Technovation 110 (2022) 102369

Contents lists available at ScienceDirect

Technovation

journal homepage: www.elsevier.com/locate/technovation

Introducing the concept of creative ancestry as a means of increasing perceived fairness and satisfaction in online collaboration: An experimental study

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ARTICLE INFO

Keywords:
Online collaboration
Laboratory experiment
Social justice
Creative ancestry
Blockchain

ABSTRACT

Online collaborations allow teams to pool knowledge from multiple domains, often across dispersed geographic locations to find innovative solutions for complex, multi-faceted problems. However, motivating individuals within online groups can prove difficult, as individual contributions are easily missed or forgotten. This study introduces the concept of creative ancestry, which describes the extent to which collaborative outputs can be traced back to the individual contributions that preceded them. We build a laboratory experiment to demonstrate the impact of creative ancestry on perceptions of fairness and output quality in online collaborations. Results from this experiment suggest the addition of creative ancestry has a positive impact on these variables and is associated with increasing perceptions of procedural justice and possibly interactional and distributive justice, dependent on the level of perceived creativity and cognitive consensus.

1. Introduction

The growth of digital technologies has created an increasing appetite for online collaborations, i.e. the pursuit of a shared objective by groups that include non-proximate members, whose participation is facilitated by ICT (Asatiani and Penttinen, 2019; Cheng et al., 2016; Liu et al., 2017; O'Leary, Gleasure, O'Reilly and Feller, 2020; Tapscott and Williams, 2008). Online collaborations take place on the web, where large projects can attract vast numbers of participants from different areas and with different interests (Kotlarsky and Oshri, 2005; Ransbotham and Kane, 2011). Common examples include mass-produced publicly-editable archives of information such as Wikipedia, global social questions, and answers sites such as Yahoo! Answers, and large open-source software projects such as Apache Hadoop. Similar developments have been taking place within large organizations, as intra-organizational platforms have emerged to facilitate globally dispersed teams and work-from-home employees (Chudoba et al., 2005; O'Leary and Cummings, 2007). Thus, many organizations rely on online teams interacting through voice, video, and text; meaning they may not work in a fixed space or even at the same time (Robert et al., 2008). The onset of the COVID-19 pandemic in 2020 accelerated the adoption of online collaboration as a mechanism for organizations to remain active and avoid complete economic shutdown (Dubey and Tripathi, 2020). This allows individuals with a range of backgrounds, expertise, and geographical locations to bring new perspectives to bear on various complex problems (Faraj and Sproull, 2000; Rodriguez et al., 2017; Surowiecki, 2004).

Online collaboration has changed the landscape for many industries, from entertainment, to software development, and even gold mining (Tapscott and Williams, 2008). Traditionally structured companies face competition from dynamic online communities which can harness the collective wisdom and talents of a global audience quickly and cheaply due to their ability to leverage flat, decentralized structures (Gupta et al., 2009). Yet concerns persist whether these online collaborations do enough to recognize individual contributions (Wang and Fesenmaier, 2003). Recognition for individual contributions is important, as many individuals require some form of formal or informal individual acknowledgement, which would motivate individuals to participate more in online collaborations (Wasko and Faraj, 2005). Situations where individual contributions are not sufficiently recognized can lead to negative consequences, including reduced perceptions of fairness across the team (Magni et al., 2018).

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https://doi.org/10.1016/j.technovation.2021.102369
Received 1 September 2020; Received in revised form 20 July 2021; Accepted 30 July 2021
Available online 13 August 2021

Traditional management structures impose strict controls and measures to determine the performance of individuals and sub-teams. This strategy is more challenging with online collaborations, due to the sheer number of contributions, and the changing roles required. For example, large numbers of non-specialized individuals tend to be effective at rooting out bad contributions; however, they may struggle when it comes to separating the good from the great (Klein and Garcia, 2015). The challenge of identifying high-value contributions places a premium on expert evaluations at some parts of the process but not others. Similar challenges occur when one individual proposes an idea and another adapts it, or when some individuals' contribution is an enabler of others (Forte et al., 2009). Hence, perceived fairness, or social justice has been found to be a key element in ensuring the success of these groups (Son and Kim, 2008; Wasko and Faraj, 2000). Yet it is not clear how such fairness can be accommodated. Transparency is often touted as the most important enabling quality (Sharma et al., 2002). Yet the value of transparency decreases where there are large numbers of unstructured interactions, as this limits both the reliability of their capture and our capacity to inspect them (Oldroyd and Morris, 2012; Woods et al., 2002). Thus, the aim of this study is to develop an approach for online collaboration systems that improves the perceived quality of outcomes by highlighting the value of individual contributions.

To address this challenge, this study presents a possible solution to the challenge of ensuring positive perceptions of fairness in online collaboration, specifically the concept of 'creative ancestry', i.e., the ability of a collaborative system to take some particular output of note and navigate backwards through the individual contributions that preceded it in a consistently structured, inspectable, and immutable manner. This construct avoids the information overload associated with transparency, while minimizing the complexity of assembling and integrating data to analyze individual contributions.

The next section discusses the need for perceived fairness and individual acknowledgement in online collaboration. Following this, we lay out a research model based on existing literature on social justice (Konovsky, 2000; Martínez-Tur, Peiró, Ramos and Moliner, 2006; Son and Kim, 2008). We then define the concept of *creative ancestry* and explain how increased *creative ancestry* for individual contributions could increase perceived fairness and, consequently, the perceived quality of the collaboration. Next, we describe a laboratory experiment to test the research model in a controlled setting. Results support the role of *creative ancestry* as an enabler of perceived collaboration quality. Structural equation modelling also shows the complex relationship between *creative ancestry*, different elements of perceived fairness, and moderating factors of cognitive group consensus and perceived group creativity. Finally, the implications of these findings are discussed for industry and research.

2. Theoretical background

2.1. Perceptions of fairness in online collaboration

Online collaboration has been referred to under a number of different synonyms in extant literature including, mass collaboration, online communities, and virtual work, for the purpose of this study, we consider online collaboration to be *the pursuit of a shared objective by groups that include non-proximate members, whose participation is facilitated by ICT* (Asatiani and Penttinen, 2019; Cheng et al., 2016; Liu et al., 2017; O'Leary et al., 2020; Tapscott and Williams, 2008). Such collaborations have become increasingly common inside and outside of organizations, as projects rely on large numbers of diverse participants to achieve the depth, breadth, and scale of expertise required (Cheung et al., 2016; Kane and Ransbotham, 2016). This has created a new 'flat world' of participation, where old collaborative hierarchies give way to more open and inclusive collaborations involving large numbers of online collaborators - collaborations that organizations must embrace within evolving and boundary-spanning technological ecosystems (Friedman, 2005).

The definition of online collaboration cited above may cover a broad range of collaborative groups, however, not all online collaborations are the same. In particular, online collaborations may vary widely by the types of tasks that their participants perform. O'Leary et al. (2020) classify forms of online collaboration along two axes: the range of collaboration participation and, the competition between inputs. For example, Open Source Software Development draws upon a dynamic community of actors and commons of inputs to synergistically create a complex information good (Crowston and Wade, 2010). Yet extensive participation requires a level of technical experience that not all users possess, placing practical restraints on what some potential contributors can do (Bagozzi and Dholakia, 2006). This contrasts with high-inclusion platforms such as wikis, where low technical barriers encourage contribution from individuals with a wider range of backgrounds (Pei Lyn Grace, 2009). Second, contributions may be essentially cooperative and iterative, as in wikis and Open-Source Software Development, or contributions may be in high-competition, i.e., one or more contributions is selected from a larger set of less-desirable alternatives. An example of limited-inclusion/high-competition collaboration is Threadless; a platform where graphic designers put forward ideas for imagery on clothing and other users vote on which are put into production. An example of high-inclusion/high-competition collaboration is Walker's crowdsourcing initiative/platform 'Do Us a Flavor' competition, where members of the public suggested new flavors for crisps, then voted for the eventual winner (Forbes and Schaefer, 2017).

The system developed in this study facilitates online collaboration with high levels of both ranges of collaboration participation as well as competition between inputs. With the increase in competition in these use-cases there is also increased incentive to act dishonestly (Cartwright and Menezes, 2014; Rick et al., 2008). Therefore, we propose that the addition of *creative ancestry* will inflate perceptions of fairness and, overall quality in the collaboration.

Traditionally, collaborative groups were restricted to collocated environments to ensure optimal communication and coordination between team members (Gupta et al., 2009). Online collaboration has been actualized through advancements in ICT, removing the barriers of co-located collaboration and providing access to global expertise (Vlaar et al., 2008; Watson-Manheim, Chudoba and Crowston, 2012). O'Leary et al. (2020) develop a model for online collaboration, highlighting the complexities of social and material, as well as endemic and relational factors which must be balanced for online collaborations to be successful. Motivating individual team members is paramount in successful online collaboration (Cummings and Dennis, 2018; Wasko and Faraj, 2005). The distributed nature of online collaborations may create tensions with the need for individual acknowledgement when ideas are successful, as online collaboration pools large amounts of disparate competencies in a way that is often difficult to disentangle (Tapscott and Williams, 2008; Yan et al., 2018).

The importance of acknowledging successful contributions in online collaboration is meaningful, as individual acknowledgement is key for repeated participation (Oh et al., 2016). For contributors, a lack of intellectual, social, or material reward means there is little motivation to continuously engage (Wasko and Faraj, 2005). This is especially problematic when competition between contributions is high and/or inclusivity is high among contributors. This leads to phenomena such as 'social loafing' or 'free-riding'; a common occurrence in online collaborations where participants exert less effort on a collaborative task than they would on a comparable individual task (Ling et al., 2005). Free-riding occurs when team members decrease their own efforts and expect others to pick up the slack (Suleiman and Watson, 2008), this can be due to a belief that one's contribution is dispensable and does not contribute to the success of the group (Dennis and Valacich, 1993; Diehl and Stroebe, 1987; George, 1992; Paulus, 2000). Free-riding in online collaboration can influence the *heterogeneity of participation* (Weinberger and Fischer, 2006). Furthermore, members of a group feel that the responsibility for the success of the group does not rest on their shoulders to the same extent as the success of an individual task would (Latané et al., 1979), a problem referred to as 'diffusion of responsibility' (Bandura et al., 1996). Free-riding is particularly relevant in the case of online collaboration due to the temporary nature of most teams, members will be more likely to behave in an untrustworthy manner and take more from the team than they give in return (Lin and Huang, 2009; Sarker et al., 2011). With high levels of participation from members who were not working in a co-located environment and were not personally familiar with one another, the task of assigning credit to contributors became increasingly difficult (Beranek et al., 2005; Chidambaram and Tung, 2005).

Perhaps more importantly, the ability to identify others making valuable contributions is an important antecedent to relationship-building (Altschuller and Benbunan-Fich, 2013). Research has found that feedback given on an individual basis did not result in a reduction in the levels of free-riding in a group. However, when feedback was given to all members of the group and member's feedback was visible to all other members, this acted as a comparative tool and decreased level of free-riding (Suleiman and Watson, 2008). Hence, online collaboration systems require a balance of group-level feedback and individual accountability to overcome free-riding, suggesting the origins and evolution of group outputs must be part of the evaluation process (Suleiman and Watson, 2008; Wang and Fesenmaier, 2003).

2.2. Factors influencing perceived social justice

As outline above, individual acknowledgement is crucial to ensure repeated participation, which is required for the focus of this research, i.e., high-participation/high-competition online collaboration (O'Leary et al., 2020). When individual contributions are not acknowledged, it gives rise to concerns over whether or not there is fairness across the team in terms of reward, expectations, resource support, and recognition (Magni et al., 2018). This led us to explore the role of perceived fairness in online collaboration. Studies of fairness or justice attempt to understand what working individuals believe to be fair as well as their response to (in)justice (Li and Cropanzano, 2009). Social justice (also referred to as perceived fairness) is perceived along multiple dimensions, notably between employees (Fortin et al., 2019; Masterson et al., 2000), between managers and employees (McFarlin and Sweeney, 1992), and between the organization as an entity and its employees (Greenberg, 1988). Prior psychological research has noted the importance of perceived social justice in online collaboration, where contrasting perceptions of surveillance and depersonalization may create suspicions the paradigm will be abused (Alge, 2001; Zweig and Webster, 2002). The following sub-sections discuss the three major components of social justice, specifically *distributive justice*, *procedural justice*, and *interactional justice*.

