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A Decentralized Marketing Model for the Online Accommodation Rental Market

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Abstract

This paper presents an infrastructure redesign of the online accommodation rental marketing model. The *decentralized* marketplace it proposes represents a significant Business Model Innovation (BMI) and a new normative marketing tool. We suggest it has the potential to be disruptive from an International Marketing (IM) perspective, shifting the focus from owners as agents, to a shared one with renters and agents. This is supportive of the paradigm where marketing is focused on facilitating and maintaining relationships. Using code that we developed, we illustrate how a *decentralized* application (*dAirBnB*) can promote disintermediation and can be built to optimize price discovery. Utilizing block chain technology, we show how trust originates from the distributed consensus enforced by a network of peers. This trusted interaction is facilitated between untrusted parties over the internet, thereby changing the marketing relationship. In this respect, the application and the business model are inextricably linked. Enabled by the technology, we propose a monetization of reputation, which introduces the concept of good behaviour as an asset in a marketing context. We explore the implications of this for both BMI and IM. Our approach would increase the quality and quantity of information in online rentals, both major dimensions of marketing advantage. The dominant position of AirBnB represents a limitation on the implementation of our approach and would be an area for policy makers to focus on.

Keywords: Business Model, Decentralized Marketing, Online Accommodation
JEL classification: D21, D26, D44, D47, L22, M31, O31, Z32, Z33

1. Introduction

Online rental, as typified by Airbnb, represents a major Business Model Innovation (BMI) and normative marketing tool. The direct marketing of individually owned properties has fundamentally changed the international market for accommodation rentals. It facilitates rentals for property owners by giving them access to a marketing platform. This paper extends the new paradigm that this enables, allowing both owners and renters to participate in the establishment and maintenance of relationships. The incorporation of reputation into the mix widens the literature's focus on owners reputations. In the sale of goods, Resnik *et al.* (2016)[1] note that buyers reputation is not important to a transaction. We suggest that is not the case in online rental. The renter's home is at risk. We propose an approach that can overcome this and add to the Customer Value Proposition (CVP).

The growth in the online lodging market over the last two decades has been dramatic. According to regulatory filings, the peer to peer booking platform Airbnb generated revenue of $3.3 billion in 2020. The industry

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has benefited from what are termed same-side network effects. This is where there are increased benefits to users based on the number of owners who place their properties up for rental[2]. Despite this, the online lodging market is dominated by a few big platforms. As a result of network benefits, Airbnb is able to scale up to dominant positions in the global market[3]. Fees and rates are not negotiable in this centralised model. Similarly, cancellation policies are not that negotiable, asymmetric, and often their management is not transparent. Our decentralized BMI changes this dynamic and alters the marketing relationship as a result.

The online listing of accommodation rentals has proved globally disruptive. In the current iteration of the model, owners are able to self market their properties. Oskam and Boswijk (2016)[4] argue this could well represent the future of the hospitality industry. Zervas *et al.* (2017)[5] collaborate this. They show that the rise in market share of the model's leading proponent, Airbnb, is negatively correlated with hotel revenue. They further demonstrate that the lower end of the hotel market suffers the largest financial impact from competition. This is changing the way the hospitality industry markets itself. As Gawer and Cusumano (2008) and Gawer (2014) explain, digital platforms allow diverse sets of actors to converge and create value[6,7]. It allows them to address a global market, whereas before single lettings were local in nature.

As the traditional approach to tourism involves the renting of rooms from hotels. Gutentag (2015) argues that Airbnb has disrupted the model by providing an online model that enables peer-to-peer accommodation[8]. He calls this 'collaborative consumption', a part of the sharing economy. That said, Muller (2020) provides a critical analysis of whether Airbnb is disruptive in the context of existing theory[9,10,11]. He suggests that when analyzing the two-sided accommodation market, one has to consider both aspects of the platform for it to be considered disruptive. He concludes that Airbnb is delimited by these criteria. It does not fully capture both the owners and guest. As the dominant entity in the online rental market, this represents a weakness in the current model and provides a supporting element for change.

In a monopoly pricing scheme, the seller posts a price and the buyer can either take it or leave it. Harris and Raviv (1981) explain that there are alternative marketing strategies for a monopolist, such as an auction[12]. The two sided price discovery (that a decentralized approach facilitates) is an extension of this line of thought.

