Smart Cities as Panopticon: Highlighting Blockchain's Potential for Smart Cities Through Competing Narratives

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PANOPTIC BLOCKCHAIN ECOSYSTEMS: AN EXPLORATORY CASE STUDY OF THE BEEF SUPPLY CHAIN

LACHLAN ROBB, FELICITY DEANE, WARWICK POWELL

Blockchain is seen as a 'disruptive' technology, as a technological expression of old ideas, as something perpetuated by hype, amongst others. This article contributes to the literature by arguing that a blockchain represents a form of panopticism attuned as a social tool that has the potential to enhance communities through forms of participation and surveillance. Blockchain is seen here through the lens of the panopticon, and as such is a technologically enabled expression of the metaphor – however, duplicated as both a carrot and a stick. Through this the paper demonstrates how the metaophor can be used to deepen an existing understanding of law and governance through the technology and social tool of blockchain. This is presented in three stages.

The first stage explores the role of the panopticon as initially conceptualised by Jeremy Bentham in the 19th century. Bentham described this panopticon as a physical structure of surveillance and control. This is furthered by the expressions of it as a metaphor for surveillance as explored by figures such as David Lyons. The second stage of this paper turns to the social and community borne effects of blockchain and the benefits of the technology as a social tool. It is argued that blockchain technology can augment juridic and governance power through the formation of blockchain-enabled communites. These communities will have the means to self-regulate their actions because of the technology in a manner that replicates the qualities of the panopticon. The third stage considers this technology through a legal lens and provides a practical example. To illustrate these ideas, this paper uses observations from the Beefledger project and explores the potential value of blockchain to the Australian beef supply chain and importance to food fraud, food safety, and animal welfare. In this regard, these blockchain-enabled communities will be of benefit not just for those who participate within them, but the broader community. Through technology, higher standards can be directly rewarded and encouraged rather than forced, as they currently are in existing regulatory systems that only have means to punish.

Contents

I INTRODUCTION

Blockchain represents a technologically enabled expression of the modern panopticon metaphor that is expanded because of the how the technology relates to the community that is being observed and empowered. This article explores the nature of blockchain technology by revisiting the Bentham's panopticon metaphor as it applies to a community of participants within a blockchain network. Blockchain can impact society in new ways because it enables both the self-regulation and self-surveillance of punishment and of internalisation of discipline (the stick); and also, for incentives towards better behaviours (the carrot). 'Old wine, new bottles' is an adage commonly used within discussions of technology that claim to revolutionise society simply because they are novel but in reality are simply new expressions of old ideas.[1] While there is much debate around the value of blockchain as a 'disruptive' technology, arguably it represents a technological expression of old ideas, repackaged into something new and carried by hype.[2] Despite this, there remains something pervasive and fascinating about blockchain's value as an expression of society that must be pursued. This paper intends to do this by demonstrating the value of blockchain in understanding the panopticon as a metaphor for contemporary modalities of power, and its contemporary expressions.

The term panopticon, first conceptualised by Jeremy Bentham in the 19th century, described gaol architecture which allowed for surveillance of prisoners in cells from a central watchtower without the prisoners knowing that they are being watched. This surveillance-by-design for Bentham was to be accompanied by a behaviour code to which prisoners were expected to conform. Adherence to the code was supposed to be achieved by the prisoners believing they were being watched. Foucault built upon Bentham's physical descriptions of the panopticon gaol in his 1975 work *Discipline and Punish* and by subsequent exploration of attached metaophor and broader ideas of panopticism. In doing so he 'superimposed the image of the actor and the importance of light'[3] and successfully brough Benthams's ideas (albeit through his own lens) into wider academic disucssions. Foucault and Bentham's expressions of the Panopticon and panopticism have led to explorations of society that raise questions of discipline and control, and have subsequently featured strongly in surveillance studies such as the work of David Lyon.[4] This article demonstrates the continued relevance of panopticism discussions as it relates to explaining the place of blockchain. In this respect it can help to show the value blockchain can add to society by focusing not purely on punishment, and through enabling communities to move away from vertical surveillance, and instead to adopt horizontal forms that can naturally evolve into self-surveillance.

This is presented in three stages: The first stage seeks to briefly explore the literature on the panopticon and panopticism primarily through Foucault's more widely adopted understandings before expanding on how this applies to surveillance and technology. The second stage explains blockchain before demonstrating how the technology exists to move away from vertical surveillance, but in doing to it actually forms a contemporary expression of panopticism that has subverted a central power but still relies on self-regulation and enforcement. Through this understanding of the technology, the article then introduces the concept of 'voluntary common-knowledge associations' (voluntary associations) which can be created through blockchains in which the participating subjects are empowered to regulate themselves.[5] This self-regulation pursues exceptional standards of excellence in those spheres of

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[1] As a concept, this is raised in discussions around the 'law of the horse' argument in the Easterbook-Lessig debates, see, eg, L Lessig, 'The Law of the Horse: What Cyberlaw Might Teach' (1999) 113(2) *Harvard Law Review* 501; B Bodo, D Gervais and JP Quintais, 'Blockchain and Smart Contracts: The Missing Link in Copyright Licensing?' (2018) 26(4) *International Journal of Law and Information Technology* 311, 335; Marci Wilson, 'Is Internet Law a Discreet Practice or Just Old Wine in a New Bottle?' (2000) 19(18) *Of Counsel* 9.

[2]

[3] Anne Brunon-Ernst, 'Deconstructing Panopticism into the Plural Panopticons' in Anne Brunon-Ernst (ed), *Beyond Foucault New Perspectives on Bentham's Panopticon* (Routledge, 2016) 28.

[4] David Lyon is a prominent sociologist known for surveillance studies and the metaphor of the 'electric panopticon', see, eg, David Lyon, *The Electronic Eye : The Rise of Surveillance Society* (University of Minnesota Press, 1994); David Lyon, *Surveillance as Social Sorting : Privacy, Risk, and Digital Discrimination* (Routledge, 2003).

[5] This could be argued to be a path similar to communitarianism as discussed by figures such as Michael Sanfel and Charles Taylor, however discussions of this are beyond the scope of the current paper.

activity that bring the subjects together in the first place, as opposed to merely or barely complying with basic minima. This is important as the bare minimum set by law is generally designed to only capture those who break it; it lacks the ability to interact (positively) with those in a community or supply chain who exceed the minimum standard. At a rudimentary level, blockchain technology applications can provide a more efficient means for subject supervision, punishment and can promote compliance with bare minimum standards. However, in addition, these associations can incentivise behaviour to encourage the pursuit of excellence. This of course requires that participants of the associations are willing to reward behavioural excellence, and further presupposes that conduct can be adequately and acceptably evidenced.

The third stage will explore a case study that shows that the value of this reiterated panopticon is that blockchain can allow for a new layer of governance to be added to that which exists, and provide for a reward system that will include both a carrot and a stick. It is this dual method that arguably achieves stronger results than the pure expression of punishment, surveillance, and discipline of society - which the panopticon has represented.[6] To illustrate these ideas, the article uses observations from the Beefledger project, in which the principal issues revolve around behaviours associated with the Australian beef product supply chain. This stage considers the laws that set the behaviour standards and the effect that blockchain technology can have in this space. This brings together the ideas of panopticism and the expressions of surveillance and community as sen in the self-regulating voluntary associations enabled by blockchain. In this regard, the introduction of voluntary associations through blockchain are argued to benefit the Australian beef supply chain, and represents potential for other supply chains that can use ideas of panopticism to not just monitor, but to encourage and benefit participants in a way that further improves the broader community.

This article seeks to build upon contemporary discusions of the panopticon. Foucault famously stated that he saw his work as a toolbox or a workshop 'which would allow both himself and others to undertake further work and experiment with different approaches.'[7] This article is positioned as but one more attempt to rummage through the figurative workshop, albeit with a contemporary twist, so as to show how the panopticon metaphor is certainly still relevant, and how blockchain's expressions run deeper than mere hype. As such, this article will expand on the ideas that have been explored briefly by academics when considering the regulatory possibilities of blockchain technology. While a number of academics have written on the effects of blockchain, and some have referenced the concept of the panopticon,[8] the literature does not engage with the concept of panopticism in any real depth. We suggest that the sometimes deliberate cursory reference to the panopticon concept leaves open the possibility of a deeper enquiry to expand on these previous references. For instance, De Feilipi's 2016 closing statement 'This controversial scenario may materialize itself as an utopia or a (crypto-) libertarian dream, but it might also lead to a dystopian society featuring a strong and decentralized panopticon.'[9] Another example, not necessarily from scholars, includes the series of tweets that emerged after the announcement of Libra in June 2019 in which it was reported: 'Pouring diesel over the embers,[10] Preston Byrne, an outspoken lawyer, dubbed Facebook's coin a "Panopticoin".'[11] This paper aims to add depth to the literature which explores blockchain and the potential changes to the regulatory frameworks that surround products which utilise it. We do this by expanding on the concepts of the panopticon, beyond a mere reference and make a more substantial enquiry as to how blockchain technology can be considered through the lens of this well-known concept of law, surveillance, and enforcement.