Distributive justice primarily relates to the perceived fairness of outcomes that one party receives from another party based on their inputs into an exchange relationship (Son and Kim, 2008). Son and Kim (2008) illustrate that this can be applied to a customer-retailer relationship where a customer inputs money and/or time into the relationship in expectation of goods or services. Similarly in an online setting, users must make the decision of whether or not to expose their personal data to the service they are using in exchange for the benefits of using the service (Son and Kim, 2008). An absence of distributive justice can result in knowledge hiding defined as an intentional attempt, by an individual, to conceal knowledge or information that has been requested by another person, regularly occurs in the workplace (Babič et al., 2019; Connelly et al., 2012). Knowledge hiding has been shown to be a problem in information sharing settings where sharedness refers to the distribution of information before a discussion (Steinel et al., 2010). Collaborators, especially junior or shy individuals, may also refrain from sharing their ideas in case they come under ridicule; a tendency referred to as 'evaluation apprehension' (Diehl and Stroebe, 1987). Allowing individuals to contribute without disclosing their identity has been found to reduce these effects and increase participation (Connolly et al., 1990; Jung et al., 2010), particularly where groups contain recognized experts (Collaros and Anderson, 1969). Steinel et al. (2010) found that pro-social-participants reveal their unshared information, and contribute important information to the group decision, while pro-self-participants withhold or distort their private information. The selfishness of pro-self-participants explains why knowledge management initiatives in organizations fail. Improving distributive justice in information sharing settings may contribute to the success of collaborative initiatives.

Procedural justice refers to the perceived fairness of the process associated with the allocation of limited resources for members, relative to demand (Wu and Chiu, 2018). *Procedural justice* can be further subcategorized into subjective and objective *procedural justice*, where objective *procedural justice* refers to actual or factual justice, and subjective *procedural justice* refers to perceptions of objective procedures and their capacity to enhance fairness judgements (Konovsky, 2000). Prior research highlights three key rules which should be satisfied for fair procedures (i) the consistency rule, which states that the allocation of procedures should be consistent across persons and over time (ii) the bias-suppression rule, which states that personal self-interests and decision-makers should be prevented from operating during the allocation process and (iii) the representativeness rule, which states that needs, values, and outlooks of all parties should be considered equal in the process (Leventhal, 1976; Richter et al., 2016; Theodorakopoulos et al., 2015).

Interactional justice describes the manner in which an individual perceives their interpersonal treatment from decision makers during an exchange relationship (Cropanzano et al., 2002). This differs from *procedural justice*, as *interactional justice* focuses on the social instance-specific component of an exchange, rather than the generalized formal standards and rules for interactions (Wu and Chiu, 2018). Thus, perceptions of *interactional justice* are closely linked to interpersonal trust between parties involved in an exchange (Lu, 2006). Knowledge sharing in functionally diverse teams has been found to improve as the level of affect-based trust in a team increased (Cheung et al., 2016). It is important to encourage knowledge sharing at all stages of a collaboration as individuals often voice ideas early in the collaborative process that are deemed of marginal value, only to have those ideas re-emerge later on with little or no credit to the original contributor (Diehl and Stroebe, 1987). Online collaborations are particularly vulnerable to this effect, as much of the benefit comes from allowing individuals to operate in parallel when groups are large (Gallupe et al., 1992). Establishing trust is particularly relevant for online collaboration, which asks individuals to commit time and effort to shared goals in the hope others will do the same (Piccoli and Ives, 2003; Wasko and Faraj, 2005).

2.3. Creative ancestry and perceived fairness

Online collaborations allow large numbers of individuals to contribute to a project, either by producing/suggesting content directly or by filtering mass-produced content into more manageable siloes of quality contributions (Klein and Garcia, 2015; Ransbotham and Kane, 2011). However, most collaborations are sustainable only if the relative contribution of each individual can be identified and acknowledged (Ling et al., 2005). This identification and acknowledgement of individual contributions presents three problems for online collaboration.

First, the relationship is not always positive between a collaborator's frequency of collaboration and their creative/constructive impact. Many collaborations have been hijacked by a subset of contributors, who use their frequent interactions to impose selfishly-desirable goals and hierarchies (Kittur and Kraut, 2008), Lee and Seo (2016) find that many Wikipedia articles are decided by the 'dominant few rather than the trivial many'. This can mean many individuals who appear disengaged or 'free-riding' were actually struggling to have their voice heard before becoming disillusioned and giving up (Bandura et al., 1996; Latané et al., 1979). Research on crowdsourcing further suggests this sense of limited interaction also decreases collaborators' psychological ownership of the outputs (Gleasure and Feller, 2016; Zheng et al., 2018). In the knowledge building domain, a key design principle is to *democratize knowledge* by ensuring that all participants feel that they are legitimate contributors to shared goals, and understand that their diverse contributions benefits the group (Scardamalia and Bereiter, 2010).

Second, an inability to determine the origins of an idea means it is difficult to acknowledge/reward those who contributed most. This creates resentment among the more committed collaborators and reinforces lazy or selfish behaviors among the least committed (George, 1992; Suleiman and Watson, 2008). Such resentment alienates core community members over time, stagnating progress and diluting interest among specialists (Chidambaram and Tung, 2005; Kidwell and Bennett, 1993). Studies of computer-supported collaborative learning (CSCL) show that awareness information, that is, "knowledge about group members' behavioral activities (e.g., what are they doing?), their knowledge and skills (e.g., what do they know and what are they able to do?), and social activities (e.g., how is the group functioning?)", is an important prerequisite to successful collaboration (Janssen and Bodemer, 2013). Tools which improve awareness of participation have been found to influence online collaboration (Buder, 2011; Janssen et al., 2011).

Third, the inability to trace the evolution of ideas creates problems for managing intellectual property (IP) rights. This is especially challenging for online collaborations, the purpose of which is ultimately to produce emergent knowledge that transcends the understanding of any one person or group involved (Kittur and Kraut, 2008; Surowiecki, 2004). This is a significant issue, given IP ownership is a key asset for many individuals and firms and the threat of uncertain ownership and/or theft can create serious issues (Bauer et al., 2016).

In sum, the main problem we are looking to address in the present study is the perception of fairness in online collaboration. This study posits that by better determining the relationship between the contributions of individuals and the output of the group, improving the ability to determine the origin of ideas in online collaboration, and improving the management of IP rights, we could improve perceptions of fairness in online collaboration. Below, we propose the construct of *creative ancestry* and how this provides an appropriate solution.

The intuitive answer to address these issues is to accommodate the ability for further inspection and ensure all interactions are open to scrutiny (Sharma et al., 2002). However, such a solution is not practical. MS Words 'track changes' feature supports further inspection on all interactions, however, this in only applicable for collaborations between relatively few participants and would not scale to support large online collaborations. Also, users of MS Word will understand that it can quickly become difficult to manage multiple contributions and identify how an output evolves from the original to its final edit. Large, online collaborations may have hundreds of thousands of interactions, meaning even if they could all be reliably captured, the scale prohibits extensive inspection (Oldroyd and Morris, 2012; Woods et al., 2002). Notable examples of this include Wikipedia's contribution history. While this solution successfully captures individual contributions made by thousands of participants, the most common contribution is for minor edits such as adding links, formatting, and spelling (Zhao et al., 2013). Perhaps most importantly, it also does not align with the output-specific backwards-traversing needs of the practical problem. Not all collaborations need to be inspected; only those that eventually produced some outcome which contributes to the success of an online collaborative effort. Online collaborations are considered successful should they achieve their stated 'shared objective' (O'Leary et al., 2020). Hence, we propose the concept of '*creative ancestry*', i.e., the ability of a collaborative system to take some particular output of note and navigate backwards through the individual contributions that preceded it in a consistently structured, inspectable, and immutable manner.

Consistently structured refers to the format in which the contribution is presented on the system. *Creative ancestry* proposes that all contributions will be presented in an identical format, regardless of who the contributor is, or when they make their contribution. The presence of consistent structure is important, as the ability to inspect interactions shrinks if the presentation and format of those interactions requires continuous interpretation. This has been demonstrated in studies of mental load, which show repeating presentational structure and hierarchy lowers attentional and working-memory demands (DeStefano and LeFevre, 2007). By maintaining a consistent structure, we avoid high-element interactivity, which would require additional working-memory demands (Sweller et al., 2019; Sweller et al., 1998). Thus, consistent structure allows inspecting agents to separate details of interest from other data or meta-data.

Interaction-level inspectability refers to the ability to inspect each contribution individually, despite the volume of contributions which may be made to the system. The presence of interaction-level inspectability is important, as this allows each interaction to be evaluated independently by collaborators. This is important, as systems must typically not only take efforts to be fair; they must also take efforts to demonstrate their intentions to be fair (Fulmer and Gelfand, 2012). This is often referred to in studies of platform or institutional trustworthiness as 'integrity' (Robert et al., 2009), meaning collaborators not only believe evaluators are capable and benevolent, they also understand how those evaluators are making judgements.

Finally, immutability refers to the inability to modify or delete a contribution once it has been submitted to the system. The presence of immutability is important, as this prevents malicious or dishonest parties from attempting to interfere with records of interactions. Without such immutability, the reliability of these records would rely on the competence and integrity of some controlling body or group. This can be problematic if trust in that controlling body or group is undermined, at which point the value of legitimate inspectability is compromised by suspicions of selective record-keeping (Allcott and Gentzkow, 2017).

Thus, *creative ancestry* avoids the information overload of full transparency, while minimizing the complexity of assembling and integrating data when analyzing individual contributions. *Creative ancestry* resonates with constructs in the neighboring fields of computer-supported cooperative work and computer-supported collaborative learning. One such construct is *common ground*, which provides the precondition for individuals to share information about their knowledge, beliefs, and understandings in a collaboration (Clark and Brennan, 1991). A second related concept is *transactive memory systems*, which provide a group with information about where in the group, that is, in which individual memory, specific knowledge is stored (Engelmann et al., 2009). An efficient transactive memory system facilitates information allocation and retrieval coordination, which describes groups plans for how content that is saved in the group can be efficiently retrieved. A third concept is *group awareness*, which describes a person's knowledge about their social and collaborative environment (e.g., knowledge about the activities, presence, or participation of group members) (Janssen et al., 2011). Group awareness tools can assist collaborators in collecting the required information to collaborate effectively in CSCL environments. Each of these existing constructs are primarily effective as preconditions to support and encourage collaborations. *Creative ancestry* differs in that it is intended to improve perceptions of fairness during and after participants have collaborated.

3. A model of creative ancestry and perceived fairness in online collaboration

Fig. 1 presents the research model for this study, which explains why *creative ancestry* may impact *collaboration quality*. This model builds upon models proposed and validated by Folger and Konovsky (1989), Colquitt (2001), Tyler and Blader (2003), and Wu and Chiu (2018).

We predict that *creative ancestry* will have a positive impact on each

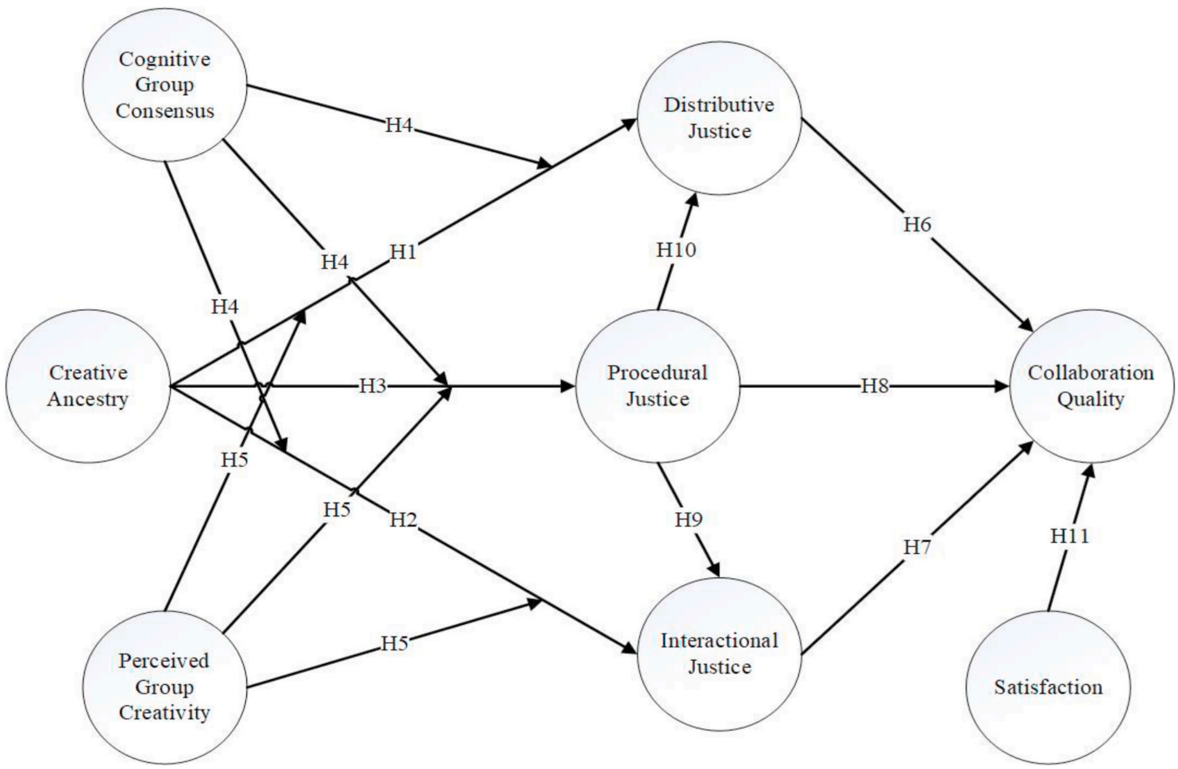

Fig. 1. Core research model.

dimension of perceived *social justice*. For *distributive justice*, where high-resource individuals (intellectual, social, or material) share freely and make best use of their assets, *creative ancestry* should bring attention to the higher proportional contribution of those individuals. Similarly, *creative ancestry* should provide greater visibility where those high-resource individuals choose to behave selfishly. This ability to identify selfish individuals is important so other collaborators can hold them accountable and factor their behaviors into future collaborations (Bertot et al., 2010). *Distributive justice* will primarily be enabled through the pseudonymity of users, which as discussed earlier has been found to be an effective mechanism for reducing evaluation apprehension among collaborators and increase participation (Connolly et al., 1990; Jung et al., 2010).