We build on recent cross disciplinary research. Samiee (2020) identifies the role of the Internet as a tool for competitive advantage and internationalization[12]. Whilst its technology supports the sharing of resources and services, it also effects the behavioural and economic actions of its participants. The literature suggests that this has to be addressed in order to extend access to the market and make online rental business model truly disruptive. This is because although the accommodation market is a major beneficiary of the Internet, it can only achieve enhanced efficiency in price discovery by using decentralized techniques.

Our extension of the Airbnb model allows two untrusted parties to agree on the terms of their rental agreement and encode them into an executable *smart contract* (a step that can be automated to a certain extent). This is driven by a smart contract through the guest and the host interaction. Both parties are assured that the stated terms cannot be altered or circumvented. This will result in a shift away from the Airbnb business model being focused on the "owner as an agent". It shifts to one of being both "owner and renters as agents". Achrol and Kotler (1999) suggest such a change could transform the marketing relationship[3].

A BMI, such as the one we propose, consists of both the operating model and the value proposition. In this respect, we innovate the operating model through the blockchain application and the value proposition through the extension to *reputation* and *trust*. In order to address the failure to capture the guest perspective, we explored the advantages of *decentralisation* as supported by blockchain technology. In a cross disciplinary collaboration, we designed and developed *dAirBnB*, a proof-of-concept decentralized application (dApp) for the highly centralised online accommodation rental market, based on deposit protocols.[1] Under certain assumptions, our BMI is supportive of the Gronroos (1990) relationship approach to establish, maintain, and enhance customer interaction[14].

[1]We presented our proof-of-concept prototype at a blockchain hackathon (an hacking marathon where ideas are developed and implemented in a collaborative competition-like event. We qualified as runner-up in our catgory. https://pureportal.strath.ac.uk/en/prizes/award-of-2nd-prize-in-the-tezos-gold-challenge-future-of-blockcha

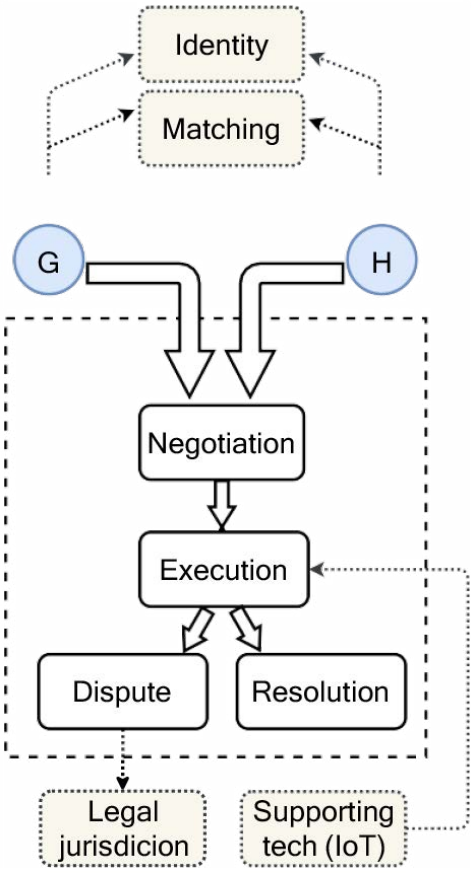

Figure 1. dAirBnB: decentralized accommodation rentals. Gaia (*G*) and Herbert (*H*) have undergone some form of digital identification, and their offer and demand matched. They have negotiated the terms of a rental contract in the form of a protocol that will be executed as a smart contract. Disputes may be escalated to a judiciary system (outside of the smart contract, which is represented by the dashed square). Supporting technology interacts with the contract.

2. The Decentralized Model

We start with the premise that decentralized technology has the potential to fundamentally transform marketing in respect of its contribution to advertising, trust, security and loyalty. Bezobski *et al.* (2021) suggest that it has the potential not only to influence but also to disrupt marketing[15].

We address the owner/guest informational gap by developing a *decentralized* execution of a rental agreement between Herbert, the host, and Gaia, the guest. We assume that the rental terms have been pre-agreed to avoid too much information (Branco 2016)[16]. It is worth noting that the agreement is produced by the free negotiation of Herbert and Gaia, and offers endless possibilities of customisation, according to party's needs.

Their agreement can be implemented in a smart contract, written in a high-level language[2] and run on a blockchain. Such a smart contract is a building block of the business model. It refers to a single agreement between two parties. The agreement would include a deposit-based incentive system that makes it counterproductive for the parties not to adhere to the agreed protocol. *dAirBnB* incorporates a reputation framework, directly supporting the dynamic definition of contracts amongst parties. In this way, the application can enhance the extent of information shared and processed. This reduces any governance choice issues likely from bounded rationality and bounded reliability by enabling a degree of opportunism (Verbeke and Greidanus, 2009)[17].