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[6] Michael Foucault, *Discipline and Punish: The Birth of the Prison*, tr Alan Sheridan (Vintage Books, 1995) 196–215.
[7] Michel Foucault, *Power*, ed James D Faubion, tr R Hurley (New Press, 2000) 223–224; see also, Brunon-Ernst (n 6) xi.
[8] Pierluigi Cuccuru, 'Beyond Bitcoin: An Early Overview on Smart Contracts' (2017) 25(3) *International Journal of Law and Information Technology* 179, 182.
[9] Primavera De Filippi and Samer Hassan, 'Blockchain Technology as a Regulatory Technology: From Code Is Law to Law Is Code' (2016) 21(12) *First Monday* 1.
[10] A concept that is itself not scientifically meaningful as pouring diesel on embers will often put a fire out or make a lot of smoke. Diesel only combusts at pressure.
[11] See Robert Hackett, Jeff Roberts, Jen Wieczner, 'Facebook's Cryptocurrency Ambitions Provoke Heated Debate—The Ledger', *Fortune* (web page, 17 June 2019) <https://fortune.com/2019/06/17/facebook-cryptocurrency-project-libra/> referring to the since-deleted tweet by Preston Byrne, @prestonjbyrne.

Surveillance theories broadly discuss three modes: horizontal, verticle, and self-surveillance.[12] The pantopicon structure embodies all three - the tower as the verticle; the horizontal within the prisoners watching one-another; and self-surveillance in the prisoners self-regulating behaviour to avoid punishment. This article however argues that a blockchain-enabled system may remove the verticle, however the horizontal and self-surveillance systems remain in place. In doing so it remains intrinsically an expression of panopticism, however through the attached technology, more neuonced expressions can take place – for instance the introduction of reward mechanisms so that there are system that can both punish and rewards. Blockchain can function in a way that not only forces compliance with the bare minmum of law, akin to the panopticon, but can provide participants with incentive to exceed the demands of bare minimum law.

II THE PANOPTICON TO ADMINISTER THE LAW

> Whenever one is dealing with a multiplicity of individuals on whom a task or a particular form of behaviour must be imposed, the panoptic schema may be used.[13]

The physical expression of the panopticon, and the metaphorical understanding of panopticism are utilised by jurisprudence as a means to understand and administer the law. The model of the panopticon began with a conceptual design of a prison, articulated by eighteenth century theorist, Jeremy Bentham.[14] Bentham suggested that efficiency of a prison could be brought about through its silent architecture. This physical expression of the panopticon was further explored by Michel Foucault who expanded it into a broader metaphor and an expression of 'panopticism'. It is regarded that Foucault's work on the panopticon is what brought Bentham's ideas to a wider audience and in turn led to the many iterations that directly link the concept of surveillance to the panopticon.[15]

This article does not seek to explore the intracacies of the Bentham-Foucault relationship[16] or debates around the evolution of panopticism through Bentham's four different versions of the survillenace machine'[17] or how this directly differes to Foucault's expression as fleshed out in his work *Discipline and Punish'*. It has been noted that 'Though many historians of ideas or systems of punishment have recognized the importanceof the Panopticon, it is really only since Foucault that interest in it has become widespread'[18] This article seeks to broadly flesh out the concepts as put forward by Bentham, and then mostly draws upon Foucault's expressions.[19] To concicely achieve this, it is important to understand two specific terms, 'Panopticon' and 'Panopticism.'[20]

The Pantopicon is seen as a physical expression of the metaphor, it is Bentham's Gaol; a name given to a 'circular building with a central tower'.[21]

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[12] See
[13] Foucault (n 5) 205.
[14] Brunon-Ernst (n 6).
[15] The effect of this can be seen in the listing by Brunon-Ernst in *Beyond Foucault* which discusses the wider influence of this through the names that have been coined to describe the surveillance paradigms: 'Poster's Superpanopticon, Boyne's Postpanopticon, Lyon's Electronic panopticon, Goombridge's Omnicon, Bigo's Ban-opticon, Gill's Global panopticon, De Landa's Panspectron, Leman-Langlois's Myoptic panopticon, De Angelis's Fractal panopticon, Butchart's Industrial panopticon, Koskela's Urban panopticon, Sweeny's Pedagopticon, Allen's Polypticon, Mathiesen's Synopticon, Berdayes's Panoptic discourse, Wacquant's Social panopticism, Bousquet's Cybernetic panopticon, Mann, Nolan and Wellman's Neopanopticon.' See, eg, Brunon-Ernst (n 3) 17; see also, Anne Brunon-Ernst and Guillaume Tusseau, 'Epilogue: The Panopticon as a Contemporary Icon' in Anne Brunon-Ernst (ed), *Beyond Foucault New Perspectives on Bentham's Panopticon* (Routledge, 2016) 194.
[16] For an in-depth discussion on the Bentham-Foucault relationship within panopticisms, see the collection of articles within *Beyond Foucault*, Brunon-Ernst (n 6).
[17] See, eg, Brunon-Ernst (n 3); see, also ibid 21.
[18] Lyon, *The Electronic Eye : The Rise of Surveillance Society* (n 4) 62.
[19] This article seeks to be careful so as not to cherry-pick, or muddy the waters, as Brunon-Ernst comments, 'there are many fields of study where Bentham's Panopticon is mistakenly identified with Foucault's panopticism.' See Brunon-Ernst (n 3) 19.
[20] We acknowledge the complex history of the terms insofar that 'panopticism' is a term coined by Foucault, but directly utilises Bentham, and has therefore become increasingly difficult to untangle. Through clear defining, we are aiming to reduce confusion. For more discussion on the terms, see, Ibid 20.
[21] Brunon-Ernst (n 6) 8.

> All that is needed, then, is to place a supervisor in a central tower and to shut up in each cell a madman, a patient, a condemned man, a worker or a schoolboy. By the effect of backlighting, one can observe from the tower, standing out precisely against the light, the small captive shadows in the cells of the periphery.[22]

From this, the term panopticism emerges as a description of the 'power relations which manifest themselves as supervision, control and correction.'[23]It is:

> One of the characteristic traits of our society. It's a type of power that is applied to individuals in the form of continuous individual supervision, in the form of control, punishment, and compensation, and in the form of correction, that is the moulding and transformation of individuals in terms of certain norms.[24]

The idea of the panopticon can be contrasted with traditional prisons. As noted by Foucault, traditional prisons were meant to enclose prisoners and hide them without light,[25] Bentham's concept also had the effect to enclose them, but this time in full view where they could be controlled by surveillance.[26] In this context, it is visibility that acts as the trap.[27] The panopticon thus both automates and deindividualizes the functioning of power, especially as it no longer matters who is in the central tower, or even if there is anyone at all. Bentham argued that the prison would become much cheaper and more efficient to run as it relied on the prisoner's sense of being watched, rather than being threatened with physical force.[28]

The panopticon's major effect was to automate power and induce within the 'watched' a feeling that they were constantly visible to the 'watcher'. Because a prisoner could never know if they were being watched, the prisoner 'becomes the principle of [their] own subjection',[29] and they regulate their behaviour accordingly. By isolating every individual in their own cell, and taking away the ability to view that which is beside them or even in front of them, every prisoner was said to become 'the object of information, never a subject in communication'.[30] That is, they are the 'watched 'and never the 'watchers'.

The primary concept that we consider here is the idea of 'panopticism' as it applies to the development of an auto-administered, peer-to-peer / self-regulated disincentive (or incentive) to behave. To a degree, the administration of justice can on a base level be reliant on the threat of punishment by the State for non-compliance with minimal standards. The minimum standard of behaviour is set by the existence of the law, and in the case of the panopticon, the visual reminder of the tower reinforces the threat of punishment and the presence of agents of the law. Indeed, the panopticon threatens punishment through its existence, and the prisoners may not know the full extent of the punishment, yet they are aware they do not wish to suffer it. This concept is one of the cornerstones of the law in most democratic countries.[31] If we can extend the metaphor of the panopticon into its expressions of panopticism, the central tower embodies the threat of State punishment; the guards the administrators of the law; the dictated behaviour can be compared to the requirements associated with legal compliance.

Accountability and separation of actions is of course a requirement of any effective law where behaviour of the individual is to be modified. In this regard, state-sanctioned surveillance is even more prevalent today than ever.[32] This means that the role of the 'watcher' is more onerous than ever, the

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[22] Foucault (n 5) 200.
[23] Brunon-Ernst (n 6) 8.
[24] Foucault (n 7) 70.
[25] Foucault (n 5) 200.
[26] Ibid.
[27] Ibid.
[28] Ibid.
[29] Ibid 203.
[30] Ibid 200.
[31] As captured within the maxim '*Ignorantia juris non excusat'* (ignorance of the law excuses not)
[32] See, eg, Zygmunt Bauman, *Liquid Surveillance a Conversation*, ed David Lyon (Polity Press, 2013).

threat to the 'watched' similarly onerous, and whether that leads to better, more effective outcomes for the 'protected' is uncertain.

