

Blockchain adoption in networks: the decision flow through three arenas

ABSTRACT

Aim/Purpose: To show how the adoption decision about blockchain technology follows a path through three 'arenas', each showing distinctive organisational and behavioural driving forces.

Methodology: Grounded theory using Meta-analysis, mind mapping, participative observation and 22 Atlas.ti analysed interviews.

Findings: Three 'arenas' were observed: (#1) visualises the driving forces, motivations and reasons that play a role in *the mind of the decision making individual*; (#2) reflects and incorporates the *transition* from the individual level decision making to the *company meso* level, meeting other decision makers. It follows the worldview given the hierarchy among decision makers and results in a company strategy with particular network implications. (#3) describes the constituting elements of *power* that play a role for four different types of networks: long term relations, consortia, exploitative networks and spot buying networks.

Originality: This study offers an original view on innovation adoption processes in supply chains, networks and systems, applied to the case of blockchain technology.

Conclusions: Blockchain usage seems mainly relevant for networks based on long-term relations, not so much for consortia, exploitative networks and spot buying networks. Which network a company chooses to participate in depends on the worldview of the company as a result of the distribution of hierarchies of the participating decision makers.

Keywords: Blockchain, Technology adoption, Worldview, Supply Chain Management

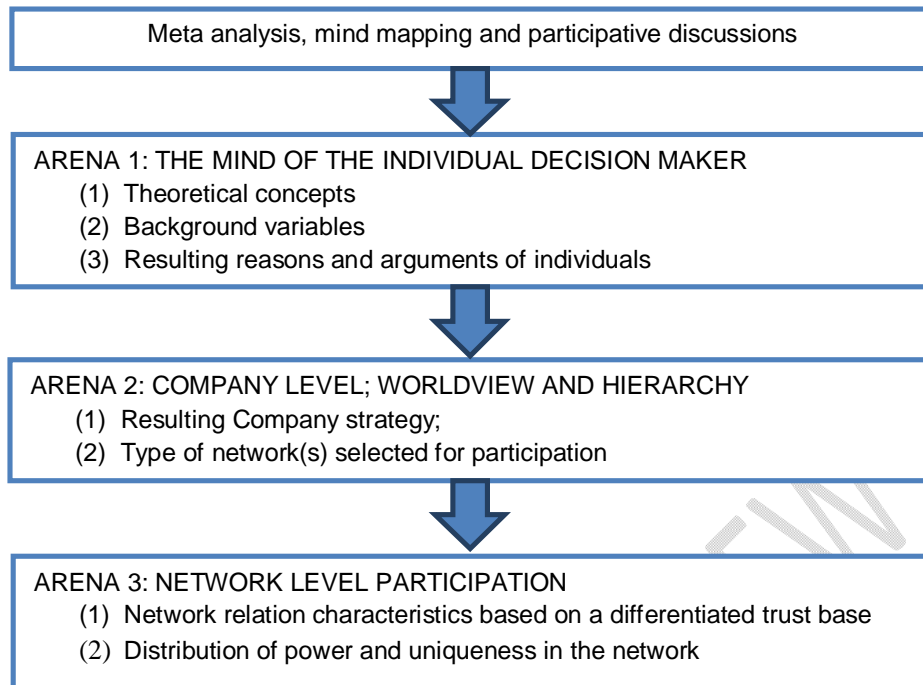
1. INTRODUCTION

Blockchain technology, with its promises of increased traceability, transparency, security [1,2] and means to boost the company's reputation [3] has shown an increased popularity in literature [4,5,6,7]. This contribution takes these advantages – and the long list of less published disadvantages [8] like high costs and negative sustainability – for granted. It will focus on the organisational and behavioural aspects that play a decisive role when a company *adopts* – or does not adopt – this technology: what decision process applies here and which decision variables play a role? How to understand and explain? How come that a particular type of company adopts blockchain technology, or why not? For which reasons? What takes place in the decision '*arena*' of a company when the decision has to be taken? What takes place in the '*arena*' where the company meets its network partners: which factors are decisive? How to understand, explain and eventually predict the outcome of these processes? But first of all: what goes on in the mind of the individual decision maker, the first '*arena*'? Which arguments in favour or against? What is the theoretical framework we have to use to understand and explain possible choices and decisions?

