

Fostering Worker Cooperatives with Blockchain Technology: Lessons from the Colony Project

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Abstract

In recent years, there has been growing policy support for expanding worker ownership of businesses in the European Union. Debates on stimulating worker ownership are a regular feature of discussions on the collaborative economy and the future of work, given anxieties regarding the reconfiguration of the nature of work and the decline of standardised employment contracts. Yet, worker ownership, in the form of labour-managed firms such as worker cooperatives, remains marginal. This article explains the appeal of worker cooperatives and examines the reasons why they continue to be relatively scarce. Taking its cue from Henry Hansmann's hypothesis that organisational innovations can make worker ownership of firms viable in previously untenable circumstances, this article explores how organisational innovations, such as those embodied in the capital and governance structure of Decentralised (Autonomous) Organisations (D(A)Os), can potentially facilitate the growth of LMFs. It does so by undertaking a case study of a blockchain project, Colony, which seeks to create decentralised, self-organising companies where decision-making power derives from high-quality work. For worker cooperatives, seeking to connect globally dispersed workers through an online workplace, Colony's proposed capital and governance structure, based on technological and game theoretic insight may offer useful lessons. Drawing from this pre-figurative structure, self-imposed institutional rules may be deployed by worker cooperatives in their by-laws to avoid some of the main pitfalls associated with labour management and thereby, potentially, vitalise the formation of the cooperative form.

1 Introduction

There has been a long-running policy-level discussion on the role of worker ownership and management of firms in the European Union.¹ Labour-managed firms

(LMFs) are firms in which the suppliers of labour, rather than capital, have ultimate control rights in the governance of a firm, including the right to collectively hire and dismiss directors.² The suppliers of labour also receive the residual earnings of the firm on the basis of their labour input.³ LMFs offer an appealing governance structure for firms due to their perceived positive effects on employee behaviour for firms⁴ as well as high survival rates during times of recession.⁵ From the workers' perspective, LMFs provide job security,⁶ 'positive energy'⁷ resulting from the knowledge that they work for their own benefit rather than for non-worker shareholders and act as 'sites of solidarity'⁸ in a neoliberal economy where workers' rights are gradually eroded.⁹ As a consequence, LMFs such as worker cooperatives have regained attention in recent times¹⁰ in view of the anxieties regarding job quality, income inequality,

Future of the EU Collaborative Economy — Using Scenarios to Explore Future Implications for Employment (2016), at 27.

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1. From improving working conditions to providing start-up support, administrative and accounting spaces as well as workspaces for self-employed persons, see EP Resolution, OJ 1983 C 128/51; A. Bock, L. Bontous, S. Figueiredo do Nascimento, & A. Szczepanikova, *The*

2. G.K. Dow, 'The Theory of the Labor-Managed Firm: Past, Present, and Future', 89 *Annals of Public and Cooperative Economics* 65, at 65 (2018).
3. H. Hansmann, *The Ownership of Enterprise* (2000), at 11. Workers also contribute capital, but their decision-making and financial rights are not predicated on the extent of their capital contribution.
4. Cf. I. Basterretxea and J. Storey, 'Do Employee-Owned Firms Produce More Positive Employee Behavioural Outcomes? If Not Why Not? A British-Spanish Comparative Analysis', 56 *British Journal of Industrial Relations* 292 (2018); R. Brown, R. McQuaid, R. Raeside, M. Dutton, V. Egde, J. Canduela, 'Buying into Capitalism? Employee Ownership in a Disconnected Era', forthcoming in *British Journal of Industrial Relations* (2018), doi:10.1111/bjir12309.
5. V. Pérotin, 'Workers' Cooperatives: Good, Sustainable Jobs in the Community', 2 *Journal of Entrepreneurial and Organizational Diversity* 34, at 40 (2013); J. Birchall and L.H. Ketilson, *Resilience of the Cooperative Business Model in Times of Crisis* (2009) at 7, 13-14.
6. I. Heras-Saizarbitoria, 'The Ties That Bind? Exploring the Basic Principles of Worker-Owned Organizations in Practice', 21 *Organization* 645, at 656, 658 (2014).
7. Basterretxea and Storey, above n. 4, at 300.
8. J. Itzigsohn and J. Rebón, 'The Recuperation of Enterprises: Defending Workers' Lifeworld, Creating New Tools of Contentment', 50 *Latin American Research Review* 178, 189-90 (2015).
9. P. Raffaelli, 'Social and Solidarity Economy in a Neoliberal Context: Transformative or Palliative? The Case of an Argentinian Worker Cooperative', 5 *Journal of Entrepreneurial and Organizational Diversity* 33, at 34 (2016); X. de la Barra, 'Sacrificing Neoliberalism to Save Capitalism: Latin America Resists and Offers Answers to Crises', 36 *Critical Sociology* 635, at 655 (2010).
10. CICOPA-COOP, *The Future of Work: Where do Industrial and Service Cooperatives Stand?* (2018); M. Sandoval, 'Fighting Precarity with Cooperation? Worker Co-operatives in the Cultural Sector', 88 *New Formations* 51, at 62 (2016).

diminishing worker protections, and worker participation raised by the collaborative economy and the 'future of work'.¹¹

Yet, LMFs continue to be relatively rare in developed economies compared to capital-managed firms (KMFs),¹² barring famous exceptions in regional economies such as that of the Basque country of Spain,¹³ the Emilia Romagna region of Italy¹⁴ and the Buenos Aires province of Argentina.¹⁵ While interest in worker cooperatives has surged in South Korea¹⁶ and certain states in the United States of America,¹⁷ their number in all of these instances still remains in the hundreds. The most common reasons attributed for their relative scarcity are acquiring start-up capital, workers' apprehension about not being able to spread their investment risk,¹⁸ the risk of absenteeism and free-riding on the efforts of other workers,¹⁹ the inability to meet the high ideological and economic expectations set when the LMF was formed²⁰ and a perceived tendency to 'degenerate' into KMFs, by replacing retiring worker-members with employees in a bid to maximise individual member remuneration, thereby diminishing worker voice and losing its democratic character.²¹ Degeneration is seen as a particularly acute concern when a worker cooperative tries to internationalise its operations.²²

Taking its cue from Hansmann's hypothesis that organisational innovations may make labour management and ownership viable in previously untenable circumstances,²³ this article explores how organisational innovations, such as those embodied in the capital and governance structure of, can potentially facilitate the growth of LMFs. D(A)Os refer to organisations that rely on blockchain technology and smart contracts as their source of governance and respond to both digital and human input.²⁴ In recent years, D(A)Os and platforms to create D(A)Os have emerged as ways to coordinate the supply of capital and labour in a globally distributed manner.²⁵ An important aspect of creating such organisations has been the design of governance systems that align incentives in a manner that promotes high-quality input as well as active member participation. This has prompted an outpouring of interest in decentralised governance,²⁶ and consequently led to proposals which employ game theory and technology to achieve, *in abstracto*, the formation of organisations, the financing of projects and high-quality and active member participation. In essence, these proposals strive for *corporate governance-by-design*.²⁷ This bears a strong resemblance to the start-up and coordination issues faced by LMFs. It is hypothesised that LMFs, particularly those operating online workplaces, may draw beneficial lessons from these experiments in decentralised governance. This is the first study that seeks to bridge the gap between worker cooperative and blockchain technology.

To explore this hypothesis, this article is structured as follows. The second section of the article elaborates on the governance structure of an archetypical LMF, a worker cooperative,²⁸ their main advantages according

11. T. Balliester and A. Elsheikhi, 'The Future of Work: A Literature Review', *International Labour Office Research Department Working Paper* 2018: 29, at 20, 26-27, 33.
12. F. Fakhfakh, V. Pérotin & M. Gago, 'Productivity, Capital and Labor in Labor-Managed and Conventional Firms: An Investigation on French Data', 65 *ILR Review* 847, at 850 (2012).
13. S.P. Thompson, 'Is the Mondragón Co-operative Experience a Cultural Exception? The Application of the Mondragón Model in Valencia and Beyond', 47 *Journal of Co-operative Studies* 19, at 19 (2014).
14. S. Zamagni and V. Zamagni, *Cooperative Enterprise: Facing the Challenge of Globalization* (2010), at 58.
15. P. Ranis, 'Argentine Worker Cooperatives in Civil Society: A Challenge to Capital-Labor Relations', 13 *WorkingUSA: The Journal of Labor and Society* 77, at 83 (2010).
16. M. Ji, 'The Worker Cooperative Movement in South Korea: From Radical Autonomy to State-Sanctioned Accommodation', 59 *Labor History* 415, at 428 (2018).
17. California, Massachusetts, New York, Ohio, Vermont, Washington and Wisconsin being particularly prominent. See, A. Johnson and M. Hoover (eds.), *Democracy at Work: U.S. Directory of Worker Cooperatives & Guide to Democratic Business Resources* (2015), at 10, 74-78.
18. J.M. Podivinsky and G. Stewart, 'Why is Labour-Managed Firm Entry So Rare? An Analysis of UK Manufacturing Data', 63 *Journal of Economic Behavior & Organization* 177, at 188 (2007); J.M. Podivinsky and G. Stewart, 'Modeling Proportions: Random Effects Models of UK Firm Entry', 54 *The Singapore Economic Review* 367, at 374 (2009).
19. Basterretxea and Storey, above n. 4, at 302-3, 307-8.
20. Cf. S. Arando, M. Gago, D.C. Jones, T. Kato, 'Efficiency in Employee-Owned Enterprises: An Econometric Case Study of Mondragón', 68 *ILR Review* 398, at 417, 421 (2015). They find that LMFs can be highly demanding and stressful workplaces due to (self-imposed) high expectations of their work.
21. This is an argument that has been made for over a century, starting with B. Potter, *The Cooperative Movement in Great Britain* (1891). An overview of the degeneration thesis is provided in K. Langmead, *Exploring the Performance of Democracy and Economic Diversity in Worker Cooperatives* (2017), at 24-27.
22. Cf. I. Bretos, A. Errasti & C. Marcuello, 'Ownership, Governance, and the Diffusion of HRM Practices in Multinational Worker Cooperatives: Case-Study Evidence from the Mondragón Group', 28 *Human Resource Management Journal* 76, at 76-77, 81-82, 85 (2018); P. Battilani and H.G. Schröter, 'Conclusion: The Decisive Factors of Cooperatives'

Future – Their Nature, Longevity, Role, and Environment', in P. Battilani and H.G. Schröter (eds.) *The Cooperative Business Movement, 1950 to the Present* (2012), at 266-7.

