramsky, T. Sijapati, B. Kiss, L. & Zimmerman, C. (2017). What is the prevalence of and associations with forced labour experiences among male migrants from Dolakha, Nepal? Findings from a crosssectional study of returnee migrants. *BMJ Open*, online.

Marschke, M. & Vandergeest, P. (2016). Slavery scandals: Unpacking labour challenges and policy responses within the off-shore fisheries sector. *Marine Policy*, *68*, 39-46.

Migrant Workers Rights (2020). *Dhaka issues smart cards for migrant workers*. Retrieved from http://www.migrantworkersrights.net/en/resources/dhaka-issues-smart-cards-for-migrant-workers Accessed August 26, 2020.

Miller, A. (2017). Repurposing Ecolabels: Consumer Pressure as a Tool to Abate: Human Rights Violations in International Fisheries. *Ecology Law Currents*, *44*, 116-131.

Morgan, J. & Olsen, W. (2015). The Absence of Decent Work: The Continued Development of Forced and Unfree Labour in India. *Global Labour Journal*, *6*(2), 173-188.

Murphy, C. (2017). Tackling Vulnerability to Labour Exploitation through Regulation: The Case of Migrant Fishermen in Ireland. *Industrial Law Journal,* 46(3), 417-434.

Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. Retrieved from https://bitcoin.org/bitcoin.pdf Accessed September 20, 2020.

New, S. J. (2015). Modern slavery and the supply chain: the limits of corporate social responsibility? *Supply Chain Management: An International Journal*, *20*(6), 697-707

Nolan, J. & Boersma, M. (2019) *Addressing Modern Slavery*, UNSW Press*,* Sydney, Australia.

Nolan, J. & Bott, G. (2018). Global supply chains and human rights: spotlight on forced labour and modern slavery practices. *Australian Journal of Human Rights*, *24*(1), 44-69.

Papathanasiou, A., Cole, R. & Murray, P. (2020). The (non-)application of blockchain technology in the Greek shipping industry, *European Management Journal*, 38, 927-938.

Phillips, N. & Mieres, F. (2015). The Governance of Forced Labour in the Global Economy. *Globalizations*, *12*(2), 244-260.

Pierce, S. C. (2011). Turning a Blind Eye: U.S. Corporate Involvement in Modem Day Slavery. *Gender, Race and Justice*, *14*, 577-600.

Piper, N. & Withers, M. (2018). Forced transnationalism and temporary labour migration: implications for understanding migrant rights. *Identities : Global Studies in Culture and Power*, 25(5), 558–575.

Queiroz, M.M & Wamba, S.F. (2019). Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. International Journal of Information Management, 46, 70-82.

Robinson, R.N.S. (2013). Darker still: Present-day slavery in hospitality and tourism services. *Hospitality & Society*, 3(2), 93-110.

Rogerson, M. & Parry, G.C. (2020). Blockchain: case studies in food supply chain visibility. *Supply Chain Management: An International Journal,* 25 (5), 601–614

Russell, E., Lee, J. & Clift, R. (2018). Can the SDGs Provide a Basis for Supply Chain Decisions in the Construction Sector? *Sustainability*, *10*, (online).

Stringer, C., Whittaker, D.H. & Simmons, G. (2016). New Zealand's turbulent waters: the use of forced labour in the fishing industry. *Global Networks*, *16*(1), 3-24.

Swan, M. (2015). Blockchain: Blueprint for a new economy. Sebastopol, CA.

Tian, F. (2017) A Supply Chain Traceability System for Food Safety Based on HACCP, Blockchain & Internet of Things, International Conference on Service Systems and Service Management, IEEE

Tönnissen, S. & Teuteberg, F. (2020). Analysing the impact of blockchain-technology for operations and supply chain management: An explanatory model drawn from multiple case studies. *International Journal of Information Management*, *52*, 101953.

VEchain https://cdn.vechain.com/vechainthor_development_plan_and_whitepaper_en_v1.0.pdf, accessed February 2019.