To answer these questions, four steps are taken: *first* of all, a Meta-analysis[9] and mind mapping will give a number of issues relevant in literature, followed and tested on their relevance through participative discussions and interviews with academics, IT specialists and practitioners. After this, the decision flow is followed through three 'arenas' of decision making. In each 'arena', the relevant aspects, forces, issues and determinants will be discussed. The first 'arena' of decision making is *the individual manager's mind*. A manager either in the role of advisor, decider, or in an implementation role. Arguments and reasons will be distilled from interviews and why managers think it is a good/ bad idea, or why they think it is not relevant for their situation.

In the second 'arena', *the company decision* about its strategy is taken, including the one about adopting blockchain or not. Assuming a possible differentiation in opinions across functional areas in the company, we assume that the hierarchy of functions and functionaries – the negotiated social hierarchy - determines the final world view [10] held and executed by the company. As a result of this decision, the company will enter yet another, third arena: a particular set of network partners. For some of these networks, the issue will be irrelevant. Still, the elements that determine the power that play a role in demanding or refusing blockchain use by network partners will be analysed. So, even companies that think it is irrelevant may be faced and forced to use it. Being 'unique', having a large volume or market share also may well play a role within the network hierarchy and power to enforce or resist demands for adopting blockchain technology.

Fig.1: The 4 steps taken and the 3 arenas of decision making



2. TRUST AND BLOCKCHAIN USE

A much discussed concept in relation to the use of blockchain technology is the concept of 'trust'. This can be viewed as some kind of 'chicken or egg issue': does one need trust to use blockchain technology or does one need blockchain technology to create trust? Trust in relations is a much described concept in literature [11] especially in social sciences [12]. Maybe one should realise that 'trust' is an *inter-human* characteristic. One can trust another human being, not a machine, or software. Machines can be 'reliable'. One can trust a supplier because reliable machinery is being used, or known inputs, so the supplier will meet the expectations. Or, one can trust a supplier because certificates issued by objective third party authorities warrant we can trust that supplier to meet our expectations.

Trust and trustworthiness between actors -"two key components of social capital" [13, p.811]- are impossible to operationalise as a single observable manifest variable each; they are typical latent constructs that require various observable manifest variables or conducting experiments with monetary rewards [13, p. 812]).

Relevant for this study is the assumption that *temporal embeddedness*[14,15,16]with both its shadow of the past and shadow of the future seems a good *proxy* for 'an attitude to reduce possible opportunism' equals 'trust' that the other party will 'behave'. Since in a 'tit-for-that' situation, opportunistic behaviour will be facing a possibility for retaliation. That is why the temporal embeddedness plays a role in dampening opportunism. Or, as Buskens writes "If network members can *sanction* untrustworthiness of actors, these actors may refrain from acting in an untrustworthy manner[15, p. 19, ital authors]. He also states that when actors are informed regularly about trustworthy behaviour of others, trust is likely to grow among these actors. Another element Buskens adds is the 'importance' of a given trustor for the trustee. He states that when a trustor involved in half of the trustee's transactions no longer trusts the trustee, this will be more problematic for the trustee than when a trustor who is involved in a much

smaller proportion of transactions no longer trusts him. Finally, he states that the sanctions of a more important trustor can be more severe for the trustee than the sanctions of a less important trustor.