23. H. Hansmann, 'When Does Worker Ownership Work? ESOPs, Law Firms, Codetermination and Economic Democracy' 99 *The Yale Law Journal* 1749, at 1816 (1990). These untenable circumstances are discussed in Section 2.4 on the scarcity of worker cooperatives.
24. Cf. Most recently, P. De Filippi and A. Wright, *Blockchain and the Law* (2018); P. Hacker and C. Thomale, 'Crypto-Securities Regulation: ICOs, Token Sales and Cryptocurrencies under EU Financial Law' (2018) <https://ssrn.com/abstract=3075820>; I.M. Barsan, 'Legal Challenges of Initial Coin Offerings (ICO)', 3 *Colloque* 54 (2017).
25. S. Davidson, P. De Filippi & J. Potts, 'Blockchains and the Economic Institutions of Capitalism', 14 *Journal of Institutional Economics* 639, at 643 (2018).
26. Cf. W. Reijers, F. O'Brolcháin & P. Haynes, 'Governance in Blockchain Technologies & Social Contract Theories', 1 *Ledger* 134 (2016); M. Atzori, 'Blockchain Technology and Decentralized Governance: Is the State Still Necessary?' (2016), <https://ssrn.com/abstract=2709713>.
27. This is distinct from public regulation by design and privacy by design, discussed in D.K. Mulligan and K.A. Bamberger, 'Saving Governance-By-Design', 106 *California Law Review* 697 (2018). Corporate governance by design is of legal and political interest as such technological innovations can shape public orders in lasting ways. See L. Winner, 'Do Artifacts Have Politics?', 109 *Daedalus* 121, at 128 (1980).
28. As with most corporate entity forms, there are jurisdictional differences in the characteristics of a worker cooperative. Therefore, this archetype is based on the Principles of European Cooperative Law (PECOL) which were published in 2017 and are derived from a synthesis of the cooperative laws of the UK, Finland, France, Germany, Italy, Portugal, Spain and the EU. G. Fajardo, A. Fici, H. Henry, D. Hiez, D. Meira, H.-H. Muenker & I. Snaith. *Principles of European Cooperative Law:*

to theoretical and empirical literature and the policy-level support for their growth, which has gained urgency with the emergence of the platform-mediated, collaborative economy. This section is concluded with a consideration of the central causes of the scarcity of LMFs. The third section of the article provides a brief overview of smart contracts and D(A)Os, as they are key to understanding the governance and incentive system of decentralised organisations. The fourth section presents a case study of one D(A)O platform, Colony, created by Collectively Intelligent Ltd. that seeks to create decentralised, open, self-organising companies where decision-making power is intertwined with high-quality labour input. The case study was conducted by reviewing Colony's legal and technical documentation, software development platform (Github), social media posts and presentations through which information about the project is shared.²⁹ First, the aspirations of the Colony project are mentioned, along with its proposed governance structure. Second, its governance features are assessed against that of a worker cooperative. This permits a tentative analysis of the Colony protocol's potential to address some of the perceived governance shortcomings of worker cooperatives, particularly when operating across borders. In view of this sample governance structure, self-imposed institutional rules may be deployed by worker cooperatives in their by-laws to avoid some of the main pitfalls associated with labour management³⁰ and thereby vitalise the use of an alternate form of business organisation. The fifth section sums up and concludes.

2 Labour Management and Ownership of Businesses

2.1 The Archetypical LMF: The Worker Cooperative

In a bid to distinguish cooperatives from other legal entity forms, the International Co-operative Alliance (ICA), a representative body of the international cooperative movement, and the International Labour Organization (ILO) promote a set of core values and principles integral to the cooperative identity. All cooperatives, including worker cooperatives, value 'self-help, self-responsibility, democracy, equality, equity and solidarity; as well as ethical values of honesty, openness, social responsibility and caring for others'.³¹ This is implemented through seven principles: (1) voluntary and

open membership; (2) democratic member control; (3) member economic participation; (4) autonomy and independence; (5) education, training and information; (6) cooperation among cooperatives; and (7) concern for the community.³² In particular, worker cooperatives seek to create and maintain sustainable jobs and wealth, which will dignify human work, improve worker-members' quality of life, allow democratic self-management and enable local and community development.³³ This is reflected in the capital and governance structure of worker cooperatives.

In a worker cooperative, most, if not all, of the capital of these firms is held by worker-members.³⁴ While worker cooperatives are generally permitted to have non-member employees, this is usually set at a low threshold and employees are often given the option of becoming members.³⁵ To become a member, an employee must not only complete a certain amount of hours of work (*i.e.* a probation period) but must usually contribute a 'buy in' to the cooperative as well, which may be redeemable at face value upon exit from the cooperative.³⁶ As the purpose of the business is to undertake economic activities in the interest of its worker-members, rather than to make a profit for the cooperatives itself or external investors,³⁷ cooperatives make allocations to mandatory and voluntary reserves from their cooperative transactions (*i.e.* surplus of revenue over costs) and profitable non-cooperative transactions (*e.g.* holding shares in other companies).³⁸ Most often, surplus, if discretionarily distributed as refunds, is received by members in proportion to their work (measured in hours worked) for the worker cooperative.³⁹ In the event of a loss being incurred, they are first covered through the reserves of the cooperative before turning to the members, in proportion to 'the quantity and/or quality of their participation in cooperative transactions within the limit of the value of the goods and services received'.⁴⁰ In case of business failure, as the assets and reserve of the worker cooperative are commonly held, if the worker cooperative is liquidated, the residual net assets are distributed according to the principle of disinterested distribution, that is, to associated cooperatives or the community.⁴¹

Principles, Commentaries and National Reports (2017), at 2-4. It also incorporates the description of V. Perotin, 'What Do We Really Know About Workers' Co-Operatives?', in A. Webster, L. Shaw & R. Vorberg-Rugh, *Mainstreaming Co-operation: An Alternative for the Twenty-First Century?* (2016).

29. The author also had conversations with two of the authors of the Colony White Paper, Jack du Rose and Dr. Aron Fischer, about the project.

30. Dow, above n. 2, at 76.

31. Art. 3(a), ILO Recommendation 193 concerning the Promotion of Cooperatives, 2002.

32. ICA, *Statement on the Cooperative Identity*, 1995; ICA, *Guidance Notes to the Co-operative Principles*, 2015.

33. CICOPA-COOP, *World Declaration on Worker Cooperatives* (2005), at 2.

34. Section 3.1, PECOL acknowledges the possibility that cooperatives can 'use shares, reserves, loans and other financial instruments as sources of capital, providing they are compatible with their cooperative nature'.

35. Section 1.5(3), PECOL. In some jurisdictions, like the UK, it is mandatory for individuals who are eligible (*i.e.* have worked a minimum number of hours) to be offered membership. Footprint Workers' Co-operative Ltd. and Seeds for Change Lancaster Co-operative Ltd., *How to set up a Workers' Co-op*, 4th ed. (2015), at 110.