Hypothesis 1. Creative ancestry positively impacts on perceived distributive justice.

For interactional *justice*, the addition of creative ancestry reduces the opportunity for duplicitous individuals to present themselves differently to some groups than others. This is important, as one of the main enablers of oppression and bullying is the ability to isolate individuals, spread reputation-harming rumors, and create barriers to information-sharing (Newman et al., 2005). This allows third party perceptions to be manipulated in a way that hides abusive behaviors, so reducing the likelihood of formal or informal sanctioning (Rayner and Hoel, 1997; Van der Wal, De Wit and Hirasing, 2003). By proposing a mechanism which will capture all contributions from participants in an immutable manner, we expect to improve interactional justice. Thus, creative ancestry limits the potential for oppressive or otherwise unfair interactions by creating a traversable and exhaustive record of interactions that is openly visible to all.

Hypothesis 2. Creative ancestry positively impacts on perceived interactional justice.

For procedural *justice*, the addition of creative ancestry affords scrutiny over the application of rules and processes, any attempts to circumvent them, and how they are enforced (Bertot et al., 2010; Mawby, 1999). A common legal dictum states 'Justice should not only be done, but should manifestly and undoubtedly be seen to be done' (attributed to Lord Chief Justice Hewart in the 1924, quoted from (Marmor, 2005). Thus, creative ancestry is essential for widespread confidence that collaborative interactions cannot be skewed in favor of specific individuals or escape scrutiny. We expect creative ancestry will enable procedural justice by proposing a mechanism which will guarantee that the rules and processes are enforced equally for all users of the system.

Hypothesis 3. Creative ancestry positively impacts on perceived procedural justice.

Two additional control variables are included in the form of cognitive group *consensus*, which refers to similarity among group members regarding how key issues are defined and conceptualized (Mohammed, 2001; Mohammed and Ringseis, 2001) and perceived group creativity (Nunamaker et al., 1987; Paulus and Nijstad, 2003). Group creativity is said to occur when a "bounded and recognizable collection of individuals works interdependently toward a shared goal of developing output that is both novel and useful" (Harvey, 2014). The effect of creative ancestry on perceived social justice assumes some shared output has been produced. However, this is not necessarily the case for all collaborations, particularly online collaborations. First, large numbers of heterarchical participants means consensus may not occur. This is often the case in large open source software collaborations, which can 'fork' into multiple separate projects (Stewart and Gosain, 2006). It also occurs in sites such as Wikipedia, where contributing groups can become adversarial and territorial (Kittur and Kraut, 2008). Under these conditions, the positive potential of creative ancestry is less obvious, as increased visibility may bring negative aspects of the collaboration to light, perhaps increasing the sense of injustice. Instead, the goal should be to achieve symmetric knowledge *advancement*, whereby knowledge does not move only from the more knowledgeable to the less knowledgeable group, but both groups gain in knowledge through their participation in a joint effort (Scardamalia and Bereiter, 2010). Second, not all collaborations produce creative outcomes likely to inspire collaborators to seek credit. Some collaborations simply peter out over time, often resulting in those responsible becoming dispassionate (Martin and Eisenhardt, 2010). Hence, a lack of meaningful output may also mean the impact of creative ancestry diminishes, as there is nothing of note to inspect. Thus, the following moderating relationships are also considered.

Hypothesis 4. The impact of creative ancestry on the perception of distributive, interactional, and procedural justice is positively moderated by cognitive group consensus.

Hypothesis 5. The impact of creative ancestry on the perception of distributive, interactional, and procedural justice is positively moderated by perceived group creativity.

The impact of perceived distributive justice on collaboration is well-established in contexts where individuals, groups, and organizations must work together towards common goals (Griffith et al., 2006; Wu and Chiu, 2018). In some cases, such collaborations occur within organizations, e.g. as regards perceptions of power disparity with managers in large organizations (Cropanzano et al., 2007). These perceptions of perceived distributive justice may take on many forms, notably regarding benefits and pay (Tremblay et al., 2000). In many other cases, perceptions of distributive justice have a strong impact when individuals in one organization collaborate with individuals in another. For example, it was found that perceived distributive justice played an important role in the formation of satisfactory supply chains, as partners were reluctant to engage with other entities with whom power relations were asymmetrical (Wu and Chiu, 2018). At an abstract level, online collaboration concerns the supply chain of individual contributions from a diverse range of participants, thus, we predict a similar positive impact for online collaborations:

Hypothesis 6. Perceived distributive justice positively impacts on online collaboration quality.

The impact of perceived interactional justice on collaborations is also well-established. Perceptions of interactional justice are incrementally embedded in a social exchange climate and it is this accumulation of instance-level social exchanges that differentiates interactional justice from procedural justice (Cropanzano et al., 2002). Interactional justice considers the quality of interpersonal treatment perceived by exchange partners, higher levels of which lead to greater mutual collaborative effort (Luo, 2007). However, interactional justice is not only perceived at an individual-level, but also at a relational level. As with, distributive *justice*, interactional justice has been found to positively impact supply-chain collaborations, in which well-defined input-output structures can reassure collaborators the relationship is beneficial and reciprocal in the long term (Griffith et al., 2006). Thus, we also predict a positive impact for perceived interactional justice on online collaboration:

Hypothesis 7. Perceived interactional justice positively impacts on online collaboration quality.

The impact of perceived procedural justice is potentially more complicated than distributive justice and interactional justice. Procedural justice relates to the formal policies and procedures which manage a relationship (Masterson et al., 2000). This ultimately represents the core agreed-upon collaborative structure for the group; a structure that should transcend identity and encourage bilateral commitment (Tyler and Blader, 2003). However, while distributive and interactional justice operate, at least partly, independently, the perception of procedural justice is entangled with other forms of justice. One collaborator may interact badly with another without there necessarily being any distributive injustice. Similarly, distributive injustice does not necessarily imply interactional injustice. Yet, either interactional or distributive injustice is required for there to be procedural injustice. For example, the presence of distributive injustice around water shortages create a heightened importance for procedural justice between the affected individuals and the authorities (Tyler and Degoey, 1995). Similarly, when some employees are reluctant to share important workplace concerns (e.g. grievances) and interactional injustice is perceived, it is procedural justice that moderates their willingness to come forward (Tangirala and Ramanujam, 2008). Put differently, the perceived fairness of the laws is most important when the system is under threat. It is not clear the extent to which procedural justice has an impact on online collaboration outside of these moderated relationships. Thus, we predict both a direct impact of procedural justice and a moderated effect via distributive justice and interactional *justice*:

Hypothesis 8. Perceived procedural justice positively impacts on online collaboration quality.

Hypothesis 9. Procedural justice positively impacts on perceived interactional justice.

Hypothesis 10. Procedural justice positively impacts on perceived distributive justice.

In addition to perceived justice around the distribution of resources, the nature of individual interactions, and the guiding procedures, the individuals must also be satisfied with the system used for collaborations (Wu and Chiu, 2018). This is because attitudes towards a platform may change how an individual perceives an interaction, particularly if users have doubts about the ability of the system to behave as expected (Pavlou and Gefen, 2004). Thus, we expect users' satisfaction with the collaborative system to positively impact on perceptions of online collaboration.

Hypothesis 11. Satisfaction positively impacts on online collaboration quality.

4. Method

4.1. A laboratory experiment approach

We designed a laboratory experiment to test the impact of *creative ancestry* on *collaboration quality* as well as the explanatory research model, based on a specifically developed collaboration system. This system created individual threads around different topics of ideation and users were free to make recommendations/vote in any thread they wished. Once a recommendation received five 'up votes', that idea was selected for shortlisting and the corresponding thread was closed. This concept has been suggested in previous research as an effect way of engaging collaborators to improve data quality by evaluating, and filtering the large volume of contributions in online collaboration (Blohm et al., 2013; Klein and Garcia, 2015). A screenshot is presented in Fig. 2.

For comparative purposes, two versions of the system were developed. Henceforth, these systems will be referred to as NCA and FCA, abbreviations of 'No Creative Ancestry' and 'Full Creative Ancestry', respectively. The systems were identical, apart from the interface which displayed the shortlisted items. Therefore, all users had the same experience of making and voting on recommendations. After this point, those using the FCA system were granted access, through a login system, to an interface which displayed shortlisted items with the *full creative ancestrys* that preceded them. For comparative purposes, the NCA system did not facilitate *creative ancestry* for selected ideas. This NCA system did not display the recommendations that preceded shortlisted ideas (see Fig. 3). Thus, while interactions were similarly structured, immutable, and inspectable as they happened, successful collaborations could not be backwards-traversed in a structured, immutable, and inspectable manner.

The experiment was conducted with three groups, the first group contained 52 participants, the second contained 28, and the third contained 41 (N = 121 participants overall). The average age of the participants was 22.22 years. 76 were male, 37 were female, 6 selected 'Prefer not to say', and 2 identified as 'Other'. As for their participation levels, all 121 participants contributed at least 1 recommendation to the

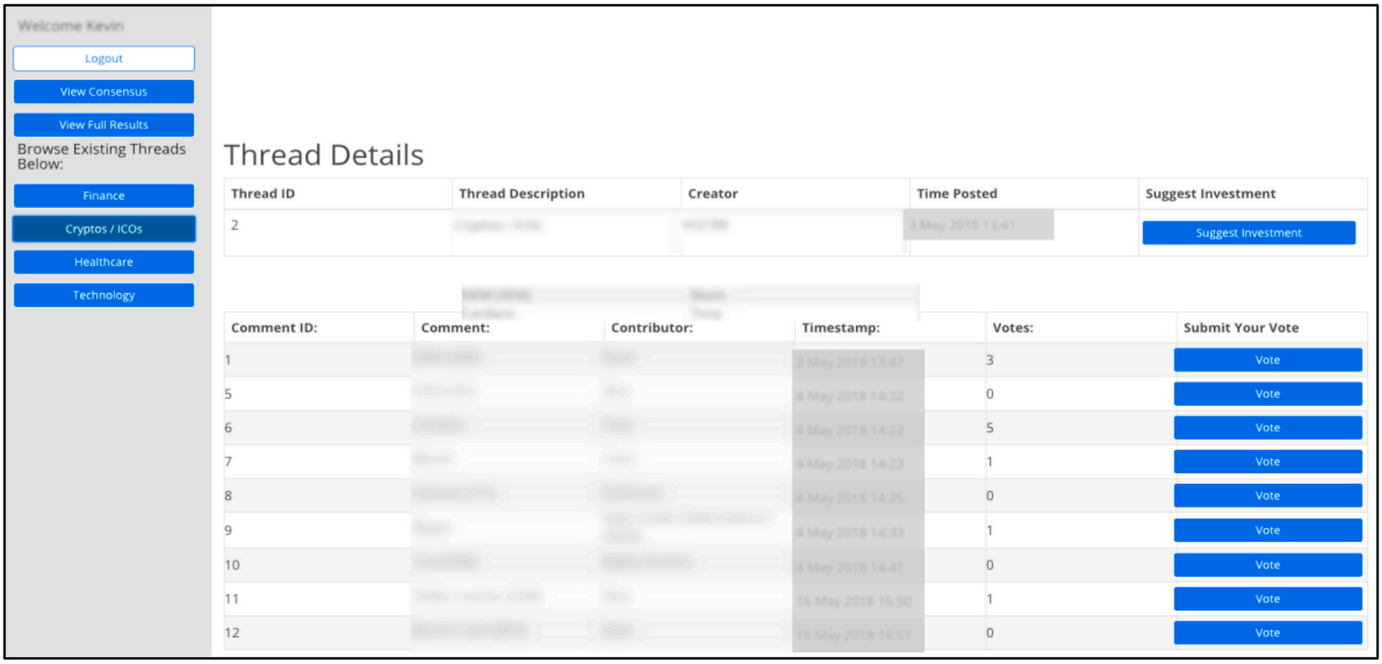

Fig. 2. Screenshot of recommendation page which was identical for both NCA and FCA system users (details blurred for anonymity purposes).