2.1 Organisational versus individual shop floor level

Furthermore, there is a difference between the effects of a 'shared future' when taken at the *organisational* level or at the *individual 'shop floor' level*; "an expected shared *organisational* future has only marginal effects (if any) on the probability of problems in the present transaction, an expected shared *individual* future does show a small but significant impact on the likelihood of problems [17, p 37]. In other words: blockchain technology may be seen relevant at an *organisational* level to compensate for a lack of perceived temporal embeddedness since each time different actors are dealing with each other at an operational level. Although each time the same companies are involved, different persons are involved. At the same time, if actors at an operational level *do* have a common shadow of the past and future, they may not feel the need for blockchain technology because the chance for opportunistic behaviour already has been minimized; they 'trust' their counterpart. So, why use an expensive technology where there is no need for it? Even more, there may be a large share of uncontracted exchanges, based on personal *contacts* rather than *contracts* [18]. That would mean that blockchain usage mainly serves inter-organisational contacts and less the hands-on operational individual level. One may assume that an increased *size of the company* reduces the chance that at an operational level the same persons are involved. Hence, if an increased company size implies lower chance for a shadow of the past/future between the responsible actors acting, it also implies an increased feeling blockchain usage would or could compensate.

2.2 How important is trust

Hence, how important do managers rank 'trust' actually, when discussing blockchain use. Asking a set of 8 international managers and 3 consumers – when discussing the use of blockchain use - how important 'trust' is next to other topics such as transparency, traceability, sustainability, reputation and a list of practical advantages/disadvantages and other technologies that may be used instead of blockchain technology, the following table reflects how important these 11 respondents found trust. Clearly, the consumers ranked it as their highest priority, managers in IT ranked it as lowest; they mentioned most often the various advantages and disadvantages. The ranking of IT specialists was confirmed with interviewing a second international set of 11 IT specialists. Their response confirmed the earlier results for all topics (table 2). In total, we conclude that the results point at a situation where we find a *differentiated mental map*, reflecting the function, sector or position in the supply chain [19].

Table 1: Frequencies of 7 topics mentioned when discussing blockchain technology

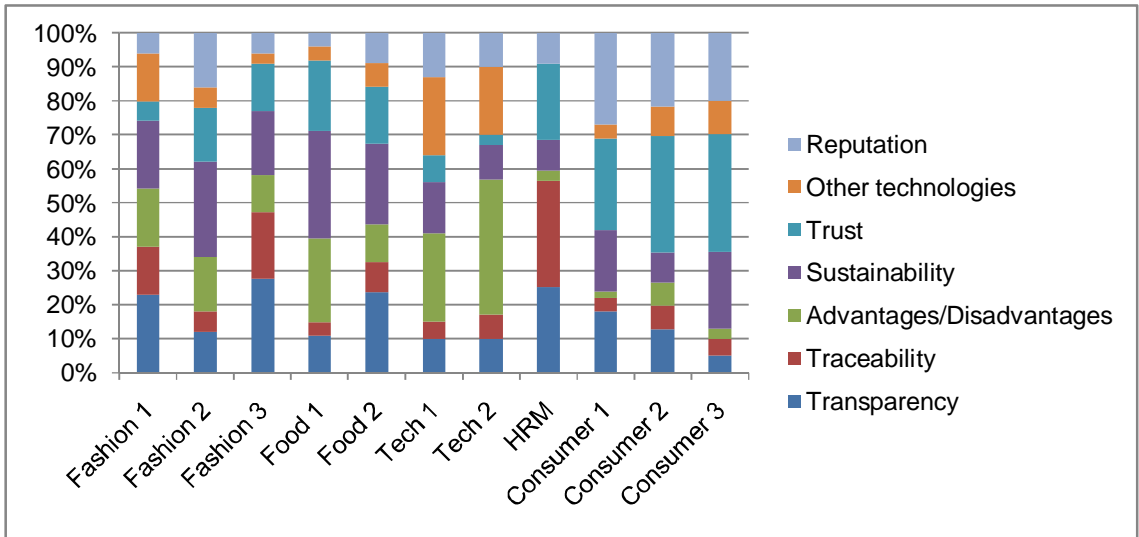


Table 2: Similarity between ranked topics of interviewees in IT: 2 international sets.