Verité (2015). *A Verité Assessment of Recruitment Practices and Migrant Labor Conditions in Nestlé's Thai Shrimp Supply Chain An Examination of Forced Labor and other Human Rights Risks Endemic to the Thai Seafood Sector*. Retrieved from https://www.verite.org/wp-content/uploads/2016/11/NestleReport-ThaiShrimp_prepared-by-Verite.pdf Accessed August 26, 2020.

Walk Free Foundation. (2018). *The Global Slavery Index 2018*, The Minderoo Foundation Pty Ltd. Retrieved from https://downloads.globalslaveryindex.org/ephemeral/GSI-2018_FNL_190828_CO_DIGITAL_P-1570586111.pdf Accessed August 7, 2020.

Walk Free Foundation. (2019). *Tackling Modern Slavery in Supply Chains: A Guide 1.0*, The Minderoo Foundation Pty Ltd. Retrieved from https://cdn.minderoo.com.au/content/uploads/2019/05/27144943/TacklingModernSlaveryInSupplyChains20141-1.pdf Accessed September 12, 2020.

Webb, P. & Garciandia, R. (2019) State responsibility for modern slavery: uncovering and bridging the gap. *The International and Comparative Law Quarterly,* 68(3), 539–571.

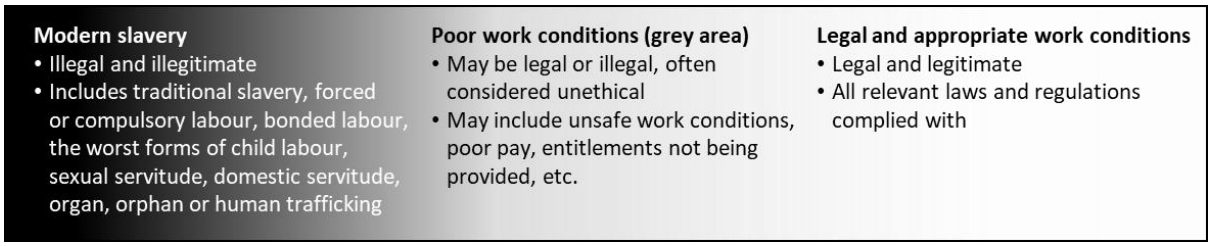
Wen, S. (2016). The Cogs and Wheels of Reflexive Law ± Business Disclosure under the Modern Slavery Act. *Journal of Law and Society*, *43*(3), 327-59.

Wilkens, C. (2018). Using Drones to Fight Slavery in the Fields: An Examination of the Practicality and Constitutionality of Applying 21st Century Technology to a 21st Century Problem. *Hastings Environmental Law Journal*, *24*(1), 157-178.

WWF (2021) https://www.wwf.org.nz/what_we_do/marine/blockchain_tuna_project/ accessed January 2021.