The basic scenario is illustrated in Figure 1. Herbert (*H*) and Gaia (*G*) have been identified by means of a suitable digital identity provided, and their demand and offer suitably matched. The smart contract, represented by the dashed box, encodes the agreement resulting from negotiation as a protocol. Actions of the protocol may include payments, fill a complaint, or cancel the agreement itself. The smart contract also includes suitable incentives that encourage "honest" behaviour, i.e., correct execution of the agreed protocol and fulfilment of the implicit rental promises (Grewal *et al.*, 2015)[18].

The dashed square in Figure 1 delineates the core interaction between G and H, as supported by a *dAirBnB* smart contract. The platform procedure performed by Airbnb is replaced using the blockchain. G and H are identified by their associated cryptographic address (or public key). As per the centralized model, G intends to rent the flat offered by H on the market. In the decentralized model, agreement negotiation and determining reputation are resolved by the procedures encoded in the smart contract, whose faithful execution is guaranteed by the blockchain.

An advantage of a decentralized application doubling as a business model is that the execution of the smart

[2]We can imagine such a high-level language as a formulation closed to human language that can be understood, and possibly developed through a guided process, by both parties.

contract on the blockchain cannot be altered.[3] In this way, the blockchain provides the trust framework in place of the centralised platforms currently dominating the market.

3. Customer Value Proposition (CVP)

The decentralized BMI delivers an improved CVP. Several previous studies like Huckle *et al.,* (2016) and Onder *et al.,* (2018) have suggested the role that blockchain technology can play in AirBnB models[19,20]. We build on these. Johnson *et al.,* (2008) argue that a successful business model has to have a CVP[21]. We argue that our solution delivers this in a technological way. In this section, we describe it at a high level to illustrate its marketing advantages.

By way of background, the blockchain is a decentralized technology that allows users to agree on some verified, trustable and untamperable information, without the intervention of a central authority. First formulation was described by Nakamoto (2008) who built on previous works, including Dwork and Naor (1992) and Jakobsen and Juels (1999), amongst several others[22,23,24]. In Nakamoto's Bitcoin, trusted information was about exchange digital assets-via transactions. The blockchain was designed to solve the complication of managing the users' rights to interact with shared data, no one being in a dominant position and without the need of trusting a central validating authority. This paves the way for numerous new business models and disintermediated markets, and a novel model of trust between stakeholders.

As its name suggests, a blockchain is a data structure representing information organised in unalterable *blocks* of data, cryptographycally linked one to another in a *chain*, with updates embedded in the latest added blocks. Such a data structure is replicated in a large number of nodes, and kept consistent by a distributed consensus algorithm. Agreement of a suitable majority of honest nodes guarantees consistency and persistency of data, even in the presence of byzantine players (an introduction to the blockchain technology can be found in (Bonneau *et al.,* 2015))[25]. According to Zheng *et al.* (2017), the blockchain has one more important characteristic, namely *persistency*[26]. The blockchain is tamper proof. Changing or deleting data transactions previously stored into the ledger is theoretically impossible without being detected by other users. Hence, invalid transactions could be immediately discovered.

In essence, a digital asset is the digital representation of value transferred through an untrustworthy network environment (Zheng *et al.,* 2017)[26]. For our purposes, we simply refer to an asset as a digital commodity exchanged over the network. At a more technical level, it is a complete and public record of all data transactions shared among nodes (Abd Elinaam *et al.,* 2010)[27]. These public records are stored in a data structure known as the ledger. In the shared ledger, data is readable and writable by everyone, but it is stored in such a way that cannot be altered nor removed.

We reiterate that blockchain is a recent but well established technology that enables trusted interaction. The system is *decentralized*. A large number of algorithmic nodes agree on the current state of digital transactions, by means of distributed consensus on replicated copies of the whole set of transactions, one copy for each node. The system is robust to a minority of dishonest nodes. In this respect, blockchain can change the marketing relationship between parties, i.e., host and guest in our case.

Antoniadis *et al.,* (2019) explore blockchain applications in marketing[28]. It is suggested that blockchain requires a revision of International Business (IB) theories. These are focused on physical marketing challenges which blockchain removes. Location choice, market entry, and organizational design all change. Despite this, only 8 percent of companies view blockchain usage in marketing as moderately or very important, but its relevance is projected to increase (Harvey *et al.,* 2018)[29].