Beyond the initial expressions of Bentham and Foucault, this article seeks to highlight the work of David Lyon, a prominent sociologist who is responsible for theories of the 'electric eye' and the 'electric panopticon' metaphor. In this, the panopticon concept is explored in greater depth as a surveillance metaphor which in contemporary society is seen in critique of surveillance technologies. This role of technological panopticons is one that this article seeks to build upon, however we do not wish to dwell purely within the realm of 'surveillance', but instead to show the effect that panopticism can have in social realms as a response to surveillance in a form that enhances communities, rather than cripples with fear.[33]

III SOCIETY, THE LAW AND BLOCKCHAIN COMMUNITIES

From Satoshi's initial expressions of a chain-of-blocks[34] to the contemporary arguments around permissioned/permission-less and modes of 'proof',[35] blockchain as a technology remains a string of code; ones and zeroes, not a magic spell. And yet, this code is heralded as a technology that allows for new-found security, trust, and validation. It does this because blockchains, at their most basic, create a record of transactions or agreements that are more tamper-proof than ordinary code because each block builds off, and refers to the others in the chain in a way that exponentially increases security. It is a concept that provides an architecture for coders to explore and build upon. It is a model that allows for information to be heralded as 'decentralised' and 'secure' in ways that allow for the blockchain to be seen as a point of truth. Because it is more secure, data stored in a blockchain is seen as more reliable and it can therefore be used as a mechanism of trust in a wide range of use cases.[36] We do not seek to argue the nomenclature or specific iterations of blockchain as it has developed, instead we seek to draw upon the collective idea of blockchain and all it represents from a broader perspective. Blockchain has enabled arguably more secure transactions and recordkeeping as well as the rise of smart contracts[37] and ICOs.[38] As a cultural expression, blockchain can be seen as representing many things. These include

[33] See generally Lyon, *The Electronic Eye : The Rise of Surveillance Society* (n 4); Lyon, 'An Electronic Panopticon? A Sociological Critique of Surveillance Theory' (n 14); David Lyon, 'Surveillance, Security and Social Sorting: Emerging Research Priorities' (2007) 17(3) *International Criminal Justice Review* 161; Lyon, *Surveillance as Social Sorting : Privacy, Risk, and Digital Discrimination* (n 4).
[34] Satoshi Nakamoto, 'Bitcoin: A Peer-to-Peer Electronic Cash System', *bitcoin.org* (2008) <https://bitcoin.org/bitcoin.pdf>.
[35] See, eg, T Sato and Y Himura, 'Smart-Contract Based System Operations for Permissioned Blockchain' in *2018 9th IFIP International Conference on New Technologies, Mobility and Security (NTMS)* (2018) 1; Mark Sheldon, 'A Primer for Information Technology General Control Considerations on a Private and Permissioned Blockchain Audit' (2019) 13(1) *Current Issues in Auditing* A15; Dustin Dreifuerst, 'Permissioned vs. Permissionless Blockchains: Who Will Win and Will It Matter?', *Medium* (Blog, 23 March 2018) <https://medium.com/@dustindreifuerst/permissioned-vs-permissionless-blockchains-acb8661ee095>.
[36] For discussions on how blockchain is defined, use cases, and potential, see, eg, Paolo Tasca and Claudio J Tessone, 'A Taxonomy of Blockchain Technologies: Principles of Identification and Classification' (2019) 4 *Ledger*; Darcy WE Allen et al, 'Cryptodemocracy and Its Institutional Possibilities' [2018] *Review of Australian Economics* 1; Keith B Letourneau and Stephen T Whelan, 'Blockchain: Staying Ahead of Tomorrow' (2017) 35(2) *The Journal of Equipment Lease Financing (Online)* 1; Cuccuru (n 8); David Rountree, 'Navigating the Blockchain and the Law' [2016] (26) *LSJ : LAW SOCIETY OF NSW JOURNAL* 72; De Filippi and Hassan (n 9).
[37] See, eg, Simon simon geiregat ugent be Geiregat, 'Cryptocurrencies Are (Smart) Contracts' (2018) 34(5) *Computer Law & Security Review* 1144; Craig A de Ridder, Mercedes K Tunstall and Nathalie Prescott, 'Recognition of Smart Contracts in the United States' (2017) 29(11) *Intellectual Property & Technology Law Journal* 17; LA DiMatteo and C Poncibo, 'Quandary of Smart Contracts and Remedies: The Role of Contract Law and Self-Help Remedies' (2018) 26(6) *European Review of Private Law* 805; K. O' Hara, 'Smart Contracts - Dumb Idea' (2017) 21(2) *IEEE Internet Computing* 97.
[38] See, eg, P Hacker and C Thomale, 'Crypto-Securities Regulation: ICOs, Token Sales and Cryptocurrencies under EU Financial Law' (2018) 15(4) *European Company and Financial Law Review* 645; Hui Deng, Huang Robin Hui and Qingran Wu, 'The Regulation of Initial Coin Offerings in China: Problems, Prognoses and Prospects' (2018) 19(3) *European Business Organization Law Review* 465; Philipp Maume and Mathias Fromberger, 'Regulation of Initial Coin Offerings: Reconciling U.S. and E.U. Securities Laws' (//Winter2019 Winter2019) 19(2) *Chicago Journal of International Law* 548.

the dream of 'the unhackable code';[39] ideas of Christensen's concept of disruptive technology;[40] a means to avoid an over reliance on trust;[41] an expression of Cypherpunk heritage and privacy concerns;[42] and the anarcho-capitalist principles that emerged from distrust of traditional currency systems;[43] and also as a 'get-rich-quick' system of entrepreneurialism.[44]

The origins of blockchain technology are directly traceable to Bitcoin.[45] Bitcoin was designed with a strong resistance to having any governmental involvement or central authority control.[46] Blockchain technology therefore emerged from a lineage which focused on the use of cryptography to preserve individual privacy and liberty.[47] To summarise, it was a libertarian creed emerging from the work of the creators of anonymous digital cash. The technology therefore drew from the desires of actors who were focused on online privacy in the face of concerns about central government intrusion and increasing centralised surveillance.[48] This opposition between private individuals and the collectivist State is likewise nothing new to society as there needs to be a balance struck between laws to protect, and freedom to act. Freedom invokes the need to enable the quest for the behavioural 'golden mean' at both a decentralised and aggregated levels.[49] In support of this is the underpinning theory of liberal philosophy and the desired limits on the power of government.[50] Liberal governance regimes necessarily see a shift away from demands of strict adherence to narrowly defined rules and regulation to the cultivation of freedoms associated with social agents. As a result, a constant challenge for legislatures is to find the 'golden mean' especially in the face of the contemporary progressive diminution of authority and trust in legislative institutions. Blockchain ecosystems create new ways in which such concerns can be addressed. This is the challenge of any blockchain application, to enable the organic emergence and adjustment of a golden mean where behaviour is optimised, drawing on the persuasion of social moral rules and actor self-interest.[51]

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[39] A more common term than 'unhackable' is 'immutable' – this promise of the technology is in many discussions, see, eg, Mark Fenwick, Wulf A Kaal and Erik PM Vermeulen, 'Legal Education in the Blockchain Revolution' (//Winter2017 Winter2017) 20(2) *Vanderbilt Journal of Entertainment & Technology Law* 351, 368; Philipp Paech, 'The Governance of Blockchain Financial Networks' (2017) 80(6) *Modern Law Review* 1073, 1077; Gönenç Gürkaynak et al, 'Intellectual Property Law and Practice in the Blockchain Realm' (2018) 34(4) *Computer Law & Security Review* 847, 848; A Bayle et al, 'When Blockchain Meets the Right to Be Forgotten: Technology versus Law in the Healthcare Industry' (2018) 788, 790.

[40] See, eg,
Joseph Bower and Clayton Christensen, 'Disruptive Technologies: Catching the Wave' (1995) 73(1) *Harvard Business Review* 43; Clayton M Christensen, *Disrupting Class : How Disruptive Innovation Will Change the Way the World Learns* (McGraw-Hill, 2008); Clayton M Christensen et al, 'Disruptive Innovation: An Intellectual History and Directions for Future Research' (2018) 55(7) *Journal of Management Studies* 1043.

[41] Jean Bacon et al, 'Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers' (2018) 25(1) *Richmond Journal of Law & Technology* 1; C Reed et al, 'Beyond BitCoin-Legal Impurities and off-Chain Assets' (2018) 26(2) *International Journal of Law and Information Technology* 160; M Milnes, 'Blockchain: Issues in Australian Competition and Consumer Law' (2018) 26(4) *Australian Journal of Competition and Consumer Law* 265; Robert Herian, 'Blockchain and the (Re)Imagining of Trusts Jurisprudence' (2017) 26(5) *Strategic Change* 453; DA Zetzsche, RP Buckley and DW Arner, 'The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain' [2018] (4) *University of Illinois Law Review* 1361; Kevin Werbach, 'Trust, but Verify: Why the Blockchain Needs the Law.' (2018) 33(2) *Berkeley Technology Law Journal* 487.

[42] Arvind Narayanan and Jeremy Clark, 'Bitcoin's Academic Pedigree' (2017) 60(12) *Communications of the ACM* 36 <http://dl.acm.org/citation.cfm?doid=3167461.3132259>.

[43] See, eg, John Flood and Lachlan Robb, 'Trust, Anarcho-Capitalism, Blockchain and Initial Coin Offerings' (November 20, 2017). *Griffith University Law School Research Paper No. 17-23; U. of Westminster School of Law Research Paper*. Available at SSRN: <https://ssrn.com/abstract=3074263>.

[44] See, eg, Z Rogers, 'Blockchain and the State: Vehicle or Vice?' (2018) 89(1) *Australian Quarterly* 3; Henry S Zaytoun, 'Cyber Pickpockets: Blockchain, Cryptocurrency, and the Law of Theft' (2019) 97(2) *North Carolina Law Review* 395.

[45] Bitcoin is a cryptocurrency that was released in 2009 and operates as a decentralised electronic currency without any central bank, instead using a peer-to-peer network to facilitate transactions and speculative value, See eg, Arvind Narayanan and Jeremy Clark, 'Bitcoin's Academic Pedigree' (2017) 60(12) *Communications of the ACM* 36.

[46] Myles Stern and Alan Reinstein, 'What Internal Auditors Should Know About Blockchain' (2019) 34(3) *Internal Auditing* 13.