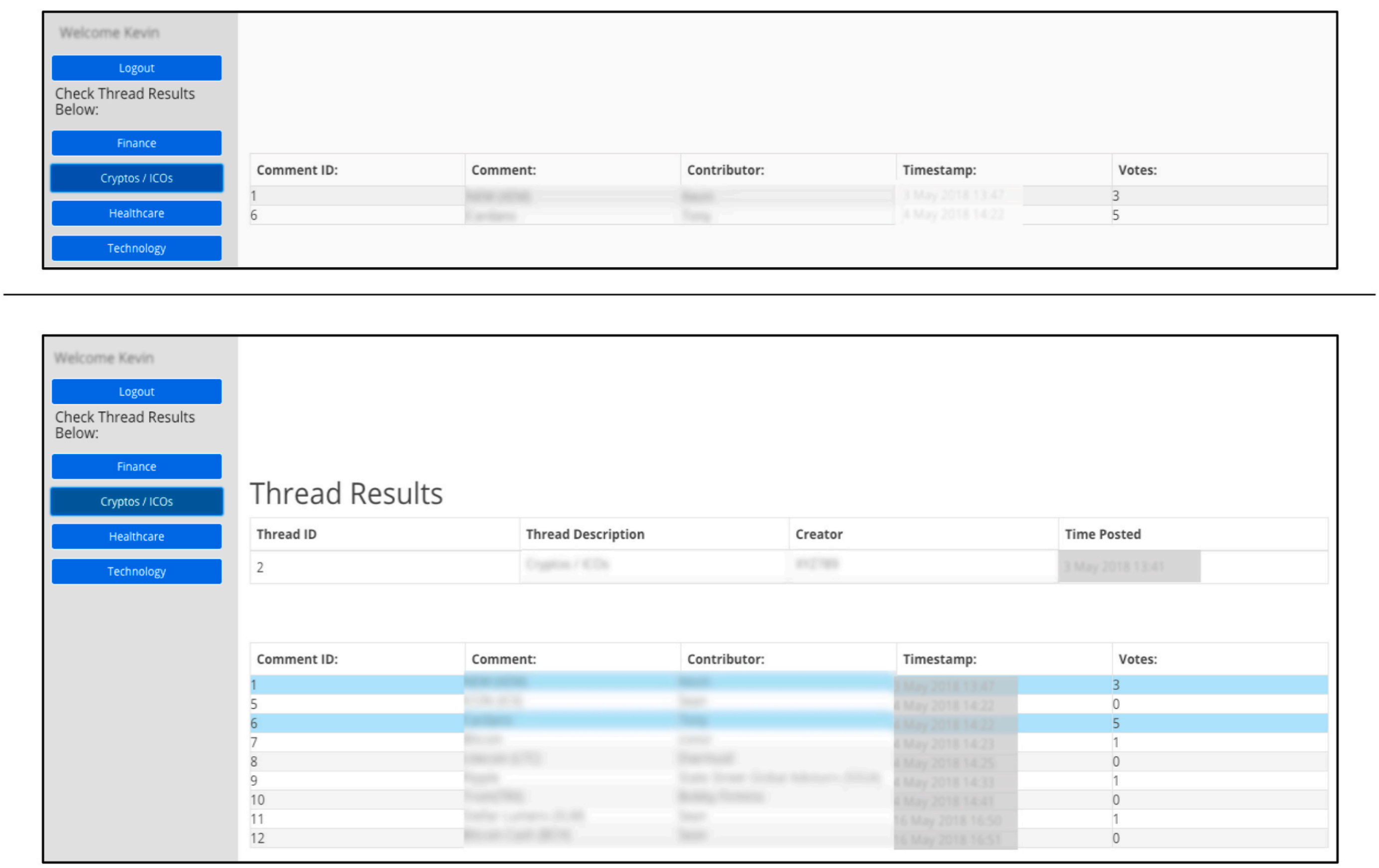

Fig. 3. Screenshot of recommendation-filtering stage with creative ancestry in the FCA system (bottom) and without in the NCA system (top) (details blurred for anonymity purposes).

study, while the most active participant made 30 contributions. The average contributions made per participant was 7.81.

The system was built on the Ethereum blockchain network. Ethereum is a public, permissionless network, meaning anyone is free to participate in the network, as opposed to networks such as Hyperledger which are private and permissioned, allowing only approved users to engage (Bouraga, 2021). Ethereum is arguably the largest blockchain system widely in circulation that is not limited to just financial transactions (Dannen, 2017). Instead, Ethereum supports the development of 'smart contracts' (Ethereum, 2021); a piece of code that the Ethereum Virtual Machine (EVM) is able to execute on the blockchain. Once this piece of code has been added to the blockchain, the smart contract itself cannot be altered, only the storage of the smart contract can. This means a piece of code now exists that is available for anyone to use (Beck et al., 2016; Swan, 2015). Specific to this study, this meant smart contracts could be developed to capture on the blockchain both the ideas put forward by individuals and the votes to back up specific ideas. The smart contracts were coded using Solidity and mined to the Ropsten Ethereum testnet. The ropsten testnet is a version of the Ethereum network that was developed for testing. Hence it uses test *Ether* which cost nothing and can be drawn down from a faucet (Dannen, 2017). We asked each participant to add the metamask extension to their Google Chrome. This allowed them to interact with the blockchain-enabled application. Participants in each of our demo sessions funded metamask accounts by requesting ether from a faucet (https://faucet.metamask.io/).

The choice to implement Creative Ancestry through blockchain rather as opposed to an alternative technology solution was not taken lightly. In recent years there has been significant interest in blockchain and its applications to use cases across a plethora of domains including cryptocurrencies (Holub and Johnson, 2018), real estate (Mashatan and Roberts, 2017), e-voting (Lopes et al., 2019), land registry (Benbunan-Fich and Castellanos, 2018), supply chain (Sharma et al., 2019), and intellectual property (O'Leary et al., 2017) to name a few. As a new technology, the first thing we looked to ensure was that blockchain was a good fit for the requirements of the creative ancestry use-case. Therefore, we began by exploring the problem we are looking to solve, the perceptions of fairness in online collaborations and propose creative ancestry as a possible solution to this problem. Only after this did we consider blockchain as a viable technology to implement creative ancestry, drawing on existing literature on blockchain adoption (Wüst and Gervais, 2017) to support our decision. In the section below we outline how technical features of the Ethereum blockchain supported the implementation of creative ancestry.

The evaluation took place before a national holiday, the context of which was integrated into the experimental collaboration task. Specifically, participants were asked how businesses in certain industries (retails, transport, pubs/nightclubs, and café/restaurant) could take advantage of the busy weekend ahead. All participants were equally free to make suggestions and these suggestions were visible to all other participants. Participants could then either vote on ideas they felt were relevant or make a recommendation of their own.

The three sessions took place in a university IT lab. Participants were seated at individual computers and asked to access the system through a URL which was dedicated to each session. Each session also interacted with a dedicated smart contract this ensured that each session operated with their own set of ideas. We divided the groups in half, participants sat next to one another, however, it was ensured that neighboring participants were using the same system. After creating individual user accounts, participants were free to contribute new ideas, browse recommendations made by others, and vote on ideas they supported.

At the end of each session, each participant was presented with the shortlisted recommendations from the vote. 57 of the participants (randomly determined), using the FCA system received the full list of recommendations with *creative ancestry* around shortlisted recommendations. The alternative group made up of 64 participants using the NCA system, were presented with only the full list of shortlisted recommendations (no *creative ancestry*). After each session participants were asked to complete a survey to measure each construct in the research model. Answers were given in the form of a seven-point Likert scale. These items were adapted from existing literature, with the exception of the items for *creative ancestry*, which were newly developed for this study (see Table A1, Appendix A).

Participants were university students with a background in IT. The research followed and applied the full ethical process and data management guidelines as prescribed by the host university. The use of students is recognized as appropriate for social/organizational/business research, provided the research questions focus on general traits, rather than comparative questions demanding representative between-subject diversity (see discussion in Greenberg (1987); Peterson (2001); Bello et al. (2009)). No such constraints apply for this study, which focuses on helping contributors bring different ideas to bear on a collaboration, not whether those contributors offer a balanced representation of the population at large. Hence the use of student participants was deemed suitable, and these students voluntarily participated as part of coursework (they did not receive compensation). Data collected for this study including survey and smart contract data are provided in Mendeley Data, https://doi.org/10.17632/67ndhcx83v.1.

4.2. Implementing creative ancestry

Throughout the experiment, participants uploaded recommendations and voted on the recommendations put forward by others. Participants were also free to browse the shortlisted recommendations, as well as the recommendations that preceded them. Each preceding recommendation was presented in a backwards-traversible sequence, allowing individual recommendations to be independently evaluated against the contributions on which they built.

A consistent structure was imposed, meaning each comment (including preceding recommendations) was displayed in an identical tabular format that laid out the text of the comment, the contributor, and a timestamp. Immutability was ensured at a technical level based on the mechanics of the Ethereum blockchain. However, it was also further communicated by allowing users to independently navigate records and compare them with their own experience and memory.

Two additional details were added in the interests of interaction-level inspectability. The first was the number of votes received by selected or preceding recommendations. This created visibility over the progression of collective approval from collaborators as discussion neared the selected idea, particularly when combined with the timestamp data. The second was the comment ID for each selected or preceding recommendation. This was arguably unnecessary; however, it represented the last item of data stored on the ideation system so was included to ensure no details were withheld from users.

The FCA system leveraged *creative ancestry* to facilitate each form of social justice (distributive, procedural, and interactional). It did this at three levels; a technical-level, an interface design-level, and an interaction/context-level.

Distributive justice was enabled at a technical-level by ensuring collaborators operate under a pseudonym. Pseudonymous interactions are typical in blockchain environments such as Ethereum (Lindman et al., 2017). Hence the interface design of the system further limited anything that would enable individuals to add additional contextual information to their profiles, e.g., job titles, bios, or images. A separate problem occurs where groups contain a subset of members that have collaborated previously, as these individuals often communicate independently and become gatekeepers of vital information (Robert et al., 2008). For this reason, the interaction/context design avoided any direct or ancillary communication channels that could result in privileged information sharing or offline discussion. The pseudonymity of users and the absence of any direct or ancillary communication channels ensures that all users are treated equally regardless of rank, title, or prior relationships, which will improve distributive justice, i.e. ensuring that the comparison of one's own outcome with those of others will be perceived to be fair (Turel et al., 2008).

Procedural justice was enabled at a technical-level through the implementation of smart contracts. These smart contracts operate as a governance mechanism for the system, autonomously enforcing predefined rules that are explicitly written into the system (Beck et al., 2018). This means the procedural rules of the system are equal for all participants and cannot be altered where it is convenient or where it suits the interests of preferred contributors. Smart contracts satisfy the three key rules for fair procedures as discussed earlier in the paper; (i) the consistency rule, (ii) the bias-suppression rule, and (iii) the representativeness rule (Leventhal, 1976; Richter et al., 2016; Theodorakopoulos et al., 2015). However, it must also be noted that even seemingly fair and democratic procedures can also be undermined where individuals manufacture criticism to drown out positive support and foster distrust (Lewicki et al., 1998; Sundaramurthy and Lewis, 2003). Hence, the design of the system did not allow users to 'down vote' ideas; they could only express their support with positive 'up votes' or non-support by abstaining. Interaction/context design reinforced this by presenting selected ideas as interesting enough to warrant further consideration, rather than 'winners' for future roll-out.

Interactional justice was enabled at a technical-level by (i) ensuring users were tied to their specific pseudonyms indefinitely and (ii) removing any capacity to remove or amend records of interactions, afforded through the immutable nature of the Ethereum blockchain. This ensures that all contributions may be considered regardless of when they are made during the process, (Diehl and Stroebe, 1987), especially as participants collaborate concurrently in large groups (Gallupe et al., 1992). *Interactional justice* was further enabled at an interface design-level by ensuring screens allow historic interactions to be browsed all the way back to the beginning of the collaboration. This reassures individuals that even minor or indirect contributions are visible; an important quality for collaborators who assume important supporting roles (George, 1992; Jones, 1984). The interaction/context-level design supports this by encouraging users by scrutinize interactions when viewing specific outputs, rather than assuming the collaboration is no longer of interest once ideas have been selected.