36. Sections 3.2(2), 3.3, PECOL.

37. Section 1(1) PECOL.

38. Sections 3.6-3.7, PECOL.

39. Section 3.6(3)(a), PECOL.

40. Section 3.6(6)(b), PECOL. This is in keeping with members' limited liability under Section 3.5, PECOL.

41. Section 3.8(2), PECOL. *Also see* Fajardo *et al.*, above n. 28, at 94. This requirement has helped LMFs avoid the theorised problem of under-investment (*i.e.* a horizon problem) – workers choosing to maximise the

These firms share the characteristic of providing work-members a voice in governance,⁴² either on a one-member, one-vote basis or based on the extent of their non-capital contribution.⁴³ In many of these firms, delegated management still exists, but the directors are elected by workers and the latter retain an extensive right to ask questions and be informed and consulted.⁴⁴ In some cases, they may have the right to vote on issues of major corporate interest.⁴⁵ In certain firms, members may be involved in a range of strategic decisions, from setting trading hours to exploring new markets to introducing a product.⁴⁶ What is notable, however, is that it appears that there is a risk for worker participation to become more shallow as cooperatives internationalise.⁴⁷

While worker cooperatives continue to be marginal organisational forms in developed economies, the appeal of worker cooperatives endures. An estimated 11 million people presently work in such cooperatives as worker-members.⁴⁸ Across the globe, they are present in a variety of industries, from sheet metal factories⁴⁹ to media,⁵⁰ from the cultural sector⁵¹ to cutting-edge ICT.⁵² In France⁵³ and Italy,⁵⁴ there is a relatively high proportion of worker cooperatives in manufacturing and construction respectively. However, the predominant view is that capital-intensive sectors, involving tasks with a high degree of standardisation, will continue to be predominated by KMFs while those in which personal relations and human creativity feature heavily are more amenable

to worker ownership and management.⁵⁵ This coincides with the view of organisational theorists, who observe that those engaged in knowledge-intensive work tend to be less indifferent about hierarchical employment relations and believe that 'the locus of decisions has to coincide with the locus of knowledge'.⁵⁶

2.2 The Appeal of Worker Cooperatives to Workers

From the non-executive workers' perspective, worker cooperatives hold the promise of lower wage differentials than KMFs⁵⁷ and improved benefits, such as collective private health insurance.⁵⁸ Based on cross-cultural evidence, it would appear that LMFs also provide stronger guarantees of employment stability, as LMFs tend to prefer reducing hours of work, rather than laying off worker-members, in response to recessions.⁵⁹ An ideal-type worker cooperative allows workers an involvement in organisational decision-making that goes far beyond the voluntarist human resource management practices (e.g. agile management) used by KMFs.⁶⁰ Along with being given a voice in production processes, workers are also given a say in key governance decisions, which reduces information asymmetry between labour and management. Instead of viewing workers as a monolithic group with uniform interests, individual preferences and views can be better communicated. In short, as workers hire managers, rather than the other way round, labour management and ownership avoids the dishonouring of workplace bargains⁶¹ – such as the unilateral termination of certain rights to voice. This allows workers to develop, simultaneously, a sense of self-determination in how they work⁶² and solidarity with each other.⁶³ This is manifested in how worker coopera-

firm's present value instead of pursuing long-term gain. See Fakhfakh, Pérotin & Gago, above n. 12, at 855.

42. Section 2.3(4)(b), PECOL.

43. Section 2.4(8)(a), PECOL.

44. Potentially extending beyond the minimum information and consultation rights ordinarily enjoyed by workers in the EU under Directive 2002/14/EC, OJ 2002 L 80/29, industry-specific legislation and legislation concerning changes of corporate control.

45. B. Bakikoa, A. Errasti and A. Begirstain, 'Governance of the Mondragon Corporación Cooperativa', 75 *Annals of Public and Cooperative Economics* 61, at 68 (2004).

46. Cf. A. Cathcart, 'Directing Democracy: Competing Interests and Contested Terrain in the John Lewis Partnership', 55 *Journal of Industrial Relations* 601, at 611 (2013); S. Hernandez, 'Striving for Control: Democracy and Oligarchy at a Mexican Cooperative', 27 *Economic and Industrial Democracy* 105, at 122 (2006).

47. Particularly if that host state does not have a solid cooperative tradition. Bretos, Errasti & Marcuello, above n. 22, at 82.

48. CICOPA, *Industrial and Service Cooperatives: Global Report 2015-2016*, at 9 (2017).

49. S. Jaumier, 'Preventing Chiefs from Being Chiefs: An Ethnography of a Co-Operative Sheet-Metal Factory', 24 *Organization* 218 (2017).

50. In Greece, there are examples of cooperatives newspapers (e.g. Efsyn), online media (e.g. Alterthess) and radio stations (e.g. Flash FM). E. Siapera and L. Papadopoulou, 'Entrepreneurialism of Cooperativism?', 10 *Journalism Practice* 178, at 185 (2016).

51. One of the leading symphony orchestras in the world, the London Symphony Orchestra, is a LMF and has been so for over a hundred years. C.P. Mulder, *Transcending Capitalism Through Cooperative Practices* (2015), at 35-37.

52. RChain Coop is a cooperative building a blockchain platform, www.rchain.coop/.

53. Fakhfakh, Pérotin & Gago, above n. 12, at 852.

54. J. Pencavel, L. Pistaferrri, and F. Schivardi, 'Wages, Employment, and Capital in Capitalist and Worker-Owned Firms', 60 *Industrial and Labor Relation Reviews* 23, at 28 (2006).

55. V.N. Zamagni, 'The Co-operative Enterprise: A Valid Alternative for a Balanced Society', in S. Novkovic and T. Webb, *Co-operatives in a Post Growth Era* (2014), at 196; Dow, above n. 2, at 78.

56. A. Grandori, 'Knowledge-Intensive Work and the (Re)emergence of Democratic Governance', 30 *Academy of Management Perspectives* 167, at 173 (2016).

57. C. Heales, M. Hodgson & H. Rich, *Humanity at Work: Mondragon, a Social Innovation Ecosystem Case Study* (2017), at 51; G.K. Dow, *Governing the Firm: Workers' Control in Theory and Practice* (2003), at 76.

58. Mulder, above n. 51, at 42.

59. Dow, above n. 2, at 74, summarising evidence from the USA, Italy and Uruguay.

60. T. Dobbins and T. Dundon, 'The Chimera of Sustainable Labour-Management Partnership', 28 *British Journal of Management* 519 (2017).

61. *Ibid.*, at 521-2; P. Thompson, 'Financialization and the Workplace: Extending and Applying the Disconnected Capitalism Thesis', 27 *Work, Employment and Society* 472, at 478-479 (2017).

62. Having more decision-making powers allows workers to develop a feeling of being trusted. See B.S. Frey and R. Jegen, 'Motivation Crowding Theory', 15 *Journal of Economic Surveys* 589, at 601 (2001); T. Ellingson and M. Johannesson, 'Paying Respect', 21 *Journal of Economic Perspectives* 135, at 139 (2007); V.H. Bernström and H. Svare, 'Significance of Monitoring and Control for Employees' Felt Trust, Motivation, and Mastery' 7 *Nordic Journal of Working Life Studies* 29, at 43 (2017). The authors also note how worker perceptions of being monitored due to a managerial fear of shirking can engender unpleasant feelings and counterproductive behaviour.

63. M. Parker et al., 'Imagining Alternatives', in M. Parker et al. (eds.), *Routledge Companion to Alternative Organizations* (2014) 31, at 32, 36-37. The Editors of this book see worker cooperatives as one of the

tives, and LMFs in general, are able to account for quality-of-life issues and individual and team well-being.⁶⁴ As a consequence, it is easy to understand why labour management and ownership has gained particular resonance in the context of the 'collaborative economy', given the effects it has had on the nature of work.⁶⁵ The actors in this space include individuals providing services, users of these services and the online platforms that mediate their interactions by offering access and executing tripartite contracts.⁶⁶ Economic theorists have characterised such online platforms as being multisided markets⁶⁷ which enable value-creating transactions by facilitating service providers and users finding each other and developing interdependence. In a labour intermediation platform, such as Etsy or Uber, the greater the number of workers on the platform, the more that platform appeals to other workers (*i.e.* a direct network effect). Conversely, the presence of a large number of potential clients persuades more workers to join the platform (*i.e.* an indirect network effect).⁶⁸ The collaborative economy accounted for 26.5 billion EUR in gross revenue in 2016 and created approximately 394,000 jobs across the European Union member states.⁶⁹ While creating employment opportunities and consumer value, from the perspectives of those who work on, or through these platforms, they create a downward pressure on permanent, full-time, subordinated employment relationships towards nonstandard employment and self-employment.⁷⁰ This creates new pressures on worker representation institutions, such as trade unions and works councils, that have been built around the employment relationship.⁷¹ This reversion to pre-twentieth century employment practices serves some well,⁷² particularly those who have highly coveted skills and scope for job mobility, but it exposes many

others to job precarity and income insecurity.⁷³ This trend can also be seen as cynical exploitation of workers' own frustrated desires for freedom and self-determination.⁷⁴

Firms representing such cooperative qualities have begun to emerge in the collaborative economy, with the ambition of providing less precarious workplaces and more broadly accountable organisations.⁷⁵ These platforms put the interest of the user-members at the forefront, by involving them in the financing and management of the platforms. These range from cooperative platforms like Doc Servizi,⁷⁶ a 8,000-person creative workers' cooperative in Italy, to Stocksy,⁷⁷ a platform cooperative that accepts and provides royalty-free stock footage.

2.3 Worker Cooperatives as Competitive Firms

In addition to these potential benefits for worker-members, worker cooperatives are also competitive businesses in their own right. Agency theory suggests that worker ownership aligns the economic interests of the organisation and individual workers, thereby promoting productivity and organisational loyalty.⁷⁸ This is in contrast to KMFs where information asymmetries and differing interests may lead to a fear that employment bargains will be reneged at a future date or that optimal firm-specific investments will not be made by either labour or management.⁷⁹ Providing feedback and suggestions on production processes allows firms to benefit from the workers' experience and knowledge of the technology, organisation and market environment.⁸⁰ Moreover, the costs of monitoring diminish, in comparison to KMFs, as workers are incentivised to monitor each other.⁸¹ Going beyond agency theory, motivation crowding theory suggests that feelings of independence and self-governance can act as intrinsic motivation to work in the interest of the organisation, even where there may be little or no direct financial reward on offer.⁸² This is of particular relevance in knowledge-intensive and creative

alternative organisations that can potentially embody the principles of autonomy, solidarity and responsibility.