3.1 From Host-Centric to Customer-Centric

The centralized business model based on trust was described by Liu (2012)[30]. It assumes an online rental platform produces a homogeneous rental transaction, which is depicted in Formula (1) as Q, based on the listing of the host's accommodation, Ha. Alternative rentals are marketed at competitive markets at a constant price, R, to the rental platform:

$$Q = f(Ha) - f(R) \quad (1)$$

[3]A smart contract is executed by all the nodes supporting the blockchain and may cause an update in the state of the information, i.e. new information, a payment say, is added to the blockchain. The blockchain consensus mechanism of honest players guarantees the correct and untamperable execution of the agreement between parties as encoded in the smart contract. Smart contracts may also receive payments and manage a budget.

Where

Q = rental agreed

f (Ha) = function of the rental obtainable from a given set of rental days. Ha = host accommodation.

Assuming the maximum rental obtainable from a given set of rental days exhibits constant returns to scale leads to the earned income Y as shown in Formula (2). This depicts the earned income of the *Airbnb* host:

$$Y = f(P) - f(R) \tag{2}$$

Where

Y = earned income

f (P) = function of the price of rental given to the guest.

f (R) = function of the alternative rentals that can be purchased on competitive markets at a constant price.

According to Gronroos (1994), the issue with this model from a marketing perspective is that it is host centric[31]. The price of rental given to the guest conveys no information about the reliability of the host. This is relevant as, with *Airbnb*, the host has the ability to void the rental. Such a scenario would clearly impact a guest utility. Furthermore, the system is not transparent to the host. Consider for instance a non-agreeable cancellation by a guest who is particularly valuable to the platform. The platform can exert its dominant position by deciding to refund the guest, and "reroute" any existing clients to the host. Such an action would be to the detriment of another host who would loose the potential booking from the rerouted guest. This would happen with both hosts being completely unaware, an abuse of monopoly power.

All online platforms require a trust framework to successfully market themselves, be they centralized or decentralized (Kollock, 1999)[32]. The centralized approach to trust differs from the relationship marketing typified in industrial marketing. The relationship element in the activity, resource and actors model does not translate well into peer to peer marketing. Airbnb and the industry address this by managing the trust amongst participants. People would not allow strangers to occupy their home for a short stay unless such a platform provides an identity and reputation framework.

dAirBnB is proposed as a solution to such kind of problem. It allows for a decentralized negotiation and execution of lodging agreements amongst untrusted parties. Trust is provided by deposit-engineered incentives, designed to promote honest behaviour amongst parties. The formula is presented below. Novak *et al.,* (2000) suggest that it is important to create a compelling online environment for consumers[33]. We illustrate the additional dynamic in Formula (3), namely the functions of reliability and experience. We emphasise that the experience element is the marketing innovation that is central to our BMI.

$$P = f(r) + f(e) \tag{3}$$

Where

P = Price

f (r) = function of reliability

f (e) = function of experience

The twin issues of reliability and experience can be addressed by a decentralized deposit-refund system similar to those explained. Such an approach would, in effect, combine a tax on rental booking to both guest and host with a rebate when the rental is consumed or cancelled. To the host it represents a subsidy to ensure trust. To the guest, it represents a pre-payment to signal he/she can be trusted. In this way, the deposit moves the mutual transaction from a single isolated one to on-going relationships with a knowledge and reputation element (Easton 1992)[34].

The *dAirBnB* approach is one of such deposit-refund systems, administered through the use of a smart contract and decentralized blockchain technology. Often, centralised platforms provide community-based reputation systems relying on user feedback. One major way of currently achieving trust is through reputation- based feedback between hosts and guests. Bolton *et al.,* (2013) observe that such feedback can be biased due to positive reciprocity[35]. This reduces its value and therefore harms market efficiency. In the following we introduce a running example exemplifying our approach.

Herbert (H) is a *host* who rents his flat whenever available, and benefits from a tech platform, AirBnB say, and the trust it provides. However, being dependent on a single dominant player may be a reason of concern for Herbert, since he cannot much negotiate fees and conditions and may have no control on advertising and rental policies.

Gaia (G) is a *guest* looking for accommodation. She also enjoys the availability of an efficient and accessible global market, with a trust and reputation framework and forms of risk protection. However, Gaia also suffers from potentially high mediation costs, asymmetry of information, and limited negotiation power.