5. Results

A components-based estimation approach was taken to reflect the exploratory nature of theory building, specifically the partial least squares (PLS) method for structural equation modeling (Gefen and Straub, 2005; Gefen et al., 2000).[1] Item loadings were first examined to determine convergent validity for the measures used. Four items were dropped (see Appendix A), after which loadings for all remaining items satisfied the criteria for a PLS model, i.e. the average loading for each construct is greater than 0.707 (Bagozzi and Yi, 1988; Gefen and Straub, 2005) and scores for the average variance extracted (AVE) each exceed 0.05 (Chin, 1998) (see Table 2). Reliability was supported as each construct satisfies the required threshold for composite reliability >.707 (Bagozzi and Yi, 1988). Discriminant validity was also supported using the (Fornell and Larcker, 1981) method, as the square root of AVE of each latent variable is greater than correlations among the latent variables. The results are presented in Table 1. Lastly, a Harman's single factor test suggested common method variance was unproblematic at 39.6 % (Podsakoff and Organ, 1986).

Once measures were validated, comparative tests were run to compare scores for constructs in the *creative ancestry* and control groups. Tests used the average scores for included indicators for each construct. Results show the *creative ancestry*-enabled system scores more highly on average for each variable. However, Shapiro Wilk tests confirmed none of these variables were normally distributed, so we ran non-parametric one-sided Mann-Whitney tests to formally compare the treatment and control groups. The results suggest each of these differences is statistically significant at a probability level <.05, with the exception of *interactional justice*.[2]

These results show support for the utility of the design construct, so we moved on to testing the structural model of associations connecting

Table 1
Discriminant validity (fornell-larker criterion).

Construct	CA	Coll	CGC	PGC	DJ	IJ	PJ	Sat
Creative Ancestry	**.71**							
Collaboration Quality	.66	**.78**						
Cog. Group Cons.	.59	.65	**.80**					
Perc. Group Creativity	.50	.69	.61	**.78**				
Dist. Justice	.63	.72	.65	.60	**.73**			
Int. Justice	.57	.70	.48	.60	.63	**.75**		
Proc. Justice	.68	.59	.52	.53	.70	.61	**.79**	
Satisfaction	.59	.62	.52	.59	.57	.59	.58	**.84**

Coll = Collaboration Quality, DJ = Distributive Justice, IJ=Interactional Justice, PJ=Procedural Justice, CA=Creative Ancestry, Sat = Satisfaction, CGC=Perceived Group Consensus, PGC=Perceived Group Creativity.

Table 2
Convergent validity.

Construct	AVE	Comp. R.	Rho	Cron.'s A.	Commun.	Redund.
Collaboration Quality	.687	.687	.810	.516	.193	–
Dist. Justice	.785	.792	.861	.608	.345	.375
Inter. Justice	.729	.747	.845	.646	.299	.220
Proc. Justice	.698	.710	.830	.619	.242	.151
Creative Ancestry	.721	.721	.827	.545	.243	.311
Satisfaction	.618	.626	.797	.567	.156	.260
Cog. Group Cons.	.711	.723	.837	.631	.270	.301
Perc. Group Creat.	.802	.811	.884	.717	.422	

Table 3
Comparison of scores for creative ancestry group and control group.

Construct	CA. mean	Con. mean	Mann-Wh.	P val.	Upper C. I. 95 %	Diff. in loc.
Creative Ancestry***	5.882	5.227	1123	<.001	-.250	-.749
Collaboration Quality*	5.342	5.041	1468.5	.032	-.001	-.250
Procedural Justice**	5.830	5.286	1323	.004	-.333	-.333
Interactional Justice	5.135	4.984	1708	.273	-.333	-<.001
Distributive justice**	5.570	5.129	1339.5	.006	-.249	-.499
Satisfaction**	5.626	5.119	1361	.008	-<.001	-.333
Cognitive Group Consensus**	5.421	4.828	1313.5	.004	-.333	-.667
Perceived Group Creativity**	5.702	5.307	1376	.009	-<.001	-.333

*p < .05, **p < .05, ***p < .001.

[1] Note, the recommended sample size for PLS path modeling is at least 10 times the number of constructs in the model (meaning n ≥ 80 for this study) or 10 times the number of measurement items in any one construct (meaning n ≤ 50 in this study), whichever is larger (Gefen et al., 2000). Thus, the sample of 121 provided sufficient sensitivity to detect relationships.

[2] Note, we calculated the statistical power of a Mann Whitney tests for these group sizes, means, and standard deviations using the simulation method of Al-Sunduqchi (1990). The result was 91 % for *perceived creative ancestry,* 81 % for *cognitive group consensus,* 54 % for *perceived group creativity,* 32 % for *collaboration quality,* 69 % for *user satisfaction,* 85 % for *procedural justice,* 70 % for *distributive justice, and* 12 % for *interactional justice*. This suggests the lack of significant association with *interactional justice* might be due to the sample size. We thank the Review Team for encouraging us to explore these considerations of sample size.

creative ancestry and *collaboration quality*. Results are presented in Table 4 for a bootstrap test with 2000 samples.

The combined results of bootstrapping and PLS path modelling coefficients are presented in Fig. 4. The data suggests perceived *distributive justice* and *interactional justice* are both positively associated with *perceived collaboration quality,* with path coefficients of 0.371 and 0.321 respectively ($p < .001$), therefore Hypothesis 6 and Hypothesis 7 are both supported. Hypothesis 8 was rejected with a p-value of .732, suggesting no direct association between *procedural justice* and *perceived collaboration quality*. Hypothesis 9 and Hypothesis 10 were supported, however, suggesting *procedural justice* has a positive association with both perceived *distribute justice* and *interactional justice*.

The data further support a direct positive association between *perceived creative ancestry* and the perception of *procedural justice,* with a path coefficient of 0.528, $p < .001$. Thus, Hypothesis 3 is supported. However, no significant direct relationship is found between *perceived creative ancestry* and *distributive justice* or *interactional justice*. Instead, there is an indirect relationship between *perceived creative ancestry* on *distributive justice* that is mediated by *cognitive group consensus*. There is also an indirect relationship between *perceived creative ancestry* and all three forms of justice moderated by *perceived group creativity*. Thus, Hypothesis 4 and Hypothesis 5 are partially supported.

When measuring the effect of an experimental manipulation, it is important the manipulation is sufficiently captured by the statistical model, and that causal inferences are not made beyond what is actually manipulated (see Rohrer (2018); Rohrer et al. (2021)). Table 3 illustrated that, although the measure for *perceived creative ancestry* is strongly correlated with the actual treatment of *creative ancestry* in the experiment, the fit is not absolute. This suggests not all users perceived the *creative ancestry* implemented in the system, or that there were elements of *creative ancestry* that users perceived in other features of the system e.g., the ability to browse ongoing discussion during the collaboration and simply remember that discussion later. While we did not investigate the reason why not all participants perceived *creative ancestry*, we can speculate that it may be caused by some participants not feeling motivated to read through comments leading up to an idea and therefore not appreciating the role of *creative ancestry*. This is not necessarily a problem, as users experiencing such a lack of motivation are presumably less influenced by perceptions of fairness. Another possibility is that some users felt the genesis of specific ideas preceded the online collaboration process, e.g., perhaps an idea was derived from a news story that had recently received coverage without due credit. Again, this is not necessarily a problem for real-world collaborations, where the discussion and evaluation of ideas is afforded more time and scrutiny. We nonetheless re-tested the path model by replacing *perceived creative ancestry* with a binary dummy variable indicating whether a user was in the treatment or control group, i.e., *implemented creative ancestry*. The results were consistent, with the exception of the association between *implemented creative ancestry* and *procedural justice*, which is found to be mediated by *cognitive group consensus* and *perceived group creativity* (see Fig. 5).

6. Discussion and implications

This study has explored the broad potential of online collaboration systems and identified the key role played by perceived social justice in the success of such systems. Drawing on prior research, the study theorizes the novel construct of *creative ancestry* as a key enabler of collaboration quality. The results from a laboratory experiment support this relationship. We also wanted to understand how specific perceptions of social justice change when *creative ancestry* is introduced. Hence, we also developed and tested a research model in our experiment. The results provide four key high-level scientific contributions.

First, the study improves our understanding of the associations between perceived social justice and the perceived effectiveness of online collaboration environments. Our results suggest *distributive justice* (fairness of reward) and *interactional justice* (fairness of treatment) have direct correlations with *perceived collaboration quality*. Additionally, the association between this *perceived collaboration quality* and *procedural justice* (fairness of process) is indirect, moderated by *distributive* and *interactional justice*. While we must be careful when drawing conclusions from the associational embedded path model in our study, these findings suggest that fair procedures may not be important in isolation; rather, fair procedures may enable the fair distribution of resources and fair interactions between collaborators. Alternatively, the relationship may be reversed, arising from breakdowns in perceived fairness. Perhaps individuals who reflect on unfair interactions or distribution may also reflect on shared procedures more critically. In either case, it seems that individuals' perceptions of procedures are closely tied to their larger sense of fairness. This supports historic findings from the management literature that position perceptions of *procedural justice* as an important, though often subtle, enabler of organizational culture (Cropanzano et al., 2002; Folger and Konovsky, 1989; Greenberg, 1987).

Second, and perhaps most importantly, the study demonstrates the impact of *creative ancestry*, as a novel theoretical construct, on *collaboration quality*. In the evaluation, collaborators scored the *creative ancestry*-enabled system more highly than the control system along every measured dimension, even though collaborators' experiences with the system up to the point of idea evaluation should have been similar. Collaborators were not notified in advance of the differences between the systems, nor were individuals invited to compare their version of the system with the alternative. Nonetheless, the addition of *creative*

Table 4
Results of bootstrapping for structural model.

Relationship	Original Sample	Sample Mean	SD	T Stat.	P Val.	C.I. 2.5 %	C.I. 97.5 %
Cog. Gr. Cons. - > Dist. Justice**	.278	.280	.086	3.229	.001	.108	.440
Cog. Gr. Cons. - > Int. Just.	.003	.006	.104	0.031	.975	.199	.205
Cog. Gr. Cons. - > Proc. Just.	.069	.059	.109	0.633	.527	.137	.288
Group Creati. - > Dist. Just.*	.173	.182	.086	2.008	.045	.016	.352
Group Creati. - > Int. Justice**	.346	.348	.103	3.351	.001	.147	.538
Group Creati. - > Proc. Justice*	.225	.232	.093	2.415	.016	.039	.395
Dist. Just. - > Coll. Quality***	.396	.402	.097	4.086	<.001	.223	.603
Int. Justice- > Coll. Quality***	.347	.349	.079	4.390	<.001	.198	.510
Proc. Just. - > Coll. Quality	-.015	-.015	.105	0.143	.886	.217	.189
Proc. Just. - > Dist. Justice ***	.381	.369	.087	4.384	<.001	.210	.546
Proc. Just. - > Int. Justice**	.303	.301	.102	2.972	.003	.100	.498
Creative Anc. - > Cg. Gr. Cons***	.593	.597	.056	10.560	<.001	.463	.685
Creative Anc. - > Group Creati.***	.507	.517	.070	7.280	<.001	.357	.620
Creative Anc. - > Dist. Justice	.120	.125	.107	1.128	.259	.095	.313
Creative Anc. - > Int. Justice	.186	.187	.116	1.603	.109	.059	.401
Creative Anc. - > Proc. Justice***	.527	.531	.078	6.796	<.001	.355	.662
Sat - > Collaboration*	.203	.195	.102	1.990	.047	.003	.390

*$p < .05$, **$p < .01$, ***$p < .001$.