64. M. Atzeni and M. Vieta, 'Between Class and Market: Self-management in Theory and in the Practice of Worker-Recuperated Enterprises in Argentina', in M. Parker *et al.* (eds.), *Routledge Companion to Alternative Organization* (2014) 47, at 56. The authors highlight how workers are able to modulate production in keeping with the needs of the team.
65. A. Ben-Ner, 'The Life-Cycle of Worker-Owned Firms in Market Economies', 10 *Journal of Economic Behavior and Organization* 287, at 296 (1988). Ben-Ner hypothesised that organisational and technological innovations that affect the workplace would drive the demand for worker-owned firms. According to the EU Agenda for the Collaborative Economy, the term 'refers to the business models where activities are facilitated by collaborative platforms that create an open marketplace for the temporary usage of goods or services often provided by private individuals'. EC Communication, 'A European Agenda for the Collaborative Economy', COM (2016) 356 final, at 3.
66. V. Hatzopoulos, *The Collaborative Economy and EU Law* (2018), at 7.
67. D.S. Evans and R. Schmalensee, *Matchmakers* (2016), at 8.
68. Hatzopoulos, above n. 66, at 9-10.
69. Technopolis Group, VVA Consulting and Trinomics, *Study to Monitor the Economic Development of the Collaborative Economy at Sector Level in the 28 EU Member States* (2018), at 12.
70. CICOPA-COOP, *The Future of Work: Where do Industrial and Service Cooperatives Stand?* (2018), at 11.
71. J. Prassl, *Collective Voice in the Platform Economy: Challenges, Opportunities, Solutions* (2018), at 14.
72. S. Deakin, 'The Contract of Employment: A Study in Legal Evolution', 11 *Historical Studies in Industrial Relations* 1, at 29 (2001).

73. This can range from manual labourers to creative workers, cutting across generations and disproportionately affecting women. G. Standing, *The Precariat* (2011), at 59; U. Huws, 'Capitalism and the Cyberariat: Contradictions of the Digital Economy', *Monthly Review*, 1 January 2015.
74. P. Frase, 'Beyond the Welfare State', *Jacobin*, 11 December 2014; E. Chiapello, 'Evolution and Co-optation: The "Artist Critique" of Management and Capitalism', 18 *Third Text* 585, at 593 (2004).
75. N. Schneider, 'An Internet of Ownership: Democratic Design for the Online Economy', 66 *The Sociological Review Monographs* 320 (2018).
76. www.docservizi.it/ (last visited 1 December 2018).
77. www.stocksy.com (last visited 1 December 2018).
78. J.P. Bonin, D.C. Jones & L. Putterman, 'Theoretical and Empirical Studies of Producer Cooperatives: Will Ever the Twain Meet?', 31 *Journal of Economic Literature* 1290, at 1303 (1993); G. Nuttall, *Sharing Success: The Nuttall Review of Employee Ownership* (2012), at 22-28.
79. Ben-Ner, above n. 65, at 293.
80. Dow, above n. 2, at 77.
81. This fundamentally differs from hierarchical monitoring as worker cooperatives preserve the right of individual members to challenge authority and commands. See Jaumier, above n. 49, at 223.
82. Frey and Jegen, above n. 62, at 595, 597-8.

industries where workers may have to work extra hours, without compensation, to complete a project.⁸³

The recent empirical evidence on this offers a nuanced picture of the commercial benefits of labour management and ownership and the conditions needed to achieve it. One study that compared sales per employee between 300 US firms that are majority or fully employee owned, with similarly sized comparator firms that are investor owned, substantiates the idea that growth in employee stake in firms and influence in decision-making lead to improvements in productivity.⁸⁴ Another study, examining a panel of 7,000 French firms, 500 of which were employee owned, reveals that worker cooperatives (SCOPs) in France are as productive, if not more, than KMFs.⁸⁵ The fact that worker cooperatives prioritise job stability means that they are willing to introduce wage flexibility, if it will ensure the survival of the firm.⁸⁶ However, in a longitudinal study of two of the largest employee-owned retailers in Europe, the John Lewis Partnership and Eroski, it was found that the former had lower absenteeism and higher job satisfaction rates among worker-members than their capital-managed counterparts, while the latter had higher absenteeism rates and lower job satisfaction rates. The authors of the study attribute this to differences in the quality of management across the two firms; in balancing the need to respond to crises with agility and decisiveness, with the goal of invigorating and implementing a culture of shared ownership.⁸⁷ While workers in LMFs may be willing to take on more responsibility, a lack of vigilance in monitoring performance and ineffectively communicating business needs – including engaged member participation – may hamper these goals.

It is for these perceived advantages that worker ownership has long received policy-level attention at the European level. During the 1980s and 1990s, the European Parliament recognised the role of cooperatives in improving working conditions,⁸⁸ regional development through job creation and preservation in local communities⁸⁹ as well as contributing to women's integration into the workplace.⁹⁰ In view of this, the Parliament called for, *inter alia*, investigations into how the formation of worker cooperatives can help rescue distressed business-

es⁹¹ and for incentives to be 'provided for innovative sectors and that steps should be taken to facilitate access by women to new technologies'.⁹² In parallel to these developments, the idea of creating a transnational European cooperative was also promoted, the origin of which dates back to the earliest consultations on establishing a European commercial company in the 1960s.⁹³ It was noted in policy discussions, and subsequently in the recitals of the European Cooperative Society (SCE) Regulation, that cross-border cooperation between cooperatives was inhibited by legal and administrative barriers – given the lack of harmonisation of national cooperative laws – and that the community was 'anxious to ensure equal terms of competition' for cooperatives with limited liability companies.⁹⁴ Following the enactment of the SCE Regulation, the European Commission issued a far-reaching Communication⁹⁵ to promote the visibility and use of cooperatives. More recently, the role that cooperatives may have in providing start-up support, administrative and accounting spaces as well as workspaces for self-employed persons was particularly noted in a 2016 study commissioned by the European Commission.⁹⁶ The European Parliament has also observed the interest in developing cooperative alternatives to collaborative economy companies.⁹⁷ Notwithstanding the appeal of worker cooperatives and their positive reception, it still remains difficult for entrepreneurs to establish cooperatives, nationally and especially transnationally, in comparison to KMFs. The next section discusses this further.

2.4 The Scarcity of Worker Cooperatives

There has been theoretical and empirical research into the reasons for the scarcity of worker cooperatives and other LMFs for at least sixty years.⁹⁸ Over this period, a number of hypotheses have been tested, most notably – whether worker-members tend to underinvest in the firm ('horizon problem'), whether workers are less productive ('shirking' and 'free-riding' problems), whether members seek to replace exiting members with employees so as to maximise individual refunds ('degeneration problem') and whether there are fewer LMFs being born in comparison to KMFs ('birth rate problem'). As indicated by the empirical research described in Section 2.3, it would appear that worker cooperatives are not inherently dysfunctional. They have the capacity to be as productive as KMFs and have high survival rates. In contrast to the shibboleth that worker cooperatives inevitably degenerate into KMFs, researchers have

83. Cf. A. Alacovska, 'Informal Creative Labour Practices: A Relational Work Perspective', 71 *Human Relations* 1563, at 1585-1586 (2018). Alacovska offers a relational perspective on creative labour practices, emphasising how feelings of friendship and kinship motivate non/under-remunerated work.

84. B. Kramer, 'Employee Ownership and Participation Effects on Outcomes in Firms Majority Employee-Owned Through Employee Stock Ownership Plans in the US', 31 *Economic and Industrial Democracy* 449, at 466-467 (2010).

85. In the printing and publishing, paper and wood industries, worker cooperatives have been found to be more productive (in terms of output) than KMFs. Fakhfakh, Pérotin & Gago, above n. 12, at 867.

86. See G. Burdin, 'Are Worker-Managed Firms More Likely to Fail Than Conventional Enterprises? Evidence from Uruguay', 67 *ILR Review* 202, at 224, 226 (2015).

87. Basterretxea and Storey, above n. 4, at 315-7.

88. EP Resolution, OJ 1983 C 128/51.

89. Recital 12 EP Resolution, OJ 1994 C 61/231; Recitals 3-4 EP Resolution, OJ 1987 C 246/94.

90. EP Resolution, OJ 1998 C 313/234; EP Resolution OJ 1989 158/380.

91. Recital 3, EP Resolution, OJ 1983 C 128/51.

92. Recital 3, EP Resolution, OJ 1998 C 313/234.

93. C. Chomel, 'The Long March of the European Cooperative Society', *Recma*, no. 291, 1, at 2 (2004).

94. Recitals 6 and 11 Regulation (EC) 1435/2003, OJ 2003 L 207/1.

95. EC Communication on the promotion of co-operative societies in Europe, COM (2004) 18 final.

96. Bock *et al.*, above n. 1, at 27.

97. Recital 11 EP Resolution on a European Agenda for the collaborative economy (2017/2003(INI)).

98. Starting with B. Ward, 'The Firm in Illyria: Market Syndicalism', 48 *American Economic Review* 566 (1958).

found that time-tested cooperatives undergo periods of cyclical degeneration and regeneration.⁹⁹ In areas where they do have shortcomings – such as lower average wages compared to peers in comparable KMFs¹⁰⁰ – it can often be attributed to the fact that worker cooperatives are different by design from their capitalist counterparts. For instance, empirical research in Italy has found that worker cooperatives have (marginally) lower and more volatile wages compared to peers in comparable KMFs. This is complemented with having more stable employment.¹⁰¹ It would therefore seem that worker cooperatives prioritise stability and retention of members over wage certainty.