One example, for instance, are cancellation policies: Gaia cannot agree on mutually fair cancellation policies, but just accept those proposed by the platform or host. Often, Gaia must guarantee her booking by means of a binding, for her only may be, credit card reservation. Herbert, differently, can cash the reservation anytime within a grace period. In that period, Herbert can still withdraw from the agreement, or keep advertising the flat and wait for more convenient deals.

To address these problems, we propose a redesign of the online lodging market trust model, exploring whether and how deposit based reputation models, implemented by smart contracts running on blockchains, can represent a viable, and desirable, alternative to the status quo. The rental accommodation market, indeed, seems to represent an interesting and general test bed for validating the decentralisation promises by blockchain technologies and smart contracts, and assess their innovation potential in marketing.

4. The Business Model Innovation (BMI)

The decentralized model is also a BMI. Berglund and Sandström (2013) propose that a BMI be based on shared knowledge, trust, network and the alignment of heterogeneous interests[36]. In alignment with this, and in order to illustrate the BMI, the centralised Airbnb model is based on the following steps:

1. The hosts actively places rental information on Airbnb about and the asking price, including photographs and marketing description.
2. The guest passively searches for a property on Airbnb, with the criteria and price range.
3. A reservation is made based on review of host. The guest then makes the payment to Airbnb, including transaction fees. Fees, grace periods, cancellation policies, and refunding may offer limited negotiation and lack transparency.
4. After the stay, the host and guest can rate the experience and write reviews about it and each other.

The BMI in the decentralized *dAirBnB* model replaces the passive Step 2 with an active one. Furthermore, it introduces negotiation and transparency in Step 3 by disintermediating some of the functionalities carried out by the centralised actor, Airbnb.

The BMI changes the transnational relationship from a marketing mix to a relationship one (Gronroos, 1994)[31]. The guest uses his/her reputation to negotiate the price and establish trust. The relevant assumptions on which this relies are discussed next. Most of them are standard assumptions in the current market, can be reasonably fulfilled by the blockchain or other currently available technology such as Customer Relationship Management software, and are generally compliant with regulations.

4.1 Agreement, Negotiation and Core Incentives

The agreement negotiation phase, and how the agreement is consequently executed, is what differentiates the two business models, Airbnb from *dAirBnB*. It enables *G* and *H* to tailor their rental to their needs, agreeing on price, payments, cancellation and conciliation policies, deadlines, and possibly other aspects of interest. *dAirBnB* changes the agreement from a one sided marketing sale to one of mutual participation. We emphasis that although our example relates to the enhanced participation of *G* - and also *H* - in the process, there is also a broader disintermediation of AirBnB that occurs due to the increased transparency. It creates what is termed 'skin in the game' in finance (Winston and Yerramilli, 2021)[37]. As the agreement outcome is encoded in a smart contract, it will automatically be enforced. We developed a pre-defined protocol to test this concept. We suggest it is possible to create a library of tested agreement templates that can deliver negotiation outcomes. These can be composed of various rental agreements aspects:

- A double escrow can be used to incentivize good behaviour, in accordance with our suggested informational benefit. In this way, both parties pay a deposit *d* to the smart contract, to be returned at the mutually satisfactory completion of the protocol. This is a quite standard blockchain-mediated trade approach.
- Distributed negotiation may lead to increased marketing benefits and facilitated price discovery. This is because transparent encoding can reduce information asymmetry, preventing for instance *H* from leveraging on rental proposals that are binding for *G* only.

With Airbnb a set of cancellation policies is offered by the platform and selected by *H*. In *dAirBnB*, mutual negotiation may foster fairer policies. *G* and *H* may for instance agree a cancellation fee proportional to the average income of the period, as estimated by the smart contract on historical data.[4] Duplicated payments due to cancellations and re-booking by the host, could also be addressed. *G1* is incentivized to leave some privacy-preserving note in respect of a cancellation payment on the blockchain. This information would then be available to *G2*, when booking the same period. *G2* could then partially refund *G1* and have a discount in the overall payment to the contract, with mutual benefit. *H* would still benefit from a fair payment, the opportunity of being in the decentralized market, possibly a share of the refund, and a better marketability of the flat. With this approach, our Business Model Innovation avoids the inefficiency of the centralised market as extra resources can be either re-deployed in the market or suitably shared between the stakeholders.