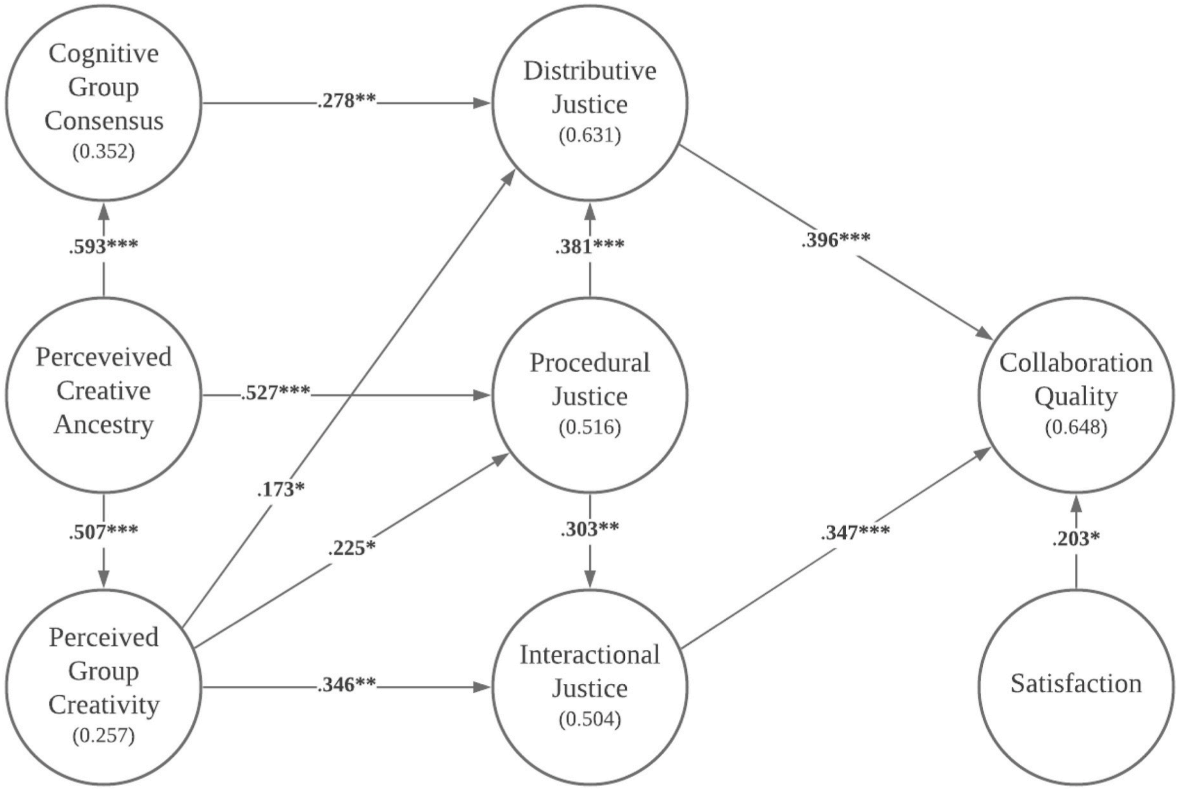

Fig. 4. Summary of PLS path modelling and bootstrapping results or embedded model.

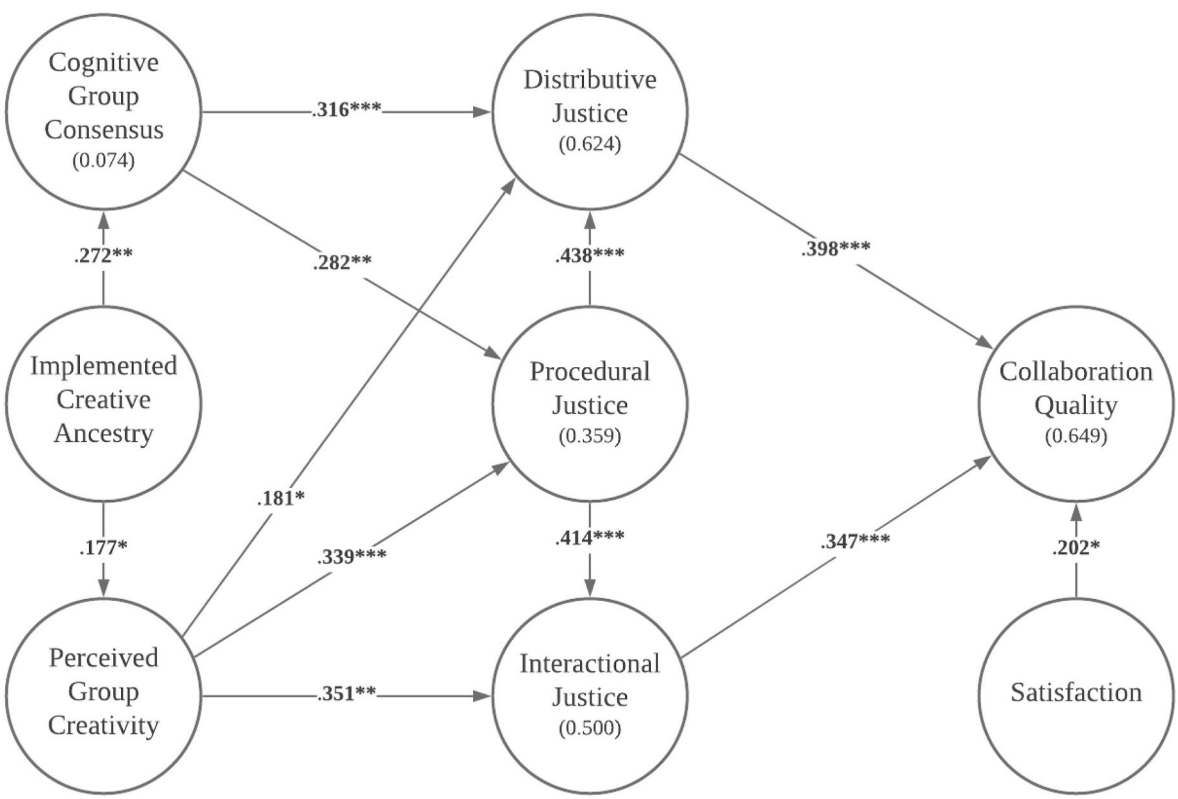

Fig. 5. Summary of PLS path modelling and bootstrapping results when perceived creative ancestry is substituted for implemented creative ancestry.

ancestry clearly added to perceptions of fairness and the favorability of outcomes. We interpret these findings as evidence that *creative ancestry* is a significant asset for online collaboration systems.

Third, this study shows how the impact of *creative ancestry* is associated with perceptions of *cognitive group consensus* and *perceived group creativity*. Once again, we advise caution when interpreting findings from our path model, which is correlational in nature. It may be the case that individuals are more aware of their consensus and creativity because they have analyzed the discussion, and this in turn leads to more positive perceptions of experience as a whole. An alternative explanation is that the value of *creative ancestry* is less when collaborations do not generate strong results. Individuals might simply not be interested in analyzing contributions when the end result was underwhelming. This presents new problems, as there may be wasted learning opportunities.

Fourth, the operationalization of our study demonstrates the utility of distributed ledger technologies for implementing *creative ancestry*. Specifically, it was revealed that the technical characteristics of blockchain technologies can have a significant effect on subjective social experiences when they are used to support *creative ancestry*. This finding extends our understanding of the potential of blockchain; specifically, it encourages us to think of blockchain as a human-facing technology with implications for the front-end user experience.

We also acknowledge two key limitations for this study. The first concerns the relative synchronicity of collaborations in the simulation. Unlike many online collaborations, which can take place over days, weeks, or even years, the simulation asked collaborators to participate during the same 1-h period. This has the potential to increase interaction richness and shared social presence by increasing the capacity for rapid feedback among those communicating (Yoo and Alavi, 2001).

The second limitation concerns the lack of repeated use by collaborators over extended periods. The participation dimension, specifically, the *quantity of participation* (Weinberger and Fischer, 2006) was limited in this study. Many online systems rely on repeat users to generate and sustain collaborations. For example, many Innocentive solvers reuse similar solutions for multiple problems to offset the amount of effort required for uncertain rewards (Cahalane, Feller, Finnegan, Hayes and O'Reilly, 2014). Similarly, Wikipedia contributors often rely on long-term culture-building to build consensus around ideas (McIntosh, 2008). Future research should consider how *creative ancestry* impacts on longer-term behaviors. Also, observing creative ancestry over a longer time period could potentially result in more users perceiving the impact of creative ancestry.

7. Conclusions

This study introduces the concept of creative ancestry for online collaboration systems, i.e., the ability of a collaborative system to take some particular output of note and navigate backwards through the individual contributions that preceded it in a consistently structured, inspectable, and immutable manner. We show how implementing creative ancestry can improve the perceived quality of outcomes by highlighting the value of individual contributions. We believe this is a significant finding for online collaboration systems, which can build on this concept to create platforms that contributors perceive as more fair. We hope this work will inspire new approaches that improve participation in online collaboration systems and help create sustainable online communities of practice.

Acknowledgments

This research has emanated from research conducted with the financial support of Science Foundation Ireland under Grant 18/SPP/3459.

Appendix A. Survey Items and Sources

Table A1
Survey items and sources

Creative ancestry (items)	Source
The system makes it easy for everyone to see the ideas that were presented by different people.	Newly developed for this study
I feel it would be difficult for someone to take all the credit by hiding the contribution made by other people.	
The system makes it easy to see the specific people responsible for developing an idea.*	
It was easy to see how individual ideas grew from previous ideas put forward by other people.	
I could see how a particular idea emerged as part of a larger conversation involving multiple people.	
Perceived distributive justice (items)	Wu & Chiu (2018)
I had an important contribution to this ideation collaboration.	
The credit I receive from this ideation collaboration is likely to be fair.*	
Each person had an important contribution to this ideation collaboration.	
The credit each person receives from this ideation collaboration is likely to be fair.	
Perceived procedural justice (items)	Wu & Chiu (2018)
The system used for this ideation collaboration has fair policies for each person using it.	
The system used for this ideation collaboration generally treats all people using it fairly.	
The system used for this ideation collaboration is equitable in its treatment of each person using it.	
Perceived interactional justice (items)	Wu & Chiu (2018)
Each person participating in this ideation collaboration is honest in dealing with other people.	
Each person participating in this ideation collaboration respects the other people using it.*	
Each person participating in this ideation collaboration always communicates with other people using it openly and directly.	
Each person participating in this ideation collaboration always provides other people using it timely feedback.	
Collaboration Quality (items)	Wu & Chiu (2018)
The people participating in this ideation collaboration figured out effective ways to communicate.	
The people participating in this ideation collaboration worked together in developing new high-level topics.	
The people participating in this ideation collaboration collaborated in coming up with new ideas.	
The people participating in this ideation collaboration collaborated in fleshing out the details of ideas.	
The people participating in this ideation collaboration had frequent interactions when problems with ideas or high-level topics occurred.	
Satisfaction (items)	Wu & Chiu (2018)
The ideation collaboration system was satisfactory as a whole.	
The ideation collaboration system is of high quality.	
The ideation collaboration system meets my expectations.	
Perceived Group Creativity (items)	Nunamaker et al. (1987)
We were insightful in our work	
I felt like we were innovative in our thinking	
Overall, I think our ideas were creative	
Cognitive Group Consensus (items)	Mohammed & Ringseis (2001)

(*continued on next page*)

Table A1 (*continued*)

Creative ancestry (items)	Source
I am confident in the ideas the group put forward	
I feel the ideas selected were the best ideas the group came up with	
I personally argued for specific ideas before they were selected*	
The ideas selected were consistent with my own personal priorities and interests	
Control variables (items)	
Did you contribute one or more ideas? (Y/N)	
Did you vote on one or more other people's ideas? (Y/N)	
Age: _/prefer not to say	
Gender: Male/Female/Other or prefer not to say	

* Items dropped during analysis.

References

Al-Sunduqchi, M.S., 1990. Determining the Appropriate Sample Size for Inferences Based on the Wilcoxon Statistics. Ph.D. Dissertation under the Direction of William C. Guenther. Dept. of Statistics, University of Wyoming, Laramie, Wyoming.

Alge, B.J., 2001. Effects of computer surveillance on perceptions of privacy and procedural justice. J. Appl. Psychol. 86 (4), 797.

Allcott, H., Gentzkow, M., 2017. Social media and fake news in the 2016 election. J. Econ. Perspect. 31 (2), 211–236.

Altschuller, S., Benbunan-Fich, R., 2013. The pursuit of trust in ad hoc virtual teams: how much electronic portrayal is too much? Eur. J. Inf. Syst. 22 (6), 619–636.

Asatiani, A., Penttinen, E., 2019. Constructing continuities in virtual work environments: a multiple case study of two firms with differing degrees of virtuality. Inf. Syst. J. 29 (2), 484–513.

Babič, K., Černe, M., Connelly, C.E., Dysvik, A., Škerlavaj, M., 2019. Are we in this together? Knowledge hiding in teams, collective prosocial motivation and leader-member exchange. J. Knowl. Manag. 23 (8), 1502–1522.

Bagozzi, R.P., Dholakia, U.M., 2006. Open source software user communities: a study of participation in Linux user groups. Manag. Sci. 52 (7), 1099–1115.

Bagozzi, R.P., Yi, Y., 1988. On the evaluation of structural equation models. J. Acad. Market. Sci. 16 (1), 74–94.

Bandura, A., Barbaranelli, C., Caprara, G.V., Pastorelli, C., 1996. Mechanisms of moral disengagement in the exercise of moral agency. J. Pers. Soc. Psychol. 71 (2), 364.