[47] Eric Hughes, 'A Cypherpunk's Manifesto', *activism.net* (1993) <https://www.activism.net/cypherpunk/manifesto.html>; Sabine Bertram and Co-Pierre Georg, 'A Privacy-Preserving System for Data Ownership Using Blockchain and Distributed Databases' [2018] *arXiv* <http://arxiv.org/abs/1810.11655>.

[48] See, eg, Zachary (n 14); Freshwater, Fisher and Walsh (n 14).

[49] The behavioural golden mean is the desirable middle ground between scattering information in many directions and bringing it all together in the one, see, eg, Aristotle., *Aristotle's Ethics : Writings from the Complete Works*, ed Jonathan Barnes and Anthony Kenny (Princeton University Press, 2014); Robert Fitterer, *Love and Objectivity in Virtue Ethics : Aristotle, Lonergan, and Nussbaum on Emotions and Moral Insight* (University of Toronto Press, 2008).

[50] Terry Flew, 'Regulation beyond Government: Weber, Foucault and the Liberal Governance of Media Content' (2015) <https://eprints.qut.edu.au/91554/>.

[51] Gerald Gaus, 'The Priority of Social Morality' in Thomas Christiano, Ingrid Creppell and Jack Knight (eds), *Morality, Governance, and Social Institutions Reflections on Russell Hardin* (Springer International Publishing, 2018) 23.

Society can rationally agree that law and the enforcement of law gives us the basic minimum standards of behaviour in most instances. The 'rule of law' by the way it's constructed (juridic power) is premised on the idea of minimal standards and punishment for non-compliance. As such, in this paper we do not wish to make the argument that the structure of the law within society and the implementation of it is somehow faulty. What we begin to find though is that blockchain can enable a contemporary expression of voluntary associations that are, arguably, self-governing because of the way the technology can enable their participants to operate, reach consensus and 'decide' on agreed knowledge within their microcosms of technologically enabled networks. In this paper we refer to this expression as facilitating 'blockchain based voluntary associations.'

It is on the formation of these voluntary associations that the argument in this paper rests. The collective facilitated by the existence of blockchain technology has the potential to raise the baseline from the current standards for those participating in these networks. These voluntary associations may result in a cultural shift through transparency of practices, leading to a change in the social norm, buttressed and operationalised through explicit incentive mechanisms that strongly nudge participants in certain behavioural directions. Governance and the rule of law will always underpin societies, but the voluntary associations will enable new forms of self-governance to emerge. The actors who voluntarily join the association will necessarily behave in the way the law intends (for fear of being punished for non-compliance), and if this is the limit of their ambitions then so be it. They aren't rewarded for compliant behaviour.[52] They are only incentivised towards behaviours that (a) are not in conflict with lawful compliance; and (b) meet additional standards of behavioural outcomes. The purpose of the association is not to achieve 'business as usual' via minimal compliance. It is to go beyond the floor and raise the standards for each of the 'watchers' the 'watched' and the 'protected'. This of course requires that someone cares about the higher standard. In this regard, society has a distribution of attitudes across a spectrum. The spectrum includes the minimum standard but allows those who are not satisfied to look beyond the minimum and enable the creation of value through behaviour and incentives – a creation in which blockchain can be of aid.

Blockchain technology has a great number of followers and critics, along with the larger societal group who either don't understand, or don't wish to understand its features. Therefore, to suggest that blockchain could bring about societal shift requires a brief consideration of the positive attributes associated with this technology.

A Blockchain as a shield

Blockchain can serve as a shield against capriciousness and information malfeasance. In particular we argue that it can assist in combatting fraud and uncertainty because blockchains are good at ensuring that the application data state is valid. [53] This is because the 'state' of the data was generated by virtue of a defined process that followed explicit and transparent rules. The result is then a data set, collection of rules and transition of states which are all similarly transparent to the network participants. A common feature of this is that once a data state has changed as a result of the rule application, it cannot be unchanged or reversed singularly or easily. This makes the data fraud and censorship resistant,[54] and is commonly referred to as being immutable – or at the very least 'tamper-evident'.[55]

In the panopticon, as we noted above, the relationship is a one-to-many configuration where the one is a figure of authority (the watcher over the watched). We suggest that blockchains can introduce a new role for the 'watched' - namely, to enable them to transition to become 'watchers', not only of

[52] The 'reward' referenced here is determined within the boundaries of the association as that which is most effective for the collective or individuals forming that association.
[53] Warwick Powell, 'Supply Chains, Blockchains and BeefLedger: Issues and Design Considerations' (2019) <https://beefledger.io/wp-content/uploads/2018/08/Blockchain-in-Supply-Chain-Conference-Paper7.pdf>.
[54] Ibid.
[55] See, eg, M Staples et al, *Risks and Opportunities for Systems Using Blockchains and Smart Contracts* (Data 61, CSIRO, May 2017).

themselves but of others within the association. It becomes a many-to-many network. The original panopticon 'watcher' can therefore take a step back, conserve energy, and let the subjects self-regulate and conduct most of the supervision themselves.

B Redistribution of power

Blockchains can accomplish a reconfiguration of how power operates in three ways. First, network participants are no longer only individual parts, merely complying or seeking (hoping) to avoid detection for compliance – 'the watched'. Second, supervision of behaviour is not only the responsibility of some third party 'watcher', such as the regulator, but is something everyone does in the voluntary association. Third, verification of conduct takes place whenever there's an 'event' or when 'states' change and is recorded to the blockchain continuously. In a product supply chain context, by tying product performance evidence to payments (the two way data flows), there are powerful incentives to 'get the information house in order'.[56] In this configuration, for those who participate, they effectively join a network in which they share responsibility for verifying the authenticity and veracity of information and make that information available to counterparties on a 'needs' basis.

C Enabling the human

Blockchain applications do not necessarily replace human interaction or intervention, but rather represent a point in which technology can enable an amplification of human-centric responsibility, augmented with technology to enable scaling. This is an argument in support of blockchain applications, as the basis of voluntary common knowledge associations (voluntary associations)[57], rather than an argument about the superiority of machines over human error; or of machine-based automation over human intervention. Blockchain's potential lies with utilising machines to streamline certain forms of data collection activities (inbound oracles[58]) and mobilising the consensus mechanisms of blockchain-based common knowledge formation to mitigate against data manipulation and deleterious capriciousness. This will not absolve humans from responsibility. Indeed, without human responsibility and active engagement, there is no prospect of building and sustaining trust, since trust is considered to be a set of social practices voluntarily engaged in, and formed through such practices, by people.[59] People trust people. People neither trust nor not trust machines. Machines are merely dependable to one extent or another. What blockchain enables is a combination of elements that create a more holistic and sustainable supply chain. The strength will come from the machine-captured data capabilities, common knowledge data formation (both inbound and outbound oracles), cryptography and well-designed economic incentives created via mechanism design and game theory.

D Decentralisation and truth

Blockchain enables a redistribution of valid data so that a socially accepted 'truth' can be verified not from central sources, but via de-centred peer-to-peer dynamics. Using cryptography, blockchains enable dispersed and pseudonymous agents to coordinate information and govern exchange in a

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[56] For a discussion of economics and incentives in blockchain see, eg, Marek Laskowski et al, 'Token Economics in Real-Life: Cryptocurrency and Incentives Design for Insolar Blockchain Network'; Christian Catalini and Joshua Gans, 'Some Simple Economics of the Blockchain' [2016] *NBER Working Paper Series* 22952; V Mohan, 'On the Use of Blockchain-Based Mechanisms to Tackle Academic Misconduct' (2019) 48(9) *Research Policy*; Caroline Jaffe, Cristina Mata and Sepandar Kamvar, 'Motivating Urban Cycling through a Blockchain-Based Financial Incentives System' 81.

[57] To be discussed in greater depth in part V

[58] Oracles are data sources external to the blockchain itself, see, eg, Jon Buck, 'Blockchain Oracles, Explained', *Cointelegraph* (Blog, 18 October 2017) <https://cointelegraph.com/explained/blockchain-oracles-explained>; Valentina Gatteschi et al, 'Blockchain and Smart Contracts for Insurance: Is the Technology Mature Enough?' (2018) 10(2) *Future Internet* 20; J Adler et al, 'Astraea: A Decentralized Blockchain Oracle' in *2018 IEEE International Conference on Internet of Things (IThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData)* (2018) 1145.

[59] Fernando Flores and Robert C Solomon, 'Creating Trust' (1998) 8(2) *Business Ethics Quarterly* 205.

decentralised way.[60] The creation of blockchain associations will enable a shift in the register of verified information from single third parties to multiple externally trusted oracles.[61] By changing the location of trust, and additional points of verification, the shift through blockchain can enhance a level of trust in a system otherwise not present. Central third parties could be, in a sense, displaced but the actors and the things that participants in a supply chain have historically cared about don't disappear. Rather, in the processes of displacement, these concerns and the functions are re-distributed across the socio-economic body of networks or associations. The law in some ways 'wraps' around these associations, but the existence of these voluntary associations is not contingent on the law. Rather, the law functions as an Oracle (a data source) and may determine certain design requirements and performance parameters. These may come from the standard set by the law (previously referred to as the 'floor') or may simply facilitate efficiency through complying with the law. That is, the voluntary establishment of blockchain communities does not in and of itself require the permission of the law. In this sense, there is no 'entity or legal personality' such as an (un)incorporated association, which existence is a function of the law.