Such behaviour can be easily enforced by encoding it in the smart contract. As the previous example suggested, a suitably incentivised trade-off between privacy and transparency may open interesting scenarios.

dAirBnB adopts the approach that in case of disputes that cannot be resolved within the agreed protocol, *dAirBnB* responsibility will be limited to provide sufficiently detailed documentation to the legal jurisdiction.

4.2 Incorporating Rewards and Reputation

As Katsikeas *et al.,* (2009) explain, trust is a central construct in relationship marketing[38]. The literature on reputation in "trusted community marketplaces" has[4]. Technically, this would require the use of an *oracle*, i.e., a trusted component in charge to provide correct information to the smart contract. This is standard practice. Oracles represent dominating positions as centralisation points. This can be mitigated, for instance, by reverting to a set of independent oracles and perform some simple averaging protocol or majority vote amongst them, depending on the kind of information required.

largely focused on ratings. In this respect, it is interesting that Hu *et al.,* (2009) observe a skewed distribution against negative reviews. Reviewers prefer to leave positive comments[39]. Fradkin *et al.,* (2015) show this is the case even with two-sided review protocols[40]. We argue that this supports our proposed protocol as a superior builder of trust.

Akerlof (1978) introduced economic models in which trust is important[41]. He argued that guarantees are preconditions for trade and production. Where these are ambiguous, Graham's Law suggests that the transaction suffers. Clear incentives, such as the deposit protocol we propose, should differentiate between good and bad quality hosts and guests, thereby enhancing price outcomes.

The decentralized application we propose is a trust model. This supports the view of Ertemel (2018) that trust is a major marketing advantage offered by blockchain[42]. The deposit is the guarantee that there is a penalty in leaving the rental or not following the protocol. There are alternative hybrid systems that can act as incentives. One could, for example, build in open banking permissions to each parties bank account. In this way, the *dAirBnB* can verify ability to pay. Combined with a direct debit smart contract, the deposit would only be drawn down when the contract was cancelled by either party, making the customer unfriendly practice of credit card pre-approvals unnecessary. In this context, pre-approvals can replace the deposit as the provider of trust.

4.3 Deposit based Incentives and Monetising Reputation

Central to the understanding of the BMI is the idea that marketing enables exchange between buyers and sellers (Bagozzi 1974)[43]. The deposit based approach we propose for further investigation promotes this. This would build on our proposed decentralized approach and is explained as follows. In agreement, *G* and *H* pay each other a contract rental sum (*R*). Should they disagree, the negotiation is void. Table 1 shows the decentralized scenario where if either G or H disagree after entering into the contract they default a deposit.

In the consensus phase, *G* and *H* have probabilistic outcomes on their fulfilling the contract as depicted in Equation (1) of the centralized model, but is also relevant in representing the decentralized business model. This represents the maximum rental outcome, which in turn is an optimal marketing outcome. The deposit held back from both parties depends on the expectations εD.

$$\varepsilon \mathrm{D} = \frac{Hp - G}{R} = \frac{R(H+1)}{R} - 1 \qquad (4)$$

		Host, *H*	
		Agree	*Disagree*
Guest, *G*	*Agree*	*(H, −G)*	*(−H)*
	Disagree	*(−G)*	*(V oid)*

Table 1. dAirBnB: A scenario between guest Gaia (*G*) and host Herbet (*H*) where both parties have to decide whether or not they should honor the deal made or forgo a deposit. The top left hand quadrant has both *H* and *G* agreeing. The top right hand quadrant has the host disagreeing and the bottom left quadrant the guest disagreeing. In the final bottom right quadrant, neither party agrees so the negotiation is void

Where:

εD = Expectation of the fraction of the rent to be taken as deposit,
R = Rent agreed,
H = Host outcome,
G = Guest outcome,
p = Probability.

Formula 4 details how the price discovery is a function of rental agreement outcomes between host and guest, where expectation is used in the probabilistic sense.