Bauer, J., Franke, N., Tuertscher, P., 2016. Intellectual property norms in online communities: how user-organized intellectual property regulation supports innovation. Inf. Syst. Res. 27 (4), 724–750.

Beck, R., Czepluch, J.S., Lollike, N., Malone, S., 2016. Blockchain-the gateway to trust-free cryptographic transactions (Paper presented at the ECIS).

Beck, R., Müller-Bloch, C., King, J.L., 2018. Governance in the blockchain economy: a framework and research agenda. J. Assoc. Inf. Syst. 19 (10), 1.

Bello, D., Leung, K., Radebaugh, L., Tung, R.L., van Witteloostuijn, A., 2009. From the Editors: student samples in international business research. J. Int. Bus. Stud. 40 (3), 361–364. https://doi.org/10.1057/jibs.2008.101.

Benbunan-Fich, R., Castellanos, A., 2018. Digitization of land records: from paper to blockchain. In: Paper Presented at the International Conference on Information Systems, San Francisco.

Beranek, P.M., Broder, J., Reinig, B.A., Romano Jr., N.C., Sump, S., 2005. Management of virtual project teams: guidelines for team leaders. Commun. Assoc. Inf. Syst. 16 (1), 10.

Bertot, J.C., Jaeger, P.T., Grimes, J.M., 2010. Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. Govern. Inf. Q. 27 (3), 264–271.

Blohm, I., Leimeister, J.M., Krcmar, H., 2013. Crowdsourcing: how to benefit from (too) many great ideas. MIS Q. Exec. 12 (4), 199–211.

Bouraga, S., 2021. A taxonomy of blockchain consensus protocols: a survey and classification framework. Expert Syst. Appl. 168, 114384.

Buder, J., 2011. Group awareness tools for learning: current and future directions. Comput. Hum. Behav. 27 (3), 1114–1117.

Cahalane, M., Feller, J., Finnegan, P., Hayes, J., O'Reilly, P., 2014. Leveraging distributed collective intelligence: an investigation of solver engagement with innovation challenges. In: Paper Presented at the International Conference on Information Systems, Auckland.

Cartwright, E., Menezes, M.L., 2014. Cheating to win: dishonesty and the intensity of competition. Econ. Lett. 122 (1), 55–58.

Cheng, X., Fu, S., Druckenmiller, D., 2016. Trust development in globally distributed collaboration: a case of US and Chinese mixed teams. J. Manag. Inf. Syst. 33 (4), 978–1007.

Cheung, S.Y., Gong, Y., Wang, M., Zhou, L., Shi, J., 2016. When and how does functional diversity influence team innovation? The mediating role of knowledge sharing and the moderation role of affect-based trust in a team. Hum. Relat. 69 (7), 1507–1531.

Chidambaram, L., Tung, L.L., 2005. Is out of sight, out of mind? An empirical study of social loafing in technology-supported groups. Inf. Syst. Res. 16 (2), 149–168.

Chin, W.W., 1998. Commentary: issues and opinion on structural equation modeling. MIS Q. 22 (1), 7–16.

Chudoba, K.M., Wynn, E., Lu, M., Watson-Manheim, M.B., 2005. How virtual are we? Measuring virtuality and understanding its impact in a global organization. Inf. Syst. J. 15 (4), 279–306.

Clark, H.H., Brennan, S.E., 1991. Grounding in communication. In: Resnick, L.B., Levine, J.M., Teasley, S.D. (Eds.), In Perspectives on Socially Shared Cognition. American Psychological Association, pp. 127–149.

Collaros, P.A., Anderson, L.R., 1969. Effect of perceived expertness upon creativity of members of brainstorming groups. J. Appl. Psychol. 53 (2, Pt.1), 159.

Colquitt, J.A., 2001. On the dimensionality of organizational justice: a construct validation of a measure. J. Appl. Psychol. 86 (3), 386.

Connelly, C.E., Zweig, D., Webster, J., Trougakos, J.P., 2012. Knowledge hiding in organizations. J. Organ. Behav. 33 (1), 64–88.

Connolly, T., Jessup, L.M., Valacich, J.S., 1990. Effects of anonymity and evaluative tone on idea generation in computer-mediated groups. Manag. Sci. 36 (6), 689–703.

Cropanzano, R., Bowen, D.E., Gilliland, S.W., 2007. The management of organizational justice. Acad. Manag. Perspect. 21 (4), 34–48.

Cropanzano, R., Prehar, C.A., Chen, P.Y., 2002. Using social exchange theory to distinguish procedural from interactional justice. Group Organ. Manag. 27 (3), 324–351.

Crowston, K., Wade, M., 2010. Introduction to JAIS special issue on empirical research on free/libre open source software. J. Assoc. Inf. Syst. Online 11 (11), I.

Cummings, J., Dennis, A.R., 2018. Virtual first impressions matter: the effect of enterprise social networking sites on impression formation in virtual teams. MIS Q. 42 (3), 697–717.

Dannen, C., 2017. Introducing Ethereum and Solidity. Springer.

Dennis, A.R., Valacich, J.S., 1993. Computer brainstorms: more heads are better than one. J. Appl. Psychol. 78 (4), 531.

DeStefano, D., LeFevre, J.-A., 2007. Cognitive load in hypertext reading: a review. Comput. Hum. Behav. 23 (3), 1616–1641.

Diehl, M., Stroebe, W., 1987. Productivity loss in brainstorming groups: toward the solution of a riddle. J. Pers. Soc. Psychol. 53 (3), 497.

Dubey, A.D., Tripathi, S., 2020. Analysing the sentiments towards work-from-home experience during COVID-19 pandemic. Journal of Innovation Management 8 (1).

Engelmann, T., Dehler, J., Bodemer, D., Buder, J., 2009. Knowledge awareness in CSCL: a psychological perspective. Comput. Hum. Behav. 25 (4), 949–960.

Ethereum, 2021. Ethereum. Retrieved from. https://www.ethereum.org/.

Faraj, S., Sproull, L., 2000. Coordinating expertise in software development teams. Manag. Sci. 46 (12), 1554–1568.

Folger, R., Konovsky, M.A., 1989. Effects of procedural and distributive justice on reactions to pay raise decisions. Acad. Manag. J. 32 (1), 115–130.

Forbes, H., Schaefer, D., 2017. Social product development: the democratization of design, manufacture and innovation. Procedia CIRP 60, 404–409. https://doi.org/10.1016/j.procir.2017.02.029.

Fornell, C., Larcker, D.F., 1981. Structural equation models with unobservable variables and measurement error: algebra and statistics. J. Market. Res. 18 (3), 382–388.

Forte, A., Larco, V., Bruckman, A., 2009. Decentralization in wikipedia governance. J. Manag. Inf. Syst. 26 (1), 49–72.

Fortin, M., Cropanzano, R., Cugueró-Escofet, N., Nadisic, T., Van Wagoner, H., 2019. How do people judge fairness in supervisor and peer relationships? Another assessment of the dimensions of justice. Hum. Relat. 1–32, 00(0).

Friedman, T.L., 2005. The World Is Flat: A Brief History of the Twenty-First Century. Farrar Straus Giroux.

Fulmer, C.A., Gelfand, M.J., 2012. At what level (and in whom) we trust: trust across multiple organizational levels. J. Manag. 38 (4), 1167–1230.

Gallupe, R.B., Dennis, A.R., Cooper, W.H., Valacich, J.S., Bastianutti, L.M., Nunamaker, J.F., 1992. Electronic brainstorming and group size. Acad. Manag. J. 35 (2), 350–369.

Gefen, D., Straub, D., 2005. A practical guide to factorial validity using PLS-Graph: tutorial and annotated example. Commun. Assoc. Inf. Syst. 16 (1), 91–109.

Gefen, D., Straub, D., Boudreau, M.-C., 2000. Structural equation modeling and regression: guidelines for research practice. Commun. Assoc. Inf. Syst. 4 (1), 1–77.

George, J.M., 1992. Extrinsic and intrinsic origins of perceived social loafing in organizations. Acad. Manag. J. 35 (1), 191–202.

Gleasure, R., Feller, J., 2016. A Rift in the Ground: theorizing the evolution of anchor values in crowdfunding communities through the oculus rift case study. J. Assoc. Inf. Syst. Online 17 (10), 708.

Greenberg, J., 1987. A taxonomy of organizational justice theories. Acad. Manag. Rev. 12 (1), 9–22.

Greenberg, J., 1988. Cultivating an image of justice: looking fair on the job. Acad. Manag. Exec. 2 (2), 155–157.