Instead, at present, it would appear that the two major reasons for the scarcity of worker cooperatives is a very low birth rate¹⁰² and, if and when created, coordination problems as the entity scales across borders.

The low birth rate has three major factors: a lack of information about the worker cooperative option, the lack of a conducive legal environment and scarcity of financing options.¹⁰³ An example can illustrate how visibility continues to be a pertinent problem for potential cooperators. A recent study commissioned by the European Commission acknowledges the importance of digital tools in supporting the platform-mediated labour market, and noted instances of good practices that include platform cooperatives,¹⁰⁴ yet the new Proposal for a Directive regarding the use of digital tools and processes in company law falls short in making the cooperative form a visible and viable alternative for entrepreneurs. If the Proposal is adopted in its current form, member states will only be required to provide online templates of company constitution instruments for company forms mentioned in a proposed Annex IIA, such as the UK Private Company Limited by Shares or Guarantee. The provision of templates for other limited liability company forms,¹⁰⁵ such as a cooperative,¹⁰⁶ remains optional.¹⁰⁷ This appears to be the result of path dependence – as entrepreneurs have shown a pref-

erence for the company forms specified in Annex IIA – yet this may make such entities a default choice, especially for start-ups. In short, cooperatives and companies will no longer be in equal competition, as set out in the aforementioned recitals of the SCE Regulation.

This lack of familiarity with the worker cooperative form also makes it difficult to finance their formation. In the absence of sufficient collateral, the workers' own savings or loans from friends and family, worker cooperatives traditionally have difficulty in obtaining debt financing. As a consequence of legal regulation and/or ideological principle, worker cooperatives can only accept limited non-member equity investment.¹⁰⁸ In any case, conventional financiers, such as private equity funds, are dissuaded from investing in worker cooperatives as they are not profit-oriented and the requirement to be majority member-controlled inhibits the grant of substantial equity positions to external investors. Instead, they often have to rely on a single, large private customer,¹⁰⁹ a sympathetic public authority¹¹⁰ and/or community contributions, through mechanisms such as crowdfunding.¹¹¹ (Admittedly, the quality and value of LMF membership is hard to estimate even for the most ideologically committed capital contributor.¹¹²) This financing challenge is also seen as one of the major deterrents to the formation of SCEs,¹¹³ as a minimum capital of EUR 30,000 is required,¹¹⁴ which is beyond the scope of many small businesses that may wish to operate across borders.¹¹⁵

Turning to the coordination issues that occur upon the formation of worker cooperatives, collective action theory suggests that the heterogeneous preferences of equal worker-members make it difficult to arrive at decisions expeditiously.¹¹⁶ Competing with capitalist firms means that there are time constraints on decision-making and worker-members may not respond to the market rapidly enough.¹¹⁷ This is borne out by the studies on the larger worker cooperatives, such as Eroski, discussed in Section 2.3.¹¹⁸ In view of this, worker-members have to work longer hours, under more stress, with serious consequences for their own health.

This coordination problem is accentuated as cooperatives scale or internationalise. With advances in modern technology, such as those discussed in Section 3, it is

99. C. Cornforth, 'Patterns of Cooperative Management: Beyond the Degeneration Thesis', 16 *Economic and Industrial Democracy* 487, at 494 (1995); Y. Stryan, 'Understanding Cooperatives: The Reproduction Perspective', 65 *Annals of Public and Cooperative Economics* 59, at 62-65 (1994).

100. J. Pencavel, L. Pistaferri & F. Schivardi, 'Wages, Employment, and Capital in Capitalist and Worker-Owned Firms', 60 *Industrial and Labor Relations Review* 23 (2006).

101. *Ibid.*

102. Dow, above n. 2, at 78.

103. Ben-Ner, above n. 65, at 289-90. This is particularly true when worker cooperatives are formed 'defensively' – as a last resort by workers to prevent business closure and maintain jobs. T. Kerswell and S. Pratap, *Worker Cooperatives in India* (2019), at 80. This makes the durability of Argentina's *empresas recuperadas* (worker-recuperated enterprises) all the more remarkable.

104. Bock *et al.*, above n. 1.

105. The broader ambit of this term can be seen in Art. 119(1) Directive (EU) 2017/1132, OJ 2017 L 169/46.

106. The fact that Directive (EU) 2017/1132, OJ 2017 L 169/46 explicitly countenances cooperatives qualifying as a limited liability company form is clear from Art. 120(2).

107. Art. 13(g), Proposal for a Directive amending Directive (EU) 2017/1132 as regards the use of digital tools and processes in company law.

108. K. Mikami, 'Cooperatives, Transferable Shares and a Unified Business Law', 87 *Annals of Public and Cooperative Economics* 365, at 374 (2016).

109. Jaumier, above n. 49, at 219.

110. Mulder, above n. 51, at 83-86.

111. Community Wealth Building, *An Introduction to Financing for Cooperatives, Social Enterprises, and Small Businesses* (2015), at 12-14.

112. Dow, above n. 2, at 79.

113. Only 41 are in operation as of 2018. See Libertas Institut, 25 August 2018, www.libertas-institut.com/wp-content/uploads/2018/08/sce-list.pdf.

114. Art. 3(2), Regulation (EC) 1435/2003, OJ 2003 L 207/1.

115. A. Fici, 'The European Cooperative Society Regulation', in D. Cracogna *et al.* (eds.), *International Handbook of Cooperative Law* (2013) 115, at 120, 145, 149.

116. Hansmann, above n. 23, at 1772-1779.

117. Atzeni and Vieta, above n. 64, at 53.

118. Basterretxea and Storey, above n. 4.

possible for workers to cooperate across borders even if their enterprise is small in scale. In certain sectors, like the creative and tech industry, it is difficult to avoid as the workplace is globalised.¹¹⁹ However, coordinating such business practices in a distributed manner, without the use of a third-party platform intermediary, involves high transaction costs. The evidence from the few worker cooperatives that have grown in scale¹²⁰ and internationalised¹²¹ their operations indicates a negative trend in participatory management, mutual monitoring and solidarity. It has been seen that contrasting cooperative cultures and restrictive legislation on worker organising in the host state inhibit the replication of cooperative practices.¹²²

Having canvassed the appeal and drawbacks of worker cooperatives, the remainder of the article explores how the organisational innovations developed by D(A)O platforms would potentially address some of these start-up and coordination problems. This analysis is predicated on the understanding of blockchain as an institutional technology, which can coordinate economic activity in novel ways.¹²³ To do so, the next section sketches how smart contracts and D(A)Os work, before presenting a particular D(A)O platform and the governance structure it has designed for D(A)Os created through its platform.

3 Understanding the Technology: Smart Contracts and D(A)Os

Developers of D(A)Os¹²⁴ draw inspiration from transaction cost economics and the nexus of contracts theory of corporations, where the corporation is viewed as a 'complex set of contracts among managers, workers, and contributors of capital' that mediate relationships in a hierarchical structure to internalise and diminish transaction costs.¹²⁵ This is reflected in their belief that decentralised (autonomous) organisations can emerge from a

complex set of 'smart contracts'. Smart contracts are software deployed on a blockchain (most famously, Ethereum) which, for a small transaction fee ('gas'), is capable of receiving and storing cryptocurrency (e.g. 'Ether') and tokenised representations of assets. They also contain conditions subject to which an exchange of assets and transactions will take place (e.g. passage of time, a certain event). As such, a smart contract can act as an escrow account, as well as automate certain functions of ordinary contracts. A simple example of a smart contract involves a transfer of cryptocurrency for an asset. Once the payment is made to the smart contract, for the contract to be executed, the nodes of the blockchain will verify that the transferees' wallets respectively hold the claimed sum of cryptocurrency and the asset. If validated, the smart contract will receive a message to automatically self-execute and the exchange will take place. The blockchain will then be updated to reflect the transfer of asset ownership as well as the change in cryptocurrency amounts in the participants' wallets.¹²⁶ As a result, third parties – whether they be title registries or courts – are not required to enforce the transaction. Unless the smart contract has a dispute resolution 'safety valve' built in, the parties will not be able to stop the performance of the contract.¹²⁷ Moreover, smart contracts do not need to be triggered ('called') by human parties to a contract but can also respond to inputs from off-chain third parties (oracles) that a certain event has occurred.

Following the creation of smart contracts, the idea soon arose of an algorithmically governed organisation which responds automatically to inputs from both digital and analogue sources.¹²⁸ The organisation would be composed of a collection of smart contracts which would have internal capital, discourage collusion among members, focus on automating transactions and, ultimately, have a peripheral role for human involvement. This idea was operationalised through the creation of The Decentralized Autonomous Organization (The DAO), for the purpose of decentralised crowdfunding. The DAO would allow participants to manage invested funds directly and for governance rules to automatically self-execute, once certain conditions were met.¹²⁹

The DAO set a minimum fundraising goal to be achieved within a defined period, failure to achieve which would have resulted in the funds being returned. During this 'creation phase', units of Ether could be sent to The DAO's smart contract address, in exchange for which The DAO would create and transfer 'DAO tokens'. These tokens conferred voting rights on their holders, in proportion to the number of tokens held.