E Blockchain's interaction with law

In terms of the law that will 'wrap' around a blockchain association, it is important to consider the parameters that might impact on design and conduct of the association. There are many aspects of the law that will be relevant, such as concerns around privacy, data ownership, anti-money laundering, contractual performance and such. This is reflected in recent global regulation trends that have sought to find certainty in how the digital and blockchain in particular are 'permitted' to act.[62] This paper does not wish to directly address the specific interactions of the laws, but instead how blockchain-based voluntary associations experience an interesting relationship with existing legal structures and concepts. Broadly speaking, this manifests in a number of distinct ways as these blockchain-based ecosystems open up a liminal space for the re-emergence and activation of a semi-autonomous domain that does not have to compromise the law per se, but similarly does not require its authority. Paradoxically these liminal communities can create functions and consequences that are useful for the objects of legislative and parliamentary concern. Legal authority's relationship to these ecosystems is, therefore, multi-dimensional and more fluid than the juridical mode of government implied by the model of the Panopticon. This represents a conflict between the ideas of technologically-enabled freedoms from society and questioning of jurisdiction and digital sovereignty; that these associations may differ in their view of how 'autonomous' they really are from the law, and which arguably consider themselves to be their 'own' point of authority, truth and verification. Conversely, we also see blockchain-enabled communities which seek to use their communities to operate semi-autonomously but directly influence the greater fabric of the community by serving as a node in a broader field of verification in communities.

A key example of this is the potential role of such communities such as that emerging around Beefledger, which through a blockchain enabled voluntary association of producers, logistics operators, processors, trade operators, wholesalers and retailers can create a more efficient system which can operate autonomously to create added efficiency, and also act as a point of 'verifiable truth' for government bodies seeking to maintain their roles in biosecurity and economic protections.

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[60] Allen et al (n 40).

[61] Oracles are a source of data about things or situations.

[62] See, eg, Josias Dewey, 'Country Chapter: USA' in Josias Dewey (ed), *Global Legal Insights: Blockchain & Cryptocurrency Regulation* (Global Legal Group, 1st ed, 2019) 479; Lefan Gong and Luping Yu, 'Country Chapter: China' in Josias Dewey (ed), *Global Legal Insights: Blockchain & Cryptocurrency Regulation* (Global Legal Group, 1st ed, 2019) 262; Simon Lovegrove and Albert Weatherill, 'Country Chapter: United Kingdom' in Josias Dewey (ed), *Global Legal Insights: Blockchain & Cryptocurrency Regulation* (Global Legal Group, 1st ed, 2019) 469; Peter Reeves and Georgina Wilcock, 'Country Chapter: Australia' in Josias Dewey (ed), *Global Legal Insights: Blockchain & Cryptocurrency Regulation* (Global Legal Group, 1st ed, 2019) 198; Library of Congress, 'Malta: Government Passes Three Laws to Encourage Blockchain Technology', *Library of Congress* (31 August 2018) <https://www.loc.gov/law/foreign-news/article/malta-government-passes-three-laws-to-encourage-blockchain-technology/>; FINMA, 'FINMA Publishes ICO Guidelines', *FINMA* (16 February 2018) <https://www.finma.ch/en/news/2018/02/20180216-mm-ico-wegleitung/>.

IV CASESTUDY: THE BEEFLEDGER PROJECT

The final part of this paper aims to bring together the ideas of blockchain, food security, and the panopticon into a practical example of how blockchain can be utilised in a way that develops a stronger ecosystem of compliance and continued improvement. This paper first briefly discusses the purpose of the Beefledger project, and the surrounding circumstance of the Australian Beef supply chain that make the project necessary, including the nature of the NLIS system and the nature of global food fraud. Next, this article will demonstrate how Beefledger adds value to the supply chain by using blockchain to through data verification that allows for expertise and trust to flow more easily. Finally, the article will demonstate how this can be seen within the concept of the panopticon to raise the standards and allow for greater principles to emerge. This, in turn, forms a secondary panopticon layer that seeks to observe-to-reward, rather than observe-to-punish.

Food matters. Food security for the projected future population is considered to be one of the greatest challenges the world must address in the next century.[63] It is reported that more than one in seven people today still do not have access to sufficient protein and energy from their diet, and even more suffer from some form of micronutrient malnourishment.[64] The production of food has social, ecological and economic impacts. Therefore, food production is one of the great challenges of our time, and as a result, understanding the impact of laws and regulations upon production is crucial.[65] Blockchain is expected to disrupt the laws and regulations of supply chains. In the face of concerns about food fraud and food safety, the Beefledger project was devised as a joint project between QUT and Beefledger Ltd through the Food Agility CRC in an effort to utilise blockchain and related technologies to alleviate questions in the beef supply chain. In doing so the project explores the intersection between agricultural interests, government bodies, new technologies, and law.[66] Beefledger is creating a blockchain solution that can house key data of the Australian beef supply chain in a manner that allows for increased transparency, efficient monitoring of biosecurity issues, increased trust in export processes and the development of a community that allows for all facets of the supply chain (from producer, to grower, to consumer) to interrogate the chain and be confident that the beef that is consumed matches the label.

A The regulatory environment

The laws regulating the beef supply chain involve an interwoven dissection of state-based legislation, national standards, federal legislation, guidelines and export requirements. There are also local laws concerning compliant land uses. Depending on the country of destination for products, there may be additional requirements imposed upon producers and other parts of the supply chain. Often the nature of the supply chain will mean that an animal is raised and registered in one state, moved to another, processed in a third, exported in a fourth and then sent to a different country. This cuts across many different, and often inconsistent areas and as such the regulations can be complicated and include a number of different regulators. Although complicated, these laws are in place for a reason, as they provide a minimum standard that aims to protect supply chain participants, the animals and their welfare, transportation and licensing, to name a few examples.[67] This minimum standard arguably works in a panopticon-style manner to ensure that there is a standard to which all participants can comply, requiring self-regulating due to resource limitations in the enforcement of these standards.

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[63] OECD and Food and Agriculture Organization of the United Nations, *OECD-FAO Agricultural Outlook 2019-2028* (2019) <https://www.oecd-ilibrary.org/content/publication/agr_outlook-2019-en>.

[64] FAO, 'World's Future Food Security "in Jeopardy" Due to Multiple Challenges, Report Warns', *Food and Agricultural Organization of the United Nations* (News Article, 22 February 2017) <http://www.fao.org/news/story/en/item/471169/icode/>.

[65] Ibid; Rosemary Rayfuse, *The Challenge of Food Security International Policy and Regulatory Frameworks.* (Edward Elgar Publishing, 2012); Muriel Lightbourne, *Food Security, Biological Diversity and Intellectual Property Rights* (Ashgate, 2009).

[66] In this sense, it concerns the 'law of the cow' rather than the infamous Easterbrook-Lessig 'law of the horse.' The Easterbook-Lessig debate around the 'law of the horse' centrered on Easterbrook's scepticism that society needs to have laws for new technology as to do so would be as 'rediculous' as having laws for every animal, such as the law of the horse. Technology has certainly developed well beyond these initial debates and the granularity of specific laws for technology is regarded as appropriate. We choose to see this as a fine reflection as to why, arguably, 'the law of the cow' is an apt idea that does indeed blur between animal concerns and technology concerns as reflected in the Beefledger project. See issues as discussed in introduction; Lessig (n 1).

[67] Here, 'protection' does not refer to the need to protect any one type of supply chain participants, but rather refers to the need to provide a balance between the actions and pursuits of producers in a supply chain and the beneficiaries or consumers within the supply chains.

One of the principle componenets of the Australian beef supply chain's regulatory framework is the National Livestock Identification System (NLIS). The NLIS was initially introduced as a response to concerns associated with biosecurity coupled with the substantial export volume from the Australian market. The NLIS is considered one of the most advanced traceability frameworks in the world.[68] Its purpose was to provide greater visibility over the movement of animals raised for human consumption.[69] The NLIS combines three elements to enable the traceability of animals: an animal identifier (a visual or electronic ear tag known as a device); identification of a physical location by means of a PIC; and, more recently, a web-accessible database to store and correlate movement data and associated details. As animals are bought, sold and moved along the supply chain, they must be tagged with an NLIS-accredited tag or device.[70] Each movement to a location with a different property identification code is recorded centrally on the NLIS Database.[71] And any removal of an animal from the system (Processing at an abattoir, or humane destruction) is similarly recorded in the Database.[72] Using this information, the NLIS is able to provide a life history of an animal's residency, and to discern when they have come into contact with other animals. The purpose of this regime is to specify minimum standards that, if adhered to, will ensure the traceability of cattle in the name of disease control and food safety. The NLIS represents the minimum standards to support the harmonisation of legislation across all Australian jurisdictions, however State and Territory legislation may impose more demanding requirements. One of the primary functions of the Beefledger blockchain is to bring together the data already being collected through NLIS instruments with other data into one coehesive account that has the protection and validation associated with blockchain. This means that it will achieve an enhanced form of traceability of livestock that not only can be used to aid with biosecurity concerns, but has potential to stretch further (to be discussed below). By appreciating the existing regulatory field, a technological solution can add increased transparency and efficiency. For the beef supply chain, this means that there will be more certainty throughout the process and especially at the point of consumption, this means that the system can address concerns of food fraud.

B Food Fraud

Food Fraud is a type of crime that involves selling food in a way that deliberately misleads or deceives and it is done with the purpose of financial gain.