Griffith, D.A., Harvey, M.G., Lusch, R.F., 2006. Social exchange in supply chain relationships: the resulting benefits of procedural and distributive justice. J. Oper. Manag. 24 (2), 85–98.
Gupta, A., Mattarelli, E., Seshasai, S., Broschak, J., 2009. Use of collaborative technologies and knowledge sharing in co-located and distributed teams: towards the 24-h knowledge factory. J. Strat. Inf. Syst. 18 (3), 147–161.
Harvey, S., 2014. Creative synthesis: exploring the process of extraordinary group creativity. Acad. Manag. Rev. 39 (3), 324–343.
Holub, M., Johnson, J., 2018. Bitcoin research across disciplines. Inf. Soc. 34 (2), 114–126.
Janssen, J., Bodemer, D., 2013. Coordinated computer-supported collaborative learning: awareness and awareness tools. Educ. Psychol. 48 (1), 40–55.
Janssen, J., Erkens, G., Kirschner, P.A., 2011. Group awareness tools: it's what you do with it that matters. Comput. Hum. Behav. 27 (3), 1046–1058.
Jones, G.R., 1984. Task visibility, free riding, and shirking: explaining the effect of structure and technology on employee behavior. Acad. Manag. Rev. 9 (4), 684–695.
Jung, J., Schneider, C., Valacich, J., 2010. Enhancing the motivational affordance of information systems: the effects of real-time performance feedback and goal setting in group collaboration environments. Manag. Sci. 56 (4), 724–742.
Kane, G.C., Ransbotham, S., 2016. Research note—content and collaboration: an affiliation network approach to information quality in online peer production communities. Inf. Syst. Res. 27 (2), 424–439.
Kidwell, R.E., Bennett, N., 1993. Employee propensity to withhold effort: a conceptual model to intersect three avenues of research. Acad. Manag. Rev. 18 (3), 429–456.
Kittur, A., Kraut, R.E., 2008. Harnessing the wisdom of crowds in wikipedia: quality through coordination. In: Paper Presented at the Proceedings of the 2008 ACM Conference on Computer Supported Cooperative Work.
Klein, M., Garcia, A.C.B., 2015. High-speed idea filtering with the bag of lemons. Decis. Support Syst. 78, 39–50.
Konovsky, M.A., 2000. Understanding procedural justice and its impact on business organizations. J. Manag. 26 (3), 489–511.
Kotlarsky, J., Oshri, I., 2005. Social ties, knowledge sharing and successful collaboration in globally distributed system development projects. Eur. J. Inf. Syst. 14 (1), 37–48.
Latané, B., Williams, K., Harkins, S., 1979. Many hands make light the work: the causes and consequences of social loafing. J. Pers. Soc. Psychol. 37 (6), 822.
Lee, J., Seo, D., 2016. Crowdsourcing not all sourced by the crowd: an observation on the behavior of Wikipedia participants. Technovation 55, 14–21.
Leventhal, G.S., 1976. What should Be done with equity theory? New approaches to the study of fairness in social relationships. In: Wiley, J. (Ed.), Social Exchange Theory.
Lewicki, R.J., McAllister, D.J., Bies, R.J., 1998. Trust and distrust: new relationships and realities. Acad. Manag. Rev. 23 (3), 438–458.
Li, A., Cropanzano, R., 2009. Fairness at the group level: justice climate and intraunit justice climate. J. Manag. 35 (3), 564–599.
Lin, T.-C., Huang, C.-C., 2009. Understanding social loafing in knowledge contribution from the perspectives of justice and trust. Expert Syst. Appl. 36 (3), 6156–6163.
Lindman, J., Tuunainen, V.K., Rossi, M., 2017. Opportunities and Risks of Blockchain Technologies–A Research Agenda.
Ling, K., Beenen, G., Ludford, P., Wang, X., Chang, K., Li, X., Rashid, A.M., 2005. Using social psychology to motivate contributions to online communities. J. Computer-Mediated Commun. 10 (4), 00-00.
Liu, M., Hull, C.E., Hung, Y.T.C., 2017. Starting open source collaborative innovation: the antecedents of network formation in community source. Inf. Syst. J. 27 (5), 643–670.
Lopes, J., Pereira, J.L., Varajão, J., 2019. Blockchain based e-voting system: a proposal. In: Paper Presented at the Americas Conference on Information Systems, Cancun.
Lu, Y., 2006. Toward the micro and macro-level consequences of interactional justice in cross-cultural joint ventures. Hum. Relat. 59 (8), 1019–1047.
Luo, Y., 2007. The independent and interactive roles of procedural, distributive, and interactional justice in strategic alliances. Acad. Manag. J. 50 (3), 644–664.
Magni, M., Ahuja, M.K., Maruping, L.M., 2018. Distant but fair: intra-team justice climate and performance in dispersed teams. J. Manag. Inf. Syst. 35 (4), 1031–1059.
Marmor, A., 2005. Should like cases be treated alike? Leg. Theor. 11 (1), 27–38.
Martin, J.A., Eisenhardt, K.M., 2010. Rewiring: cross-business-unit collaborations in multibusiness organizations. Acad. Manag. J. 53 (2), 265–301.
Martínez-Tur, V., Peiró, J.M., Ramos, J., Moliner, C., 2006. Justice perceptions as predictors of customer satisfaction: the impact of distributive, procedural, and interactional justice. J. Appl. Soc. Psychol. 36 (1), 100–119.
Mashatan, A., Roberts, Z., 2017. An enhanced real estate transaction process based on blockchain technology. In: Paper Presented at the Americas Conference on Information Systems, Boston.
Masterson, S.S., Lewis, K., Goldman, B.M., Taylor, M.S., 2000. Integrating justice and social exchange: the differing effects of fair procedures and treatment on work relationships. Acad. Manag. J. 43 (4), 738–748.
Mawby, R.C., 1999. Visibility, transparency and police-media relations. Polic. Soc.: Int. J. 9 (3), 263–286.
McFarlin, D.B., Sweeney, P.D., 1992. Distributive and procedural justice as predictors of satisfaction with personal and organizational outcomes. Acad. Manag. J. 35 (3), 626–637.
McIntosh, S., 2008. Collaboration, consensus, and conflict: negotiating news the wiki way. Journal. Pract. 2 (2), 197–211.
Mohammed, S., 2001. Toward an understanding of cognitive consensus in a group decision-making context. J. Appl. Behav. Sci. 37 (4), 408–425.
Mohammed, S., Ringseis, E., 2001. Cognitive diversity and consensus in group decision making: the role of inputs, processes, and outcomes. Organ. Behav. Hum. Decis. Process. 85 (2), 310–335.
Newman, M.L., Holden, G.W., Delville, Y., 2005. Isolation and the stress of being bullied. J. Adolesc. 28 (3), 343–357.
Nunamaker Jr., J.F., Applegate, L.M., Konsynski, B.R., 1987. Facilitating group creativity: experience with a group decision support system. J. Manag. Inf. Syst. 3 (4), 5–19.
O'Leary, K., Gleasure, R., O'Reilly, P., Feller, J., 2020. Reviewing the contributing factors and benefits of distributed collaboration. Commun. Assoc. Inf. Syst. 47 (1), 24.
O'Leary, K., O'Reilly, P., Feller, J., Gleasure, R., Li, S., Cristoforo, J., 2017. Exploring the application of blockchain technology to combat the effects of social loafing in cross functional group projects. In: Paper Presented at the Proceedings of the 13th International Symposium on Open Collaboration.
O'Leary, M.B., Cummings, J.N., 2007. The spatial, temporal, and configurational characteristics of geographic dispersion in teams. MIS Q. 433–452.
Oh, W., Moon, J.Y., Hahn, J., Kim, T., 2016. Research note—leader influence on sustained participation in online collaborative work communities: a simulation-based approach. Inf. Syst. Res. 27 (2), 383–402.
Oldroyd, J.B., Morris, S.S., 2012. Catching falling stars: a human resource response to social capital's detrimental effect of information overload on star employees. Acad. Manag. Rev. 37 (3), 396–418.
Paulus, P., 2000. Groups, teams, and creativity: the creative potential of idea-generating groups. Appl. Psychol. 49 (2), 237–262.
Paulus, P.B., Nijstad, B.A., 2003. Group Creativity: Innovation through Collaboration. Oxford University Press.
Pavlou, P.A., Gefen, D., 2004. Building effective online marketplaces with institution-based trust. Inf. Syst. Res. 15 (1), 37–59.
Pei Lyn Grace, T., 2009. Wikis as a knowledge management tool. J. Knowl. Manag. 13 (4), 64–74.
Peterson, R.A., 2001. On the use of college students in social science research: insights from a second-order meta-analysis. J. Consum. Res. 28 (3), 450–461.
Piccoli, G., Ives, B., 2003. Trust and the unintended effects of behavior control in virtual teams. MIS Q. 27 (3), 365–395.
Podsakoff, P.M., Organ, D.W., 1986. Self-reports in organizational research: problems and prospects. J. Manag. 12 (4), 531–544.
Ransbotham, S., Kane, G.C., 2011. Membership turnover and collaboration success in online communities: explaining rises and falls from grace in Wikipedia. MIS Q. 35 (3), 613–627.
Rayner, C., Hoel, H., 1997. A summary review of literature relating to workplace bullying. J. Community Appl. Soc. Psychol. 7 (3), 181–191.
Richter, M., König, C.J., Koppermann, C., Schilling, M., 2016. Displaying fairness while delivering bad news: testing the effectiveness of organizational bad news training in the layoff context. J. Appl. Psychol. 101 (6), 779.
Rick, S., Loewenstein, G., Monterosso, J.R., Langleben, D.D., Mazar, N., Amir, O., Ariely, D., 2008. Commentaries and rejoinder to "the dishonesty of honest people". J. Market. Res. 45 (6), 645–653.
Robert Jr., L.P., Dennis, A.R., Ahuja, M.K., 2008. Social capital and knowledge integration in digitally enabled teams. Inf. Syst. Res. 19 (3), 314–334.
Robert, L.P., Denis, A.R., Hung, Y.-T.C., 2009. Individual swift trust and knowledge-based trust in face-to-face and virtual team members. J. Manag. Inf. Syst. 26 (2), 241–279.
Rodriguez, M., Doloreux, D., Shearmur, R., 2017. Variety in external knowledge sourcing and innovation novelty: evidence from the KIBS sector in Spain. Technovation 68, 35–43.
Rohrer, J.M., 2018. Thinking clearly about correlations and causation: graphical causal models for observational data. Advances in Methods and Practices in Psychological Science 1 (1), 27–42.
Rohrer, J.M., Hünermund, P., Arslan, R.C., Elson, M., 2021. That's a Lot to PROCESS! Pitfalls of Popular Path Models.
Sarker, S., Ahuja, M., Sarker, S., Kirkeby, S., 2011. The role of communication and trust in global virtual teams: a social network perspective. J. Manag. Inf. Syst. 28 (1), 273–310.
Scardamalia, M., Bereiter, C., 2010. A brief history of knowledge building. Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie 36 (1).
Sharma, R.S., Wingreen, S., Kshetri, N., Hewa, T.M., 2019. Design principles for validating use cases of blockchain for food supply chains. In: Paper Presented at the Americas Conference on Information Systems, Cancun.
Sharma, S., Sugumaran, V., Rajagopalan, B., 2002. A framework for creating hybrid-open source software communities. Inf. Syst. J. 12 (1), 7–25.
Son, J.-Y., Kim, S.S., 2008. Internet users' information privacy-protective responses: a taxonomy and a nomological model. MIS Q. 32 (3), 503–529.
Steinel, W., Utz, S., Koning, L., 2010. The good, the bad and the ugly thing to do when sharing information: revealing, concealing and lying depend on social motivation, distribution and importance of information. Organ. Behav. Hum. Decis. Process. 113 (2), 85–96.
Stewart, K.J., Gosain, S., 2006. The impact of ideology on effectiveness in open source software development teams. MIS Q. 30 (2), 291–314.
Suleiman, J., Watson, R.T., 2008. Social loafing in technology-supported teams. Comput. Support. Coop. Work 17 (4), 291–309.
Sundaramurthy, C., Lewis, M., 2003. Control and collaboration: paradoxes of governance. Acad. Manag. Rev. 28 (3), 397–415.
Surowiecki, J., 2004. The wisdom of crowds: why the many are smarter than the few and how collective wisdom shapes business, economies, societies and nations. In: Random House Large Print Nonfiction, vol. 296.
Swan, M., 2015. Blockchain: Blueprint for a New Economy. O'Reilly Media, Inc.
Sweller, J., van Merriënboer, J.J., Paas, F., 2019. Cognitive architecture and instructional design: 20 years later. Educ. Psychol. Rev. 31 (2), 261–292.

Sweller, J., Van Merrienboer, J.J., Paas, F.G., 1998. Cognitive architecture and instructional design. Educ. Psychol. Rev. 10 (3), 251–296.

Tangirala, S., Ramanujam, R., 2008. Employee silence on critical work issues: the cross level effects of procedural justice climate. Person. Psychol. 61 (1), 37–68.

Tapscott, D., Williams, A., 2008. Wikinomics: How Mass Collaboration Changes Everything. Penguin.

Theodorakopoulos, N., Ram, M., Kakabadse, N., 2015. Procedural justice in procurement management and inclusive interorganizational relations: an institutional perspective. Br. J. Manag. 26 (2), 237–254.

Tremblay, M., Sire, B., Balkin, D.B., 2000. The role of organizational justice in pay and employee benefit satisfaction, and its effects on work attitudes. Group Organ. Manag. 25 (3), 269–290.

Turel, O., Yuan, Y., Connelly, C.E., 2008. In justice we trust: predicting user acceptance of e-customer services. J. Manag. Inf. Syst. 24 (4), 123–151.

Tyler, T.R., Blader, S.L., 2003. The group engagement model: procedural justice, social identity, and cooperative behavior. Pers. Soc. Psychol. Rev. 7 (4), 349–361.

Tyler, T.R., Degoey, P., 1995. Collective restraint in social dilemmas: procedural justice and social identification effects on support for authorities. J. Pers. Soc. Psychol. 69 (3), 482.

Van der Wal, M.F., De Wit, C.A., Hirasing, R.A., 2003. Psychosocial health among young victims and offenders of direct and indirect bullying. Pediatrics 111 (6), 1312–1317.

Vlaar, P.W., van Fenema, P.C., Tiwari, V., 2008. Cocreating understanding and value in distributed work: how members of onsite and offshore vendor teams give, make, demand, and break sense. MIS Q. 32 (2), 227–255.

Wang, Y., Fesenmaier, D.R., 2003. Assessing motivation of contribution in online communities: an empirical investigation of an online travel community. Electron. Mark. 13 (1), 33–45.

Wasko, M.M., Faraj, S., 2000. "It is what one does": why people participate and help others in electronic communities of practice. J. Strat. Inf. Syst. 9 (2–3), 155–173.

Wasko, M.M., Faraj, S., 2005. Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. MIS Q. 29 (1), 35–57.

Watson-Manheim, M.B., Chudoba, K.M., Crowston, K., 2012. Perceived discontinuities and constructed continuities in virtual work. Inf. Syst. J. 22 (1), 29–52.

Weinberger, A., Fischer, F., 2006. A framework to analyze argumentative knowledge construction in computer-supported collaborative learning. Comput. Educ. 46 (1), 71–95.

Woods, D.D., Patterson, E.S., Roth, E.M., 2002. Can we ever escape from data overload? A cognitive systems diagnosis. Cognit. Technol. Work 4 (1), 22–36.

Wu, L., Chiu, M.-L., 2018. Examining supply chain collaboration with determinants and performance impact: social capital, justice, and technology use perspectives. Int. J. Inf. Manag. 39, 5–19.

Wüst, K., Gervais, A., 2017. Do you need a Blockchain? IACR Cryptology ePrint Archive 375, 2017.

Yan, J., Leidner, D.E., Benbya, H., 2018. Differential innovativeness outcomes of user and employee participation in an online user innovation community. J. Manag. Inf. Syst. 35 (3), 900–933.

Yoo, Y., Alavi, M., 2001. Media and group cohesion: relative influences on social presence, task participation, and group consensus. MIS Q. 25 (3), 371–390.

Zhao, S.J., Zhang, K.Z., Wagner, C., Chen, H., 2013. Investigating the determinants of contribution value in Wikipedia. Int. J. Inf. Manag. 33 (1), 83–92.

Zheng, H., Xu, B., Zhang, M., Wang, T., 2018. Sponsor's cocreation and psychological ownership in reward-based crowdfunding. Inf. Syst. J. 28 (6), 1213–1238.

Zweig, D., Webster, J., 2002. Where is the line between benign and invasive? An examination of psychological barriers to the acceptance of awareness monitoring systems. J. Organ. Behav. 23 (5), 605–633.