119. V. Lehdonvirta, Otto Kässi, Isis Hjorth, Helena Barnard & Mark Graham, 'The Global Platform Economy: A New Offshoring Institution Enabling Emerging-Economy Microproviders', 45 *Journal of Management* 567 (2019).

120. T. Webb and G. Cheney, 'Worker-Owned-and-Governed Enterprises and the Wider Co-Operative Movement', in M. Parker et al. (eds.), *Routledge Companion to Alternative Organization* (2014) 64 at 76-77; Ben-Ner, above n. 65, at 297.

121. Cf. A. Errasti, I. Bretos & E. Etxezarreta, 'What do Mondragon Coopitalist Multinationals Look Like? The Rise and Fall of Fagor Electrodomesticos S. Coop. and its European Subsidiaries', 87 *Annals of Public and Cooperative Economics* 433 (2016).

122. Bretos, Errasti & Marcuello, above n. 22, at 85.

123. Davidson, De Filippi & Potts, above n. 25, at 641.

124. Hence, why projects like Colony cite Coase's seminal article on the Nature of the Firm on the first page of their White Paper. A. Rea, A. Fischer & J. du Rose, 'Colony: Technical White Paper', 27 July 2018, at 1, <https://colony.io/whitepaper.pdf>.

125. F.H. Easterbrook and D.R. Fischel, 'Limited Liability and the Corporation', 52 *University of Chicago Law Review* 89, at 89 (1985); O.E. Williamson, *The Economic Institutions of Capitalism* (1985).

126. www.ethdocs.org/en/latest/introduction/what-is-ethereum.html#ethereum-virtual-machine.

127. De Filippi and Wright, above n. 24, at 75.

128. Q. DuPont, 'Experiments in Algorithmic Governance: A History and Ethnography of "The DAO", a Failed Decentralized Autonomous Organization', in M. Campbell-Verduyn (ed.), *Bitcoin and Beyond* (2018) 157, at 159.

129. C. Jentzsch, 'Decentralized Autonomous Organization to Automate Governance' (2016), at 3 <https://download.slock.it/public/DAO/WhitePaper.pdf>.

They would be freely transferable and divisible.¹³⁰ As an entity, creating, storing and transferring tokens was the limit of what The DAO could achieve autonomously.¹³¹ For creating and voting on funding proposals, it required human Contractors. The off-chain projects that would result from successful funding proposals would be directly governed by token-holders, in proportion to the tokens they held, and returns would be distributed pro rata. These tokens could also be sold for fiat currencies through exchanges.

The creation of The DAO was met with a great deal of enthusiasm and during its initial creation phase, it raised US\$ 150 million worth of Ether.¹³² It was intended that The DAO would be an archetype for future decentralised organisations and in a sense, it was successful. The successful crowdfunding of The DAO – and the subsequent siphoning of over US\$ 50 million of Ether and investigation by the US Securities and Exchange Commission (SEC) – has served as a cautionary tale for everyone involved in the blockchain ecosystem. While its name is a misnomer, as key decision-making powers resided in certain humans, it continues to be the prime example of a decentralised organisation. The ambition of creating DOs and DAOs persists¹³³ but tempered with the knowledge that they are exposed to governance risks endogenous to decentralised systems operating under the logic of smart contracts and are subject to an array of off-chain risk and regulation.

rewards. Significantly, unlike currencies or securities, reputation cannot be transferred and is non-negotiable in crypto-capital markets.¹³⁶

Colony is still at an early stage of development and much of what is described below is based on its white paper, setting out the features the development team expects the layers of Colony to have. The development team have been building the Colony Network and Colony JS, a software library that enables independent developers to develop applications (dApps) that can interact with the underlying smart contracts. These colonies may be established to create software but also for tangible goods, such as jewellery. As one of the founders of Colony, Jack du Rose, began developing the platform as a way of solving problems he encountered while coordinating persons in a global, high-end jewellery supply chain,¹³⁷ the illustrative examples in the following subsection draw from the jewellery industry.

4.2 The Governance of Colony

To understand the governance of the Colony platform, it is necessary to consider the Colony Network, the Meta Colony and individual colony layers separately.

The Colony protocol¹³⁸ is built on the Colony Network, a collection of smart contracts deployed on the Ethereum blockchain by the Colony development team. These contracts provide the broad parameters in which colonies may be created, such as the fees charged to use the Network, upgrades of its functionality and the reputation mining mechanism.¹³⁹ Management of the Colony Network will be gradually ceded to a Meta Colony, the first, parent colony to be created on the Network.¹⁴⁰ When this has occurred, tokens in the Meta Colony (CLNY) will have been distributed and reputation can be earned in the Meta Colony through the completion of tasks, such as making updates to individual colony smart contracts. CLNY and reputation holders get to vote on the fundamental parameters of the Network (control rights) and receive a portion of the fee charged by the Network when individuals are paid.¹⁴¹ Moreover, CLNY holders act as reputation miners, calculating rep-

4 Case Study of Colony

4.1 What Colony Does

Colony is a platform that provides the infrastructure for creating an ecosystem of self-organising companies (*i.e.* 'colonies'),¹³⁴ by lowering the costs of a diverse group of people coordinating their efforts and resources to realise shared goals, even when they do not necessarily know or trust each other. The ambition of Colony is that this coordination will occur in the organisation created through its platform in a meritocratic manner through the dynamic allocation of *reputation*.

Reputation is a number that is associated with a person, reflecting the value of their recent contributions to a colony. It may be earned by bootstrapping colonies, successfully completing tasks and constructively resolving disputes.¹³⁵ This figure affects the extent of a person's control rights in the organisation as well as their share of

130. Securities and Exchange Commission, 'Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO' [DAO Report], 25 July 2017, at 6.

131. Jentzsch, above n. 129, at 2.

132. DAO Report, above n. 130, at 16.

133. See Colony, DigixDAO; MakerDAO and Hutten DDO, among others.

134. The name was inspired by the archetypal ant colony, a complex adaptive system that may be found in nature. See G. Rosenblatt, 'Is Colony a Glimpse of the Blockchain-Based Future of Work?', www.the-vital-edge.com/colony-blockchain/.

135. Rea, Fischer & du Rose, above n. 124, at 15. In the Meta Colony, reputation can also be earned through reputation mining.

136. *Ibid.*, at 14.

137. Blockchain Review, How Blockchain Technology is Enabling the Future of Work, https://www.youtube.com/watch?v=o_erLhcDqMU (last visited 1 December 2018).

138. In general, protocols are a set of rules and steps that facilitate effective communication between computers. As with the internet, the Colony protocol is one of several layers of protocols arranged in a stack through which information travels from one computer to another. The Colony protocol is in between the Ethereum decentralised data processing layer and the layer of applications that are deployed using Colony. In short, the Colony protocol provides the rules for the division of labour, decision making and financial management of decentralised organisations.

139. Rea, Fischer & du Rose, above n. 124, at 5. Individual colonies can opt in to the upgrades.

140. *Ibid.*, at 7-8.

141. *Ibid.*, at 7, 46-47. If the fee is paid in CLNY tokens, it is burned. If it is paid in white-listed external crypto-currencies such as Ether and DAI, it will be distributed to a reward pot and a working capital pot. If the fee is paid in a native colony token that is illiquid, monthly Dutch auctions will be held in which the native token can be acquired in exchange for CLNY tokens. These CLNY tokens are then burned (destroyed). I thank Jack du Rose for this information.

utation scores off-chain and updating reputation scores on-chain, for which new CLNY tokens and reputation are conferred as rewards.¹⁴² The functionality of CLNY tokens will be set initially by the Colony development team and the Ethereum community but eventually by the Meta Colony.

Individual colonies may be created to achieve a single goal or multiple goals, over a short or long time frame. They are entities with discrete purposes but act within the broad parameters set by the Colony Network. Regardless of the goal, they will substantially share the membership and governance rules described below due to the underlying smart contract code. As these rules are embodied in code, when they are being used they are much harder to skirt than institutional and social rules in a worker cooperative, where they may be under-enforced.¹⁴³ When a colony is created, it will generate its own native token that will primarily have financial value.¹⁴⁴ To achieve its goal(s), the work needed can be broken down into tasks and (sub) domains (*e.g.* assembly) in which tasks can be clustered. This is analogous to departments in an organisation. Domains can also be nested within wider domains, with the widest domain being the colony itself. Along with allocating a task to a domain, tasks will be tagged with relevant skills needed for its completion (*e.g.* #casting, #soldering). This may be a specific skill within a broader skill set (*e.g.* #design). Thus, there is an organisational tree and a skills tree, with participants able to earn and lose reputation in both.

To create and define a task, a person with sufficient reputation must deposit ('stake') colony tokens proportionate to the amount of reputation in the domain.¹⁴⁵ Reputation and colony tokens may be initially assigned as control rights and working capital at the time a colony is created to allow certain persons to set up tasks.¹⁴⁶ Otherwise, usually, a task initiator will submit a funding proposal from the pot (wallet) of a parent domain.¹⁴⁷ The proposal will specify the amount of funds needed and can be denominated in the colony's own currency or in Ether. If there is only one funding proposal for a task, there are sufficient funds in the pot and there are no objections, the smart contract will begin to release funds to the pot of the task. This materialises Colony's emphasis on completing work efficiently rather than voting on every decision. Once the funds needed for payment are in place (the bounty), the manager will have to enter into a tentative agreement with a worker who has the necessary skill set and reputation. When

joining the Colony platform, workers would have tagged their skill sets and managers can use this to search for one who is most appropriate for a task. After an agreement is reached, a task may be specified to them along with working guidelines, a due date and payment terms (for the worker, evaluator and manager).¹⁴⁸ While the manager may also act in the capacity of evaluator, this role can be delegated to a separate person as well. The evaluator may be unknown to the worker, as they may only be identifiable by their public key.