| Topics mentioned | set 1 | set 2 |
|--------------------------|-------|-------|
| Transparency | 10% | 12% |
| Traceability | 6% | 8% |
| Advantages/Disadvantages | 33% | 30% |
| Sustainability | 13% | 14% |
| Trust | 6% | 4% |
| Other technologies | 22% | 19% |
| Reputation | 11% | 14% |
| | 100% | 100% |
| r=0.98 | n=2 | n=11 |

2.3 Cohesion between and within groups

Do managers from the same sector or function show similar rankings of topics? How similar or different are their answers with managers from other sectors, or IT-managers, or HRM managers? And how different are their answers – reflecting their mental maps – from consumers? Table 3 shows that the ‘within group’ cohesion of answers is rather high; one might name this the Mental Map Similarity coefficient, measured by a simple correlation coefficient. Within food and fashion, this MMS score is medium, but among the IT-managers and among consumers, the MMS score is rather high. Table 2 shows the MMS score – based on two different sets of international IT managers - is 0.98. Consumers seem to be united in their view that trust is the most important; tech or IT managers agree in scoring trust lowest. Looking at the MMS score *between* categories and sectors, one finds much lower scores and even some negative scores. This would indicate sometimes rather opposite mental maps when it comes to what is

important. Hence, agreement within the sector, function or group, differentiation between the sectors, functions or groups.

Table 3: Cohesion between respondents

| <i>Within cohesion</i> | | <i>Between cohesion</i> | |
|------------------------|-----------------|-------------------------|-----------------------|
| 0.13 | Fash 1_2 | 0.55 | Food2_Fashion1 |
| 0.63 | Fash 1_3 | 0.83 | Food1_Fashion2 |
| 0.73 | Fash 2_3 | 0.26 | Food1_Fashion3 |
| | | 0.30 | Food1_Fash1 |
| 0.61 | Food 1_2 | 0.73 | HRM_Fash3 |
| | | 0.21 | HRM_Cons1 |
| 0.88 | Tech1_2 | -0.66 | HRM_Tech2 |
| | | 0.09 | Tech1_Fash2 |
| 0.82 | Cons1_2 | 0.24 | Tech1_Food1 |
| 0.82 | Cons 2-3 | -0.72 | Cons2_Food1 |
| 0.82 | Cons1-3 | 0.48 | Cons1_Fas2 |
| | | 0.12 | Cons2_Food2 |

3. Theoretical framework

The following theoretical framework has been used.

3.1 Coercive isomorphism

Rules and external factors beyond control are likely to result in similar responses. Examples are Government regulations, laws, demands made by tax offices, customs control, animal safety regulation or consumer protection regulations and HCCP protocols or similar regulations. These laws and regulatory demands may and will differ between countries. The particular response by those who have to deal with this all can be described as *coercive* isomorphism. Actors do not *like* the particular option they select to do, but simply are forced to apply it. Hence, the answer of respondents in an interview reflecting a particular choice of behaviour in this case is likely "simply because we have to".

3.2 Mimetic isomorphism

When faced with the technical uncertainty of choosing between competing technologies, companies have a choice of techniques to reduce uncertainty and where *imitative behaviour* is a frequently used strategy for minimizing uncertainty. This *Mimetic isomorphism* is a simple and effective response to uncertainty [20, p 151]. Already Cyert and March [21] observed that businesses may reduce their decision-making costs by duplicating previous judgments taken by other businesses. It enables a company to add its competencies with the assumed aggregate wisdom of other companies. The question remains if mimetic isomorphism leads to better performance *per se*? Abrahamson and Rosenkopf [22] indicate that mimetic isomorphism not only makes sense, but also is a lucrative concept. This copy-cat behaviour contributes to the formation of "rational bandwagons" of imitative judgments, methods, and behaviour. Previous research [23,24] has utilized mimetic isomorphism to forecast foreign business choices. The

answer of respondents in an interview reflecting a particular choice of behaviour in this case is likely “everybody does it this way”

3.2 Normative isomorphism

Next to being forced by regulations and the copy-cat behaviour just described, business or professional norms, together with ethical norms and values may drive a person to make certain choices [25]. It implies that personality and leadership style are likely to have an impact on behaviour. This is even more relevant, when it is about deciding on normative sensitive aspects. In such cases, both emotional intelligence and adaptability intelligence are relevant in explaining and predicting behaviour. The answer of respondents in an interview reflecting a particular choice of behaviour in this case is likely “it is the professional way we do this type of things”.