> It is a collective term to encompass the deliberate and intentional substitution, addition, tampering, or misrepresentation of food, food ingredients, or food packaging; or false or misleading statements made about a product for economic gain.[73]

Food fraud can occur through various means including misrepresenting the provenance, use-by dates, misrepresenting some of the processes associated with the production (animal welfare – the egg debate), substitution and adulteration.[74] In Australia, food fraud is captured under a number of possible legislative measures. This includes measures of misleading and deceptive conduct in the Australian

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[68] Glynn T Tonsor and Ted C Schroeder, 'Livestock Identification: Lessons for the U.S. Beef Industry from the Australian System' (2006) 18(3) *Journal of International Food & Agribusiness Marketing* 103.

[69] R Iglesias and I East, 'Cattle Movement Patterns in Australia: An Analysis of the NLIS Database 2008–2012' (2015) 93(11) *Australian Veterinary Journal* 394.

[70] See, eg, *Biosecurity Act 2014* (Qld), ss 141, 145; *Livestock Disease Control Act 1994* (Vic) s 9; *Biosecurity (National Livestock Identification System) Regulation 2017* (NSW) reg 17; *Livestock Regulation 2013* (SA) reg 61.

[71] See, eg, *Biosecurity Act 2014* (Qld), s 185; *Livestock Disease Control Act 1994* (Vic) s 8A; *Biosecurity (National Livestock Identification System) Regulation 2017* (NSW) reg 41; *Livestock Regulation 2013* (SA) reg 63.

[72] See, eg, *Biosecurity Act 2014* (Qld), s 185; *Livestock Disease Control Act 1994* (Vic) s 94B; *Biosecurity (National Livestock Identification System) Regulation 2017* (NSW) regs 41, 45; *Livestock Regulation 2013* (SA) reg 69.

[73] OECD and Food and Agriculture Organization of the United Nations (n 67).

[74] These issues around food fraud, misreprestation, and the effect of misleading 'verification' in food labelling is an ongoing issue across a wide range of agricultural products in Australia, for interesting disucssions see, eg, Christine Parker and Josephine De Costa, 'Misleading the Ethical Consumer: The Regulation of Free-Range Egg Labelling' (2016) 39(3) *Melbourne University Law Review* 895; Christine Parker, 'Voting with Your Fork? Industrial Free-Range Eggs and the Regulatory Construction of Consumer Choice', ed Susan S Silbey (2013) 649(1) *The ANNALS of the American Academy of Political and Social Science* 52.

Consumer Law,[75] labelling requirements in terms of the product composition,[76] and prohibition against meat tampering with the intention of deceit associated with species.[77] These requirements are echoed in Commonwealth export regulations, but are more prescriptive in the exact requirements in terms of product details and tampering penalties.[78] Supply chain fraud and food safety concerns are global in nature. They are not limited to developing economies as the European horsemeat scandal demonstrated.[79] In 2012, after routine testing was performed on what had been labelled as beef, the Irish authorities determined that horsemeat was present in beef products, sometimes in large quantities. [80] Perhaps even more offensive to some was that these products had originated in UK abattoirs.[81]

The risk of food fraud and food safety concerns is exacerbated in conditions of either limited information overall, or information asymmetry along parts of the supply chain. In the latter case, this manifests as problems of either 'hidden information' or 'hidden action.' In rapid growth markets like China, concerns about the effectiveness of food safety and fraud prevention regimes are intensified as the economic incentives noted above, attract malfeasance to the market in search of quick 'super profits'. Despite strident efforts via the mechanisms of juridic power, concerns about food fraud and associated issues of food safety abound.[82] The situation in China is apparent through recent research conducted by Price Waterhouse Coopers, which estimates that for every two kilograms of beef sold in China as Australian, one kilogram is not Australian at all.[83] Chinese researchers estimate that for every ten kilograms of beef sold in the marketplace, only one is actually what it claims to be. Of the remainder, one-third is not beef (in whole or in part via adulteration), one-third is not from the country that is claimed and the remainder is not the cut of meat that is claimed.[84] Cases of composite beef being sold as whole Australian steaks have recently been exposed.[85] As a result of these and other examples, Chinese consumer trust in regulatory systems is diminished. We have observed that consumers of all ages are regularly sceptical of product claims and increasingly depend on the referral credentials of other consumers (strangers via ratings) or direct referral of trusted friend networks when choosing products.[86] It is in this environment that BeefLedger has been designed.

The above demonstrates that in the face of concerns associated with the supply of beef both domestically and for export, Australia's legislative and regulatory regimes have exhibited classic panoptic-like design qualities. Central supervisory bodies are positioned as loci of compliance and punishment. Actors are under the watchful eye of regulatory bodies and are required to participate in a range of activities that provide evidence of compliance. In practice, actors effectively govern themselves via interaction with the instruments of the regulatory authorities (or their agents). The National Vendor Declaration documentary regime in NLIS / PIC compliance is the mechanism that enlists actor compliance performance. In effect, the 'ven-dec' is the silent architecture of behavioural modification.

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[75] *Competition and Consumer Act 2010* (Cth) Sch 2, s 18.
[76] See, eg, *Food Production (Safety) Regulation 2014* (Qld) Reg 159.
[77] See, eg, *Food Production (Safety) Act 2000* (Qld) s 81.
[78] See, eg, *Export Control (Meat and Meat Products) Orders 2005* (Cth) sch 6, s 1.3; *Export Control Act 1982* (Cth) s 15.
[79] Evershed (n 79).
[80] Ibid.
[81] Ibid.
[82] This is illustrated by the many 'frequent and serious' food scandals in china such as "Sudan red","c1enbuterol", "Sanlu toxic milk powder" and "trench oil", see, eg, F Tian, 'An Agri-Food Supply Chain Traceability System for China Based on RFID & Blockchain Technology'.
[83] Premium Quality Meat CEO Anthony Puharich stated 'We estimate it is a kilogram for kilogram. So for every kilogram of meat being sold in countries like China, at least another kilogram is being sold labelled as Australian but it is not.' See Lydia Burton, 'Counterfeit Aussie Beef Trade Worth Billions Meets Its Match with Smartphone Technology', *ABC News* (4 September 2018) <https://www.abc.net.au/news/rural/2018-09-04/technology-aims-to-stop-fake-aussie-branded-beef/10132720>; see, also, Lucille Keen, 'Trust Your Crust', *PwC Australia* (19 December 2017) <https://www.pwc.com.au/publications/the-press/trust-your-crust.html>; Necia Wilden, 'Cracking down on Fake Steak with Invisible, Trackable Beef Barcodes', *Australian Financial Review* (10 August 2018) <https://www.afr.com/life-and-luxury/food-and-wine/cracking-down-on-fake-steak-with-invisible-trackable-barcodes-20180810-h13t3n>.
[84] Pork, horse meat and duck breast are common adulteration or substitute ingredients, see, eg, PJ O'Mahony, 'Finding Horse Meat in Beef Products—a Global Problem' (2013) 106(6) *QJM: An International Journal of Medicine* 595.
[85] See, eg, Shahrooz Rahmati et al, 'Identification of Meat Origin in Food Products–A Review' (2016) 68 *Food Control* 379; Kara O'Neill, 'Are You Eating Fake Steak? Customers "Tricked into Paying Premium Prices for Scraps of Meat"', *Mirror* (10 June 2015) <https://www.mirror.co.uk/news/weird-news/you-eating-fake-steak-customers-5856558>.
[86] Restauranteurs reported to the Beefledger research team in January 2019 that they sourced their produce only through trusted suppliers and would not consider alternatives due to fraud and quality concerns. The observations and data reported were collected by Dr in accordance with QUT ethics approval, using semi structured interviews and observations (Information from future research publication)

The applicable laws concerning biosecurity are conducted or performed through the acts of completing forms and transferring their duplicates to downstream parties.

Through observations of the BeefLedger project, this article argue that the importance of a user-lead blockchain system to capture data to give those who create the data the access to it, could potentially have a very positive effect. This effect far exceeds the 'bare minimum' as represented by legislation, standards, and guidelines as well as the benefits associated with the biosecurity concerns currently experienced as a result of the NLIS. The benefits of the NLIS are limited to the particular instances for which the data was collected, whereas the broader benefits of this data could result in positive buying practices, improved animal welfare, enhanced safety of the animals (and of the people who operate within the supply chain), environmental benefits, and tracking and tracing of carbon just to name a few examples.

C Beefledger and Blockchain

Beefledger's blockchain seeks to use a technological solution to encourage a community to act in a way that removes centralised and vertical observation, and instead succeed through horizontal and self-surveillance systems. This community is ultimately a collection of agents that participate in the blockchain by adding and/or verifying information. It is what the Beefledger project has dubbed a 'voluntary common knowledge association.' Not to be confused with associations with legal-status, this body of agents is one which the project sees as associating voluntarilty to both share knowledge and to agree on the state of common knowledge within a system. It is akin to the nature of miners within a typical blockchain system,[87] however it is seen as inherently more human-centric. Unlike miners in a typical blockchain, the incentive to participate is not purely financial, this is because those who agree on the common knowledge are themselves involved in the supply chain and have a vested interest in having their actions verified and for all other actors to be held to the desired standard. An example of this would be that as a cattle owner gains new cattle, the owner will scan the NLIS ear tags of the animals[88] and this will be uploaded onto the chain. This asset creation will then be put to the community to vote upon as to whether it should be added. Following this, when these assets are moved from farm to farm, or from farm to feedlot, the cattle will be scanned again (as required legally under the NLIS reporting)[89] and the change to the state of the assets will be verified by participants in the Beefledger blockchain. Each action of the cattle through their lifecycle from farm, to feedlot, to abattoir, through to packaging, export, and sale to consumers will be potentially recorded onto the chain in a way that allows the community to achieve a state of 'common knowledge' around the nature and providence of its beef assets.