Following the completion and evaluation of the task, there will be three days to raise objections and disputes regarding the quality of the task performed. When there are no objections, the worker gets paid in the colony's native token or another approved cryptocurrency.¹⁴⁹ If paid in native tokens, the workers' reputation in their domain increases, as well as all the wider domains of which it is part, including the colony itself (*i.e.* the top-level domain). Simultaneously, their reputation for performing the tagged skill increases, as well as any wider, parent skills of which the skill is a part.¹⁵⁰ The sum of their top-level domain and top-level skills reputations determines their influence on decisions that affect the individual colony. To avoid disproportionate gains in reputation following the completion of a task, the bounty initially set should be consistent.¹⁵¹

If there is an objection, an objector must be able to defend his/her objection. Its content should not only specify why a task is inadequate and what could be done better, but also suggestions as to the 'reputations' (*i.e.* Colony members with a certain level of reputation) that should vote if a dispute arises and reasoning for why these reputations should vote. This allows objections to be scaled to a larger group of peers, whether at a domain, colony or Meta Colony level. This objection can only be made if an objector has a certain reputation score and stakes some of their own tokens.¹⁵² If no one makes a counter-stake to object to the objection, then the objection will pass and the worker will receive less/no pay. If someone does sufficiently counter-stake within three days, then a dispute will arise. The staking of tokens is needed not only to avoid frivolous objections but also to compensate the persons involved in settling a dispute through voting. The weight of their votes is contingent on a person's reputation in the skill and domain in dispute.¹⁵³ Being on the winning or losing side of a dispute has the corresponding effect of enhancing or diminishing reputation scores. The payment and reputational scores allotted to the worker or evaluator depends on the final score received after disputes are resolved. If the work is found to be inadequate, the worker will receive diminished payment and lose repu-

142. *Ibid.*, at 7, 19, 22. Calculating reputation scores off-chain saves costs incurred by Ethereum blockchain transactions.

143. Reyes analogises these parameters with choosing a corporate statute. C.L. Reyes, 'If Rockefeller were a Coder', 87 *George Washington Law Review* 1 (forthcoming 2018), at 34.

144. They will have a vote on changing the supply of native tokens in a colony, Rea, Fischer & du Rose, above n. 124, at 12. They will also be entitled to vote on arbitrary transactions, that is, actions that are unforeseen by the colony and the Meta Colony, at 49.

145. *Ibid.*, at 9.

146. *Ibid.*, at 17.

147. *Ibid.*, at 32-33.

148. *Ibid.*, at 9.

149. *Ibid.*, at 10.

150. The manager's token-holding and domain reputation rises or falls in the same manner, but their skill rating is not affected, *ibid.*, at 16.

151. *Ibid.*, at 13. The White Paper indicates that the tokens allocated could represent the hours worked.

152. Rea, Fischer & du Rose, above n. 124, at 39, Annex A.

153. *Ibid.*, at 42.

tation in their domain and their tagged skill, as well as parent and child domains and parent and child skills.

In addition to payment for completed tasks to workers, managers and evaluators, persons in the colony holding native colony tokens and reputation are entitled to rewards from the revenue earned by the colony.¹⁵⁴ This means that a worker in a colony, waiting for the next task to be assigned to them, can continue to earn (for a while) from the revenue they had helped generate.

4.3 Worker Cooperatives: Learning from the Colony Project

A close reading of the governance structure of colony reveals a startling resemblance to LMFs, such as worker cooperatives. Firstly, the economic activities are carried out primarily for the benefits of its participants. Secondly, most, if not all, of the capital of the organisation is held by the participants. This is indicated by the fact that tokens and reputation are issued exclusively to the participants of a new colony,¹⁵⁵ before gaining potential investors, and as such can only be gained through various forms of work: production, evaluation and management. This is akin to the common practice in the start-up technology sector of granting employees stock options,¹⁵⁶ but in this instance it is coupled with the right to have a voice in significant strategic decisions.

Thirdly, as currently designed, colonies have voluntary, open membership by default. Restricted membership is not mentioned in the Colony White Paper. This is characteristic of initiatives in open source communities, where objective peer review is critical and where, instead, there are concerns about keeping participants motivated and committed.¹⁵⁷ However, the key difference with open source communities is that colonies may not be limited to the private provision of public goods,¹⁵⁸ for which values such as the long-term striving for excellence may come into play.¹⁵⁹ Colonies may be used for the production of private goods as well.

Fourthly, Colony has what can be broadly described as dynamic meritocratic governance, where the weight of one's vote is dynamically adjusted according to one's contributions to a task, domain or colony. In itself, this is not contrary to cooperative principles as there are cooperatives which weigh voting power according to, for example, production.¹⁶⁰ Participants still have a voice in the governance and strategic decision-making of the col-

ony, as exemplified by the fact that anyone can set up a task for the colony to complete.

Fifthly, it is clear from the White Paper that the assets of a colony are conceptually distinct from that of the participants, as they are escrowed in a smart contract and associated pots. Access to these pots is conditional on a successful funding proposal. There is also a separate revenue pot from which rewards may be distributed or working capital replenished.¹⁶¹ Notionally, colony smart contracts can subsist indefinitely with tokens in escrow, even after it has been abandoned, indicating that it is technologically possible for the colony to have its own capital. Moreover, the payment of Network fees, which is reinvested to maintain the Network and to do useful supportive work (*e.g.* build applications) is also reminiscent of the cooperative practice of building financial reserves and investing in useful services (*e.g.* training) to sustain the mission of the business.

While taking these similarities into account, there are certain functionalities in Colony, which can potentially overcome the start-up and coordination costs that worker cooperatives often face, especially when operating across borders.

Decentralised organisations prefigure ready-made governance structures that are easily accessible online and are native to globally distributed blockchains. While the governance mechanism is technically complex, as with other digital applications, once launched its use will be intuitive and user-friendly. As such, these organisations can provide capital and governance structures for digitally native worker cooperatives to adopt.

In terms of financing, worker cooperatives can consider implementing a system in which financial rewards and decision-making power are generated through useful patronage, represented as separate quantified units, but with only the financial rewards being exchangeable – as they are with native tokens and reputation on the Colony platform.¹⁶² If the token gains use-value, then it can be sold or swapped for other, more widely used cryptocurrencies, which can tide over those who only have intermittent work. The relative transferability of a token compared to a partnership interest, a standard cooperative membership, or an employee share held in a trust, allows workers to diversify their risks, in the event their cooperative fails. At the same time, this allows for a certain amount of external investment to flow into the business. As (most) decision-making rights are not attached to native tokens independent of reputation, it may be acquired and held by third parties without diluting the

154. *Ibid.*, at 44–45.

155. *Ibid.*, at 13.

156. Cf. Index Ventures, *Rewarding Talent: A Guide to Stock Options for European Entrepreneurs* (2017), at 13.

157. See, *e.g.* G. von Krogh *et al.*, 'Carrots and Rainbows: Motivation and Social Practice in Open Source Software Development', 36 *MIS Quarterly* 649 (2012).

158. As open source software is often characterised as, see M.A. Rossi, 'Decoding the Free/Open Source Software Puzzle: A Survey of Theoretical and Empirical Contributions', in J. Bitzer and P.J.H. Schröder (eds.), *The Economics of Open Source Software Development* (2006) 15, at 33.

159. See the discussion on the social philosophy of Alasdair Macintyre in van Krogh *et al.*, above n. 157, at 661ff.

160. Section 2.4(8)(a), PECOL.

161. Rea, Fischer & du Rose, above n. 124, at 44.

162. Financial reward here refers to both a cryptocurrency for work done and a token from the revenue of the colony. Reputation, like labour, is inalienable from the worker-member. The development of online reputation systems allows skills, organisational contributions and organisational value to be represented more tangibly, homogeneously and dynamically than capital shares and labour membership. On the limitations of a LMF membership market due to the inalienability of labour, see G.K. Dow, *The Labor-Managed Firm: Theoretical Foundations* (2018), at 8.

decision-making rights of worker-members, as is the predominant concern with non-member investment.¹⁶³ In terms of collective action problems, a frequent criticism of worker cooperatives is time spent on meetings to reconcile heterogeneous interests,¹⁶⁴ and as such taking actions on the basis of tacit consent, rather than majority voting or unanimity, may in fact be preferable. Similarly, the requiring of staking of reputation and tokens in raising an objection can help avoid trivial disagreements about the quality of work. Turning to the aforementioned cross-border coordination issues, the fact that workers are drawn from different backgrounds prevents them from having a shared background in terms of politics, work and culture, which are usually associated with worker cooperatives.¹⁶⁵ Instead, reputation-weighted governance may be especially suited for organisations seeking to coordinate a heterogeneous, pseudonymous group of actors¹⁶⁶ who operate across a wide geographical territory with limited trust and state policing. While blockchain communities have only emerged in recent years,¹⁶⁷ history is replete with examples of such organisations. Examples range from the Amsterdam Stock Exchange in the seventeenth century¹⁶⁸ to modern Moroccan bazaars.¹⁶⁹ Contemporaneous examples include Usenet newsgroups, massive multiplayer online gaming and open source software developer communities. A common theme appears to be finding counterparties with desirable qualities (e.g. a certain set of skills and experience), while at the same time coordinating these individuals to ensure contractual performance and the pursuance of the collective interest.