The consensus process is illustrated in Figure 2. *H* has a deposit loss history depicted by one star. *G* has a deposit loss history depicted by three stars. The consensus is formed around a mean of two stars.

$$nh_i^{\mathrm{dA}} = f(R)^i[H_1^i, H + G_n^i \ ] \tag{5}$$

Where: nh_i^{dA} = the numerous hosts on *dAirBnB*, the rental outcome function ϕ is decreasing as $H + G$ is increasing and G_n^i represents the various potential guests.

or, from the guest perspective,

$$nh_i^{dA} = f(R)^i[G_1^i, H + G_n^i \ ] \tag{6}$$

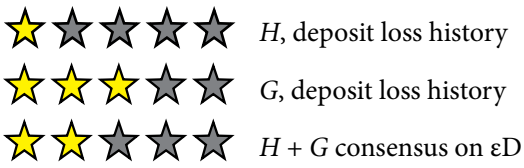

Figure 2. The stars depict *dAirBnB* 's probability of deposit forfeiture. Gaia and Herbert's deposit defaults are compared. The consensus determines εD. The general frame-work supposes that there are two asymmetric outcomes from this comparison. These are depicted in the following Formulas (5) and (6):

Where:

nh_i^{dA} = the numerous guests on *dAirBnB*, the rental outcome function

$f(R)^i$ is the function of the i*th* rental agreed. This is decreasing as $H + G$ is increasing.

In Formulas (5) and (6), price discovery is made according to traditional economic supply and demand dynamics as shown earlier in Formula (4). The deposits act as incentives to establish trust, which establishes a marketing advantage and thereby increase rental outcomes. Incentives are economical and make good behaviour Pareto optimal. In the example above, they are based on a traditional escrow scheme, where both host and guest behaviour is constrained by a deposit that will be returned only at the mutually satisfactorily completion of the agreed protocol. The deposit is determined by consensus negotiation which reduces the issue of rental heterogeneity. This further underlies the BMI contribution of blockchain to marketing.

To illustrate, suppose the numerous hosts in a city compete for a rental as in Formula (5). They review the reputation and evaluate the deposit offered by the numerous guests. The guests do the same as in Formula (6). Agreement is made as in the protocol shown in Table 1, where both host and guest agree in the top left hand quadrant to enter into a rental. The optimal outcome is described by Formula (4) and results in an outcome where both parties are experiencing a better interaction experience in terms of satisfaction in the negotiation outcome.

We emphasis we have implemented a double escrow smart contract. We suggest that the deposit system represents a suggestion for future research. The decentralized model introduced earlier in Section 4, however, has been developed by the authors to demonstrate proof of concept. As a next step, the contract could incorporate permanent identities to which reputation could be attached. Then different marketing strategies and overlays could be adopted. Reputation could be ascertained as a transitive closure of trusted relationships between individuals, which could be easily deduced from the blockchain. Alternatively, it could be more traditionally ascertained, for instance exploiting micro-transactions to record appreciation.

The suggestion to ask for a deposit would be a way to monetize reputation. Clemons (2009) argues that the monetizing of virtual electronic social networks is the new approach for marketing[44]. He points out the parties

in a social network transaction are not captive. Unless they feel part of a negotiation (or be entertained), they can potentially feel they are being manipulated.

5. Methodology: Piloting dAirBnB

The focus of this trans-disciplinary concept paper is the BMI. In the work we did on the decentralized model, we implemented and tested a *dAirBnB* smart contract the details of which are available from the authors on request. This contract can be viewed as a state machine which reacts to specific actions by participants depending on its current state.

For instance, the first-and only-thing that *H* and *G* are initially entitled to perform is the payment of a deposit. This is done with a cryptocurrency and recorded on blockchain. *C* reacts to such a payment by enabling further actions or events along the life of the rental agreement. For instance, exploiting the opportunities arising from the integration of blockchain and internet of things. We envisage smart devices, e.g., smart locks, that can securely certify to *C* the start of the rental. In this specific example, *C*, as agreed by *G* and *H*, would start a count-down within which *G* can raise a complaint about the flat, after having entered it. The construction of *C* guarantees that no party of the agreement can fail to respect the agreement without incurring in a loss, which makes not fulfilling obligations not convenient. Being the contract deployed and run on a blockchain, the parties trust that it cannot be altered and will run exactly as specified.

According to our contract, each relevant step in the real-life execution of the agreement is mapped to the contract execution. There are choice points, opening possibly different executions of the agreement, which lead to possibly different conclusions. *G* and *H* are incentivized to get to a point of common satisfaction, where they will both maximise their utility functions.

In our experimentation, we further explored the possibility of monetizing reputation. We did this by designing a blockchain-supported digital token, called *rep*, and its associated tokenomics (i.e., the economics of the token). Rep can be exchanged at a fixed rate against the contract currency[4], can be used as deposit, i.e., skin in the game- by both parties, and earned as reputation from successfully completed agreements. It has also other special features that make it fit for purpose. For instance, in order to prevent Sibyl attacks where one "impersonates" the reputation of others, rep cannot be freely exchanged or lent among users. The design of rep's tokenomics is a distinguishing and innovative feature made available by the "programmable" nature of cryptocurrencies and blockchain-supported tokens.