The Beefledger project utilises a permissioned, proof-of-authority network. The power of this system is that it can be seen as a voluntary association as well as a community that is incentivised to act within the transparent system of the blockchain because it means that their actions can be properly rewarded and verified by members of the community. This allows for greater certainty in the process while creating an ecosystem that can reward higher thresholds of performance above simply punishing the failure to comply with the legislative bare-minimum. In this respect, although this project focuses on the beef supply chain, we suggest that the experiences from this project could be replicated in any number of supply chain environments.

In the sections that follows we discuss the technical components and concepts that the Beefledger voluntary association draws upon – specifically the value of data proposition, the nature of authority

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[87] For discussions on miners and their roles see, eg, Edward Morse, 'From Rai Stones to Blockchains: The Transformation of Payments' (2018) 34(4) *Computer Law & Security Review* 946, 951; Reijers Wessel and Mark Coeckelbergh, 'The Blockchain as a Narrative Technology: Investigating the Social Ontology and Normative Configurations of Cryptocurrencies' (2018) 31(1) *Philosophy & Technology* 103, 106; Justin Henning, 'The Howey Test: Are Crypto-Assets Investment Contracts?' (//Winter2018 Winter2018) 27(1) *University of Miami Business Law Review* 51, 55.

[88] This is currently done either manually, or through RFID scanners in the 'Cattle Crush' upon arrival at new locations.

[89] See, eg, *Biosecurity Act (QLD)* 2014; *Livestock Disease Control Act 1994* (VIC); *Biosecurity (National Livestock Identification System) Regulation 2017* (NSW).

and trust, and finally what this model means within the greater ideas of the panopticon. It is through the description of this ecosystem that we explain how the unique qualities of blockchain technology can indeed produce an efficient and effective panopticon that will achieve the higher standards discussed within this paper.

I Blockchain's value in proposing and verifying data

Within the Beefledger voluntary association, participants will be able to record information on the blockchain. This information may come from a range of supply chain data points, for example registration of an animal in the NLIS, animal movement, animal weight, processing conditions, or animal welfare. This data might be as simple as an automatic upload of a scanned tag or barcode, or it may be photographic evidence of a point in time. This data, in whatever format provided, will be proposed to the network. Following this, the data must be verified by the community to be added into the ledger. This is the procedure required for all community data collection. As such, we argue that within a voluntary association, the ability to have a greater decentralisation of this process of knowledge proposition and verification allows for greater trust and collective economic benefits.

The act of proposing data (or making a claim in need of validation) to the network has economic consequences in more ways than one. Proposers are asking the network to perform a number of services - namely validation and storage. Within this process there are fees being payed along the way so that data is proposed, processed, validated, and voted upon. This process involves incentives for others to then process and validate the new data and this in turn keeps the system moving and growing.[90] This mechanism draws on insights of Thomas Schelling, a Nobel prize winning economist specialising in decision making in strategic environments.[91] Strategic environments are those in which the rewards and punishments available are contingent not only on the choices of a singular participant but on the choices made by others. A mechanism that rewards voting with the majority requires validators to consider how others will vote, and this becomes a system where the system becomes representative without a need for communication. Schelling's work resulted in the idea of a 'focal point' – a point arrived at by a majority of strangers without communications between them, because the 'point' draws on a reservoir of mutual knowledge that is strongly suggestive of how others are likely to choose.[92]

Data that is validated by the network is then stored to a number of nodes, operated by members of the network. Proof of Authority consensus mechanisms ensure each of the nodes are continually synchronising their records (data and data blocks).[93] Decentralised and simultaneous storage contributes to overall network security and mitigates risks of capricious data censorship or fraud. While such mechanisms cannot be guarantees of absolute truth, they are able to introduce additional layers of security that go towards lessening the possibility of capricious acts of data capriciousness *as claims are being made*. If malfeasance is to be pursued, it can only be pursued collectively. Collaborative data validation runs the risk of being corrupted by data collusion. A range of mechanisms can be introduced to mitigate collusion risk by way of significant economic risk in the event that collusion is detected. In effect, the economic design of the 'truth game' tends to nudge actors away from deliberate and coordinate untruths.

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[90] Proposers must pay fees when proposing data. To participate in the validation process, network members in effect vote on the validity or otherwise of proposals. Participation in voting mechanisms also requires validators to pay a fee. Combined, the proposer and validator fees constitute the pool from which network services for that particular proposal are paid. Validators proceed to vote. Validators are rewarded in the event that they vote with the majority. The minority forfeit their voting fee, validators claim the reward as a return of their fee plus a proportion of the proposal fee. The remainder of the proposal fee goes to hardware nodes that fulfill data storage functions.

[91] Schelling's work has been cited numerous times within the blockchain community due to the effect of this work, see, eg, Thomas Schelling, *The Strategy of Conflict* (Harvard University Press, 1980).

[92] See, eg, Ibid; Am Colman, 'Thomas C. Schelling's Psychological Decision Theory: Introduction to a Special Issue' (2006) 27(5) *Journal Of Economic Psychology* 603; Judith Mehta, Chris Starmer and Robert Sugden, 'Focal Points in Pure Coordination Games: An Experimental Investigation' (1994) 36(2) *Theory and Decision* 163.

[93] See, eg, Tasca and Tessone (n 40) 12.

II Authorities, expertise and trust to support voluntary associations

As noted above, the operation of these voluntary associations continues to rely upon the role of the authorities and the minimum standards enforced by them. For instance, one traditional argument in favour of the role of centralised supervisors, acting in the name of the lay consumer, is the requirement of expertise. Consumers will often lack sufficient expertise to verify whether or not compliance with (complex) requirements has been achieved. One such example would be that typical lay consumer will lack the knowledge or expertise to assess the safety of the food they purchase, such as biosecurity issues down the supply chain, unless there is something obviously awry at the point of sale. As such, the consumer needs a window into this process at the point of sale that provides them with the knowledge that what they are eating is safe. Typically, this trust is linked to the product being purchased, or the point of sale (such as a trusted supermarket chain) however this trust is not always present, and is harder to achieve in the Chinese market,[94] as such a technical solution may be of benefit. The need for a trusted third party, mediating the (competing) interests of producers and consumers is also sustained on the basis of impartiality. Thus, expertise and impartiality are intertwined as foundations for juridic authority. The proposed involvement of lay consumers in supply chain validation procedures does not elide the need or rationale for expertise *per se*. On the contrary, expertise contributes to the truth-claims being made by supply chain actors by way of *activity evidence* (discussed in more detail below). Expertise begins to perform the role of Oracles.[95] At issue is valid identification of the expert and verification of the validity of the evidence being submitted as part of the data proposal. Cryptographic technologies address both these requirements efficiently and effectively.

III The panopticon and raising the floor of the standards

So far, much of the discussion has involved the means by which blockchain-based common knowledge formation and storage acts as a more secure, more dependable and less capricious ecosystem for validating claims made about actions in a supply chain. In effect, this proposition activates the capacity of the technology to be a better record of past events. As records of the past, blockchains and associated processes and institutional designs can be said to deliver an incremental improvement to the centrality of registers of accounts for the proper functioning of capitalism.[96] However, it is the capacity to turn the technology towards incentivising desired future outcomes that holds the most promise insofar as shifting from a world in which compliance with bare minima takes precedence to one in which society's valorisation of excellence (in its multitudinous dimensions) can pull supply chain behaviours in new directions. Rather than compelling supply chain actors to modify activities and behaviours for fear of punishment, it is possible to design ecosystems that transparently and dependably reward actors when they can demonstrate the achievement of outcomes that go 'above and beyond' bare minimal standards.

The Beefledger voluntary association allows for the role of consumers to be redesigned. At the heart of the 'Beefledger voluntary association' is the capacity to have participants assist to validate the process despite not directly involved in the production or processing of cattle and the manufacture of beef products. This aids to spread more knowledge and participation in the community so that more certainty and confidence can be reaches. The ability and desire to achieve beyond minimum standards will therefore have its origins within the stakeholders, rather than being externally sourced through regulatory requirements. Consumers are no longer the passive beneficiaries (or victims) or third-party oversight. Rather, consumers are empowered to contribute directly to the validity of claims made by actors involved in the entire supply chain, in ways that are economically meaningful and impactful.

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[94] See, eg, Yufeng Li et al, 'Crisis Management of Food Security Scandals in China: Motivations and Solutions towards Purchase Intention' (2018) 17(1) *Journal of Consumer Behaviour* 13; Yaolin Liu, Cheng Wen and Xingjian Liu, 'China's Food Security Soiled by Contamination' (2013) 339(6126) *Science (New York, N.Y.)* 1382; Adrian Hearn, 'State-Society Trust in Sino-Brazilian Agriculture' (2015) 20(3) *Journal of Chinese Political Science* 301; O'Mahony (n 96).

[95] As discussed, Oracles are data sources external to the blockchain itself which can be used to verifiy data within the blockchain, see, eg, Buck (n 62); Gatteschi et al (n 62); Adler et al (n 62).