This does not necessarily require external enforcement, through judges or regulators, but can be achieved through the threat of diminished reputation. The risk of losing reputation is sufficient motivation for performance by a party, especially when it is in their interest to have continuous transactions with a counterparty,¹⁷⁰ on a regular¹⁷¹ or irregular basis.¹⁷² As such, the fear of lost

reputation will 'crowd in' honesty in the long run.¹⁷³ This is true of online communities and project-based work, particularly in creative industries.¹⁷⁴ This, however, assumes that parties have sufficient information and knowledge of each other's reputations. Online reputation systems are able to address these information asymmetries to an extent, as user reviews and ratings provide granular information about a potential counterparty in a digestible form. Yet, peer-to-peer systems are vulnerable to manipulation by platforms that host them and biased reviewers, raising concerns about the system's own trustworthiness.¹⁷⁵

However, the manner of its deployment in the Colony protocol makes the system less prone to cronyism. Managers of tasks are incentivised to intuitively and objectively choose workers based on a quantification of their demonstrated skills and recent contributions, rather than personal characteristics, as they stake their own tokens when initiating a task. This score is not generated through ratings by (potentially) anonymous individuals with little to lose. Instead, evaluators stand to receive diminished payment and a reduced reputation score for inadequate evaluations, while contesting a task or decision through the dispute resolution mechanism requires risking tokens and reputation. A teething concern about the democratisation of reputation systems is that it will ultimately not be sustained, with its growing complexity leading to the emergence of oligarchy. One empirical study has already observed this trend with regard to peer-production projects, leading to structural changes in authority and a reorientation of organisational goals.¹⁷⁶ A key distinguishing feature of Colony's reputation system, however, is its degradability, which prevents early movers from resting on their laurels and incentivises the continuous, useful engagement of all members in the governance of colonies. To embed such a system in a worker cooperative, a link to a user-friendly portal that provides up-to-date individual reputation scores and accrued financial rewards may be provided in the section of the by-laws concerning membership.

5 Conclusion

Colony is one of a handful of blockchain projects currently exploring how to design organisations that work

163. It is also less clear-cut that a token, as described herein, will constitute a security as compared to tradable shares in a worker cooperative, which generally will. See K. Mikami, 'Are Cooperative Firms a Less Competitive Form of Business? Production Efficiency and Financial Viability of Cooperative Firms with Tradable Membership Shares', 42 *Economic Systems* 487, at 501 (2018); S. Zamagni and V. Zamagni, *Cooperative Enterprise: Facing the Challenge of Globalization* (2010), at 87-88.

164. Cf. G.F. Davis, 'Can an Economy Survive Without Corporations? Technology and Robust Organizational Alternatives', 30 *Academy of Management Perspectives* 129, at 137 (2016).

165. Z.F. Gamson and H.M. Levin, 'Obstacles to the Survival of Democratic Workplaces', in R. Jackall and H. Levin, *Worker Cooperatives in America* (1984) 220, at 225.

166. I. Bohnet, B.S. Frey & S. Huck, 'More Order with Less Law: On Contract Enforcement, Trust, and Crowding', 95 *American Political Science Review* 131 (2001).

167. DuPont, above n. 128, at 175.

168. E. Stringham, 'The Extralegal Development of Securities Trading in Seventeenth-Century Amsterdam', 43 *The Quarterly Review of Economics and Finance* 321, at 324 (2003).

169. C. Geertz, 'The Bazaar Economy: Information and Search in Peasant Marketing', 68 *The American Economic Review* 28, at 29 (1978).

170. Stringham, above n. 168, at 323-4, 336.

171. R.C. Ellickson, *Order Without Law* (1991), at 55-58, 214.

172. P.R. Milgrom, D.C. North & B.R. Weingast, 'The Role of Institutions in the Revival of Trade: The Law Merchant, Private Judges, and the

Champagne Fairs', 2 *Economics and Politics* 1, at 7-8 (1990); D.W. Brown, *When Strangers Cooperate* (1995), at 18.

173. Bohnet, Frey & Huck, above n. 166, at 132, 138.

174. J. Lerner and J. Tirole, 'Some Simple Economics of Open Source', 50 *The Journal of Industrial Economics* 197, at 218 (2002); P. Schörpf et al., 'Triangular Love-Hate: Management and Control in Creative Crowdworking', 32 *New Technology, Work and Employment* 43, at 46 (2017).

175. S. Ranchordás, 'Online Reputation and the Regulation of Information Asymmetries in the Platform Economy', 5 *Critical Analysis of Law* 127, at 134-8 (2018).

176. A. Shaw and B.M. Hill, 'Laboratories of Oligarchy? How the Iron Law Extends to Peer Production', 64 *Journal of Communication* 215, at 219, 229 (2014).

in the interest of its multi-stakeholder organisations.¹⁷⁷ These decentralised organisations reconfigure ownership within firms, enabling greater rights to the residual profits of the firm and control rights. In doing so, they bear a remarkable resemblance in the crypto-space to the early pioneers of worker cooperativism.

Undoubtedly, such projects (including Colony) entail risks and proactive cooperators should be wary of them when experimenting with blockchain technology. The regulatory status of crypto-tokens is still in flux¹⁷⁸ and sudden classification as a security can have deeply unpleasant, costly securities liability consequences for members.¹⁷⁹ This article has concentrated on the capital and governance structures of cooperatives, but it is still unsettled which legal structure would be most suitable for the goals of DOs while still providing the benefits of limited liability.¹⁸⁰ It is therefore important to be open to the idea of also using technologies other than blockchain in creating the governance and capital structure recommended in this article. Moreover, for the promoters of such businesses, as well as interested participants, it is necessary to challenge and grapple with the complexity of these governance structures in which corporate governance-by-design is sought, as it potentially embeds power structures in new and unexpected ways. Decades of research into cooperative degeneration and regeneration highlight the importance of being alive to the possibility of oligarchy emerging.

On a more optimistic note, blockchain projects such as Colony provide considerable insight into the technological and theoretical possibilities (and limitations) of decentralised governance. The proposed capital and governance structure of colonies may hold lessons for LMFs, such as worker cooperatives, in the process of being formed and those confronted with cross-border coordination problems as they expand overseas. These decentralised governance structures allow us to imagine self-employed persons or small businesses in Bangladesh, Uzbekistan and the Netherlands collaborating together in a joint venture, where power is not distributed according to capital or bargaining power, but reputation tied to the quality of their non-capital contributions. As blockchain technology is adopted more widely, this may be a part of a broader movement to achieve a more engaged, more effective participatory democracy across nation states.¹⁸¹ By providing the contours of how worker cooperatives may draw lessons from these block-

chain projects, this article has sought to contribute to the realisation of alternative economies¹⁸² in which there is greater scope for worker ownership.

177. DAOStack, <https://daostack.io/>; Aragon, <https://aragon.org/>; Steem, <https://steem.com>, among others (last visited on 8 December 2018).

178. W. Hinman, 'Digital Asset Transactions: When Howey Met Gary (Plastic)', 14 June 2018, <https://www.sec.gov/news/speech/speech-hinman-061418>.

179. For a case involving securities classification of a purported utility token, see *In Re: Munchee*, Administrative Proceeding File No. 3-18304, 11 December 2017, at 5-6.

180. Reyes, above n. 143, at 43 suggests the business trust. Indeed, some blockchain projects have incorporated as a cooperative, see Lars, 'ARK Creates a Unique Business Entity', *Medium*, 27 November 2017.

181. M.-L. Marsal-Llacuna, 'Future Living Framework: Is Blockchain the Next Enabling Network?', 128 *Technological Forecasting & Social Change* 226, at 232 (2018).

182. J.K. Gibson-Graham and G. Roelvink, 'The Nitty Gritty of Creating Alternative Economies', 30 *Social Alternatives* 29 (2011).

Abbreviations and Glossary

Blockchain Technology	A resilient, near-immutable, distributed and transparent database that can pseudonymously execute economic transactions. It can be public or private, thereby affecting who can interact with the blockchain. (See De Filippi and Wright, at n. 24, at 2)
CLNY	Meta Colony of the Colony protocol. The Meta Colony also has its own tokens, referred to as CLNY tokens.
Cryptocurrency/Currency Token	Tokens that are a unit of account and are used as a means of payment
D(A)O	Decentralised (Autonomous) Organisations that use blockchain technology and smart contracts as their primary or exclusive source of governance and respond to both digital and human inputs. (See De Filippi and Wright, at n. 24, at 136-7)
Investment Token	Tokens that have the characteristics of an equity instrument and embody expectations of future profit through the managerial efforts of others
KMF	Capital-Managed Firm
LMF	Labour-Managed Firm
PECOL	Principles of European Cooperative Law
Off-chain	All transactions that are not represented on the blockchain
Oracle	A third party, trusted by parties of a smart contract, that relays information from the outside world to a smart contract
SCE	European Cooperative Society
SEC	Securities and Exchange Commission of the United States of America
Smart Contract	Software that embodies an agreement between parties and then (self-)executes when certain conditions are met
Utility Token	Tokens that give a right of access to an online platform, product or service