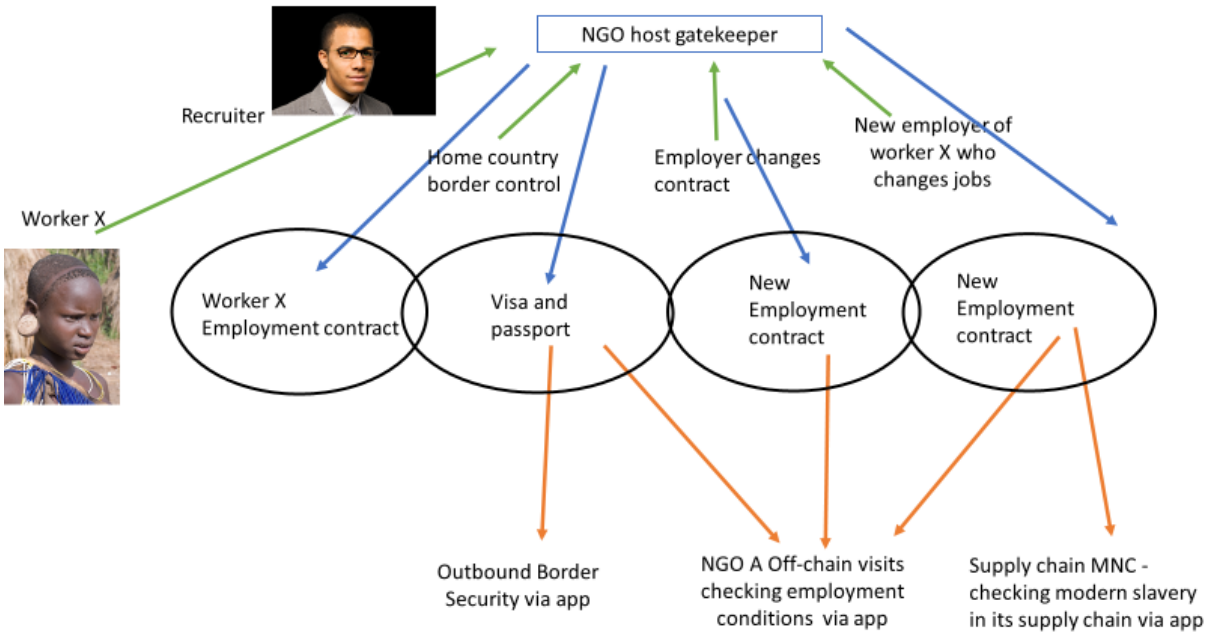
Zirnsak, M., Sinclair, A., Moore, H., Carolan, C. & Smith, B. (2018). *Joint Submission to the Inquiry into Establishing a Modern Slavery Act Joint Standing Committee on Foreign Affairs, Defence and Trade Sub-Committee on Foreign Affairs and Aid*, Salvation Army-Freedom Partnership to End Modern Slavery. Retrieved from http://fecca.org.au/wp-content/uploads/2017/04/Joint-Submission-into-Modern-Slavery-Act.pdf Accessed August 27 2020.

FIGURE 1 CONTINUUM OF WORK PRACTICES



Source: Christ et al. (2020).

FIGURE 2 BLOCKCHAIN PROCESS



This Figure shows a potential blockchain process for modern slavery. The NGO host gatekeeper enters information to blocks on the blockchain at different times. Anyone with eth app can download the information.

TABLE 1 - STAGES OF MIGRANT RECRUITMENT AND LABOUR

STAGE	ISSUES INVOLVED	REFERENCES
Initial contact with recruiter/employer	Recruitment Type of work and industry Conditions Country of work including pay, hours and overtime Fees Contract may be withheld from worker after being signed	LeBaron (2014); Stringer et al. (2016); Barrientos (2013); Marschke and Vandergeest (2016); Chantavanich et al. (2016); Farbenblum and Nolan (2017); Nolan and Bott (2018)
Process of migration	Passport needed Visa needed – should be consistent with contract Location should be consistent with agreed conditions and not changed retrospectively Transport as agreed	Farbenblum and Nolan (2017); LeBaron et al. (2018); Nolan and Bott (2018)
Arrival	Conditions not consistent with contract Contract changed retrospectively Location changes Type of work and industry changes	Pierce (2011); Mak et al. (2017); Wilkens (2018); Morgan and Olsen (2015); LeBaron (2014); David (2010)
Actual work	Pay less than agreed Documents confiscated Overtime and hours of work change Visa conditions change Fee deductions taken from pay inconsistent with original contract	Russell et al. (2018); Benstead et al. (in press); Pierce (2011); Morgan and Olsen (2015); LeBaron (2014); Mak et al. (2017); David (2010); LeBaron et al. (2018)
Ability to leave	Travel documents confiscated	LeBaron et al. (2018); Mak et al. (2017); Miller (2017); Wilkins (2018); Stringer et al. (2016)