[96] For instance, see the emergence of double entry book keeping in the 1500s, see, eg, Jane Gleeson-White and Geoff Harcourt, 'Double Entry Book Keeping: A Conversation' (2012) 23(3) *The Economic and Labour Relations Review* 89; Shimin Chen, 'The Rise and Fall of Debit-Credit Bookkeeping in China: History and Analysis' (1998) 25(1) *The Accounting Historians Journal* 73.

Additionally, consumer advocacy groups have played important roles historically as the 'consumers' voice' the economic impact of advocacy is indirect. The Beefledger blockchain-enabled ecosystem not only provides the mechanisms by which all participating network members can participate in claim validation processes, it also introduces powerful economic (financial) mechanisms that directly link validation of acceptable or superior performance by actors along the chain with consumer-driven valorisation.

By specifying desired outcomes that can be evidentialised with particular specific bodies of data, the data validation and storage protocols of the blockchain ecosystem can be mobilised in the interests of the pursuits of excellence. Here, excellence is determined by buyer valorisation. By definition, these conditions of excellence must exceed the bare minima of juridic floors. Buyers can, in this new digital environment, stipulate the amount they are willing to pay for a product provided that it meets certain pre-specified performance conditions verified by agreed data preconditions. Smart contracts embed these performance-rewards mechanisms, so that actors can pursue excellence in the knowledge that capriciousness has been excluded from the rewards mechanism. Hidden knowledge and hidden action risks are, thus, mitigated by financially rewarding transparency. Within the Beefledger voluntary association the financial rewards can be determined by the community itself, but it is anticipated that these rewards will correlate to behaviour that will increase product value. For instance, transparency will be achieved through validated certainty that the final product is, for instance, 'Australian', 'from Mt Gambier', 'Wagyu', 'grass-fed', 'treated humanely', and/or 'has been transported in a safe temperature.' All of these potential data points will add value to the product. By having this information available to a consumer or purchaser, participants will be incentivised to exceed the minimum standard and allow for information to be verified, depending on consumer demand.

The Beefledger system, through blockchain, allows for a panopticon-style tracking and 'watching' of behaviour in an ecosystem where rules are more flexible than the juridic 'bare minimum'. This means that while legislation will provide a bare minimum and apply penalties for breaches, the voluntary association can decide upon greater bands of performance and rewards for higher performance that will encourage greater action and behaviour in a system beyond the legislative standard. By using a blockchain based system it will be tracible, transparent, and flexible in a manner similar to the panopticon. The 'watched' can experience a transformation of the panopticon as they will be incentivised to self-regulate beyond a minimum standard, with a view to higher quality performance as determined by the community. The blockchain-enabled BeefLedger ecosystem described here is a case of data re-purposing. Digitalised data is infinitely divisible, enabling its deployment in many contexts, including those previously not anticipated. While the modus operandi of the NLIS-PIC regime has its antecedents in biosecurity concerns, the ability to rearticulate data on asset identity and time/place dimensions to meet other demands is opened up further because of the smart contracts potential of blockchain technologies.

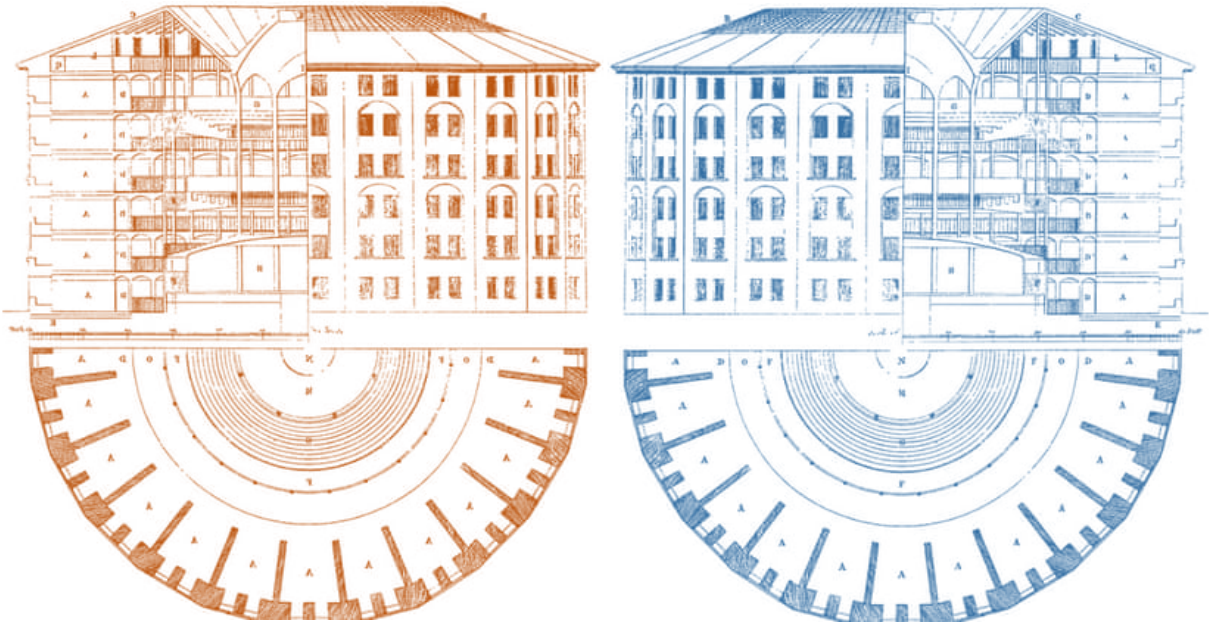
V CONCLUSION

The 'regulatory floor' exists because society requires minimum standards to hold people accountable. These laws are crucial; however, when we explored the beef supply chain, we found no evidence to detect where actors were systematically breaching those minimum standards. Despite this, problems within the supply chain continue to plague producers and consumers. In this regard we argue that the law cannot capture additional concerns which, while important, are not inherently 'prescriptive' in nature as to lend themselves to a minimum standard. For instance, concerns such as fraud, biosecurity, and environmental costs, can be regulated to one standard while also demand a higher standard. In our

experience, this demand is also presented by consumer appetite for transparency associated with these concerns in a manner that is not achievable using the existing mechanisms that emulate the traditional panoptic structure. As such, we have demonstated that through the introduction of technology, this panoptic structure can be enhanced in a manner that may indeed induce this ideal higher standard. This is achieved through projects like Beefledger that introduce a benefit enhanced supply chain incorporating a voluntary association which utilises this heightened panopticon-like system that adds reward mechanisms tied to transparency, rather than traditional system that sees only the harsh light of observation as it is tied to punishment. It provides a way of interacting with the majority who are complying with the minimum standard while adding additional layers of 'preferred behaviour' which is in itself not legislative in nature. While we drew upon the beef supply chain, these higher standards and technological systems will need to be more widely applied to any consumable supply chain. With increasing environmental pressures, population growth, expanding trade and other resource constraints of efficiency and trust must be supported. While there are laws to deter the worst forms of behaviour, society must encourage greater standards and reward better performance.

Blockchain-enabled reward mechanisms do not substitute for the 'rule of law', or indeed the negation-in-potentia of extant juridic power relations; these continue to operate. It is not a case of either / or. Negative juridical power continues to be a feature, arguably more efficiently administered with blockchain technologies than was heretofore possible. At the same time, however, via the mechanisms of enhanced self-supervision and reward mechanisms, opportunities are opened up for new modes of behaviours. These behaviours are aligned not just with the demands of bare compliance, but with the prospects of gaining rewards by 'going above and beyond'.

Within this paper we have argued that it is not the problems or solutions that are new – but the technology that enables for a dynamic and more people-driven solution that makes this of particular fascination. Within the ideas of the rule of law, juridical power, and broader ideas of what 'law' and 'society' are, we do not claim that blockchain based voluntary associations replace this; rather, we suggest that the 'floor' or base level provided by the rule of law can, because of technology, be supplemented with self-enforcing mechanisms that actors voluntarily subscribe to. These mechanisms can actually incentivise the pursuit of outcomes that exceed the 'floor' conditions. Thus, we suggest that these voluntary associations will potentially change supply chain cultures and lead to improvements that the law alone has thus far been unable to achieve, and arguably was never designed to achieve. This is akin to adding an additional level of reflection to the panopticon that deals with rewards to supplement the existing level that deals with discipline. Both levels will be subject to the panoptic ideas of self-regulation with a stronger and explicit capacity for peer-to-peer surveillance. The metaphorical panopticon is now doubled - or mirrored - and will now one be enhanced with both a carrot and a stick as a result of technology within the blockchain-based voluntary associations.



Within this though we cannot forget that there are always other forces at work beyond what may be simply defined as ‘law’. One such force is the strength that comes from the market. Often seen as a tool for capitalism, we argue that markets have the ability to serve as a platform for activists, where information is available and information asymmetry is reduced. Instead of serving as a tool for the manipulation to enable capitalism, false growth and wealth accumulation, the development of a blockchain based information system can serve the many. In this regard we suggest that a blockchain based information system has the potential to address concerns associated with caveat emptor, quia ignorare non debuit quod jus alienum emit (‘Let a purchaser beware, for he ought not to be ignorant of the nature of the property which he is buying from another party.’) Of course, ignorance is partly a function of information asymmetry (hidden knowledge); hence, in a move in the name of consumer protection, we have the balancing act of caveat venditor, which again will be better facilitated through a blockchain based solution. However, we can do even better. Consumers may (one day) be able to specify their preferences, which can and will be digitally verified through a ‘daisy chain’ of transactional smart contracts. Until that time we must respond to growing needs within industries and critically look to the role that technology may have upon our ways of understanding changing ecosystems.

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