3.3 Resource Based View and Resource Dependence Theory

To obtain access to or control over certain resources or assets, a company may simply decide to join a particular relationship in a network of a certain group of companies. This might be in terms of knowledge, reputation, access to buyers or suppliers or simply in order to satisfy the bank, tax office or the parent company. As such, the Resource Based View (RBV) fits in well with each of the three types of institutional isomorphism just described. When it expires that a company adopts blockchain technology just to develop and maintain external relationships, also the Resource Dependence Theory (RDT) is relevant. Even Transaction Cost Economics (TCE) might be used to *explain* decisions, The answer of respondents in an interview in this case is likely “we badly needed this resource or access to that network, knowledge or market”.

4 METHODOLOGY

A mixed-method qualitative-quantitative exploratory Grounded Theory approach was adopted. For each step, the outcomes of the analysis of each of the three arenas led to an accumulative understanding of the factors playing a decisive role in the adoption issue of blockchain technology. Interviews were analysed using Atlas.ti. For each arena, the relevant theories explaining the existence and relevance of the determining factors were described.

5 RESULTS

5.1 Step 1: Meta-analysis, mind mapping, participative observations and discussions

The results of a meta-analysis– using Google Scholar, Ebsco, Scopus and WOS – were used as input for a mind map at the start of the project. It showed many seemingly relevant aspects [26, p. 29 and 30]. These were used for discussions with motivated interested participants in an inventory first round.

Table 4: Participants in the initial stage of gathering and checking viewpoints

| Theme: | |
|-------------------------|---|
| Blockchain | Research fellow in blockchain solutions Professor in computer security 6 Blockchain experts in technology 8 Blockchain experts in applications |
| Application of BC | Professional operating in electronic payment Business developer Internet of Things (IoT) Economics expert smart contracts Construction procurement manager |
| SCM Construction sector | Construction procurement manager Director logistics firm on construction materials Operation officer logistics construction materials Professional port warehouse (logistics recorder) Project manager of a construction firm |

Table 5: Topics viewed as most important in initial round

| <i>Topics viewed as most important</i> | | | |
|--|-----|------------|----|
| Sustainability | 36% | Reputation | 7% |
| Transparency | 21% | Security | 0% |
| Make trust | 21% | Speed | 0% |
| Traceability | 14% | | |

The accumulated knowledge resulting from this initial round was used as input for the next steps of the study. A number of 22 interviews – distributed across two sets of international interviewees - were part of a Two Stage Mini-Delphi strategy [27].

5.2 Step 2: Arena 1: The Micro level of the individual

5.2.1 The Genesis of the managers' mental map

As a normal human being, the manager's mental map views the world from a subjective perception and actually only notices those things *relevant* and *perceived* as important [28, p 55]. They have their own reference-model which they use to view the world around them and this subjective perception influences the way the selection process is performed which in its turn is determined by the social environment, milieu or social space of individuals: the *'habitus'*[29, 30]. This habitus is characterised by a regulating action that imposes a certain way of 'being' on the members of the habitus. The habitus influences the mental map of individuals and their behaviour. Bourdieu [29] describes the conditioning process of the habitus as "a structured structuring structure" [cf. 30]: the habitus not only conditions people to solve known problems according to proven methods of solving them, it also structures the way people look for solutions of new, not yet experienced problems. The habitus results in a specific *modus operandi*: a specific way

of doing things. Not only the present habitus influences behaviour, this is also influenced by the historical trajectory people passed through conditioning networks, like schools, other educational institutions, companies, courses and cultural aspects[28]. Or, in broader terms, the type of signals the manager will look for, values and actually will notice are determined by the structured experience

5.2.2. Observable results of determining factors in Arena 1

Given the described process taking place, which factors were found to matter when discussing blockchain adoption with interviewees? Apart from the initial interviews, shown in table 5, two more sets of interviewees were asked. Tables 1,2 and 3 already showed the results of these Two Stage Mini-Delphi interviews with 22 interviewees in total. Most popular arguments among managers referred to transparency, traceability and sustainability. IT managers rather focused on the technical advantages and disadvantages. Consumers showed a strong focus on trust and reputation.