Ideally, the success of a decentralized model will depend on the how it is implemented. In this respect, Xu *et al.,* (2017) provide a quick list of milestones that may contribute to building a blockchain[45]. These are (1) the pilot project, (2) the adoption, (3) the benefit, (4) the scale up and (5) the widespread adoption. Our proposal covers the first three of these. It builds on the two different marketing views of blockchain that exist in the literature. These are, (1) a sales focused role as an exchange network for assets transactions, and (2) a relationship focused role as a tool to replace notaries or other trusted parties in any dispute (Mougayar, 2016)[46].

6. Discussion

In demonstrating the way a distributed model can be applied to the online rental market, we have highlighted the need for existing frameworks and marketing approaches to adapt to the evolving digital landscape. Such protocols would move us closer to the "smart tourism" by blockchain envisioned by Nam *et al.,* (2021)[47].

Our approach has both revenue and price discovery implications. It allows for a higher level of trust and therefore more transactions. It further allows for a two party negotiation and therefore fairer price to both parties. Zott and Amit (2010) are closely aligned to our view of a business model as a system[48]. They argue it that transcends firm and should be viewed in concert with its stakeholders. Blockchain achieves this through its content, structure and governance structure.

We suggest that our innovation would drive return users. Quinby and Gasdia (2014) argues that value for money was one of the most important variables in choice of Airbnb by customers[49]. The price discovery facilitated by both parties entering into negotiation should therefore result in greater satisfaction. Mao and Lyu (2017) investigated why travelers return to use Airbnb[50]. They found that attitude and subject norms are important. In

[4]We can assume that *dAirBnB* uses a stable coin available to the blockchain where *dAirBnB* is implemented. A stable coin is a cryptocurrency whose exchange rate is stabilised, for instance by pegging it to a stable fiat currency, or by controlling its issuance.

this respect, perceived risk of a potential loss is relevant to the customer decision and as such supportive of our proposed skin in the game deposits and blockchain negotiation protocol (McDougall and Levesque, 2000)[51].

The concept of online disintermediated negotiation is currently receiving scholarly attention in the field of computing. One such example is the Boson Protocol, proposed by Banon and Barosa (2020), which is similar to our approach[52]. This is a peer-to-peer negotiation which can replicate the benefits of an online rental intermediary. It uses centralized intermediaries, but minimizes arbitration, trust and cost. The protocol implements a two sided deposit structure which automates the mediation of disputes and ensures skin in the game.

Although our proposed innovation would improve the price discovery and marketing reach of online rental customers, Airbnb is under little pressure to change a successful model due to its dominant market position. The dynamics of the dominant marketing model are discussed by Vargo and Lusch (2004)[53]. They suggest that knowledge is the most important source of competitive advantage. As such, although a dejure monopoly, we believe Airbnb would benefit from considering a distributed adaption to their business model, along the lines we suggest. The focus of AirBnB's business model on hosts is also something that regulators might consider.

7. Conclusion

We present an alternative to the Airbnb business model, thereby addressing the critique that it is not truly disruptive. We propose a decentralized BMI for the online accommodation rental market. Our approach addresses the lack of guest participation in the marketing dialogue.

We present a proof of concept for a decentralized accommodation rental market. We design and implemented this as a smart contract on a blockchain. Our pro- posed decentralized application, which we term *dAirBnB*, makes the online rental business model more efficient and fair. This is done by migrating the online model to the blockchain. We illustrate the properties of the application and how they evolve the business thought.

Our contribution is in demonstrating that decentralized applications can be practically implemented in the online rental market. We extend the role of Internet marketing through the building of relationship and reputation-ship through programming code. This illustrates the need to further extend marketing insights to take account of the disruption caused by Internet focused business models.

The innovative reputation system we propose is similar to a frequent customer program. We suggest it be based on deposits so as to ensure 'skin in the game' by both parties to the rental. The advantage of this approach is that it can be hard coded into a smart contract on a blockchain, thereby automating the marketing advantages. It is potentially disruptive from a global marketing perspective because it is designed to establish trust and reputation. It aids the marketing and customer relationship process and has a marketing advantage due to the improved price discovery process, which theoretically results in more rental bookings.

8. References

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