When all interview results were analysed, using Atlas-ti, a hypothetical model could be constructed, as if based on a linear structural equation model (LISREL). This model acts as the basic model to reflect or picture the aspects, opinions, forces and thoughts that play their role in the genesis of the mental map of the individual manager when it comes to blockchain technology.

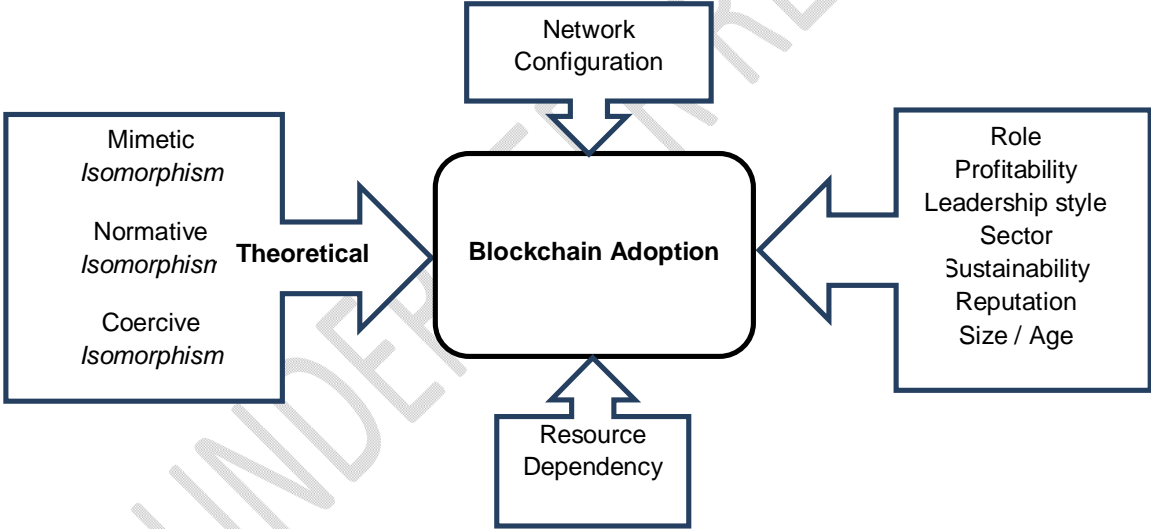


Fig.2: Arguments, opinions, and reasons playing a role in the Genesis of the Mind map

5.3 Step 3: Arena 2: Company level

5.3.1 The Battle of the Egos

The process - or 'battle' - that results in the accepted and shared modus operandi of an organisation - includes the view on the usefulness or desirability of blockchain technology. In fact, it is a process of negotiation [31,10]. This worldview or 'order' is determined by those who are in a position to dominate the discussion about it. In other words: those that rank high in the *social order* of the organisation have more impact in the discussion than those that are awarded a lower rank. This ranking of people and functions can be termed the negotiated *social order*: the CEO ranking highest, with the controller and the marketing manager usually sharing high positions. Of course, the

ranking - the social order - varies between organisations and is open for re-negotiation. Purchasing in most organisations still ranks rather low, with firms in trading and retail usually having a more dominant purchasing department and branding companies and high end fashion companies usually having a dominant marketing department, given the usual exceptions to the rule.

Figure 3 illustrates the ‘Battle of the Egos’ resulting in a particular world view of the company, given the advice of consultants and possible lobbyists, confirming the various types of isomorphism [20, 28 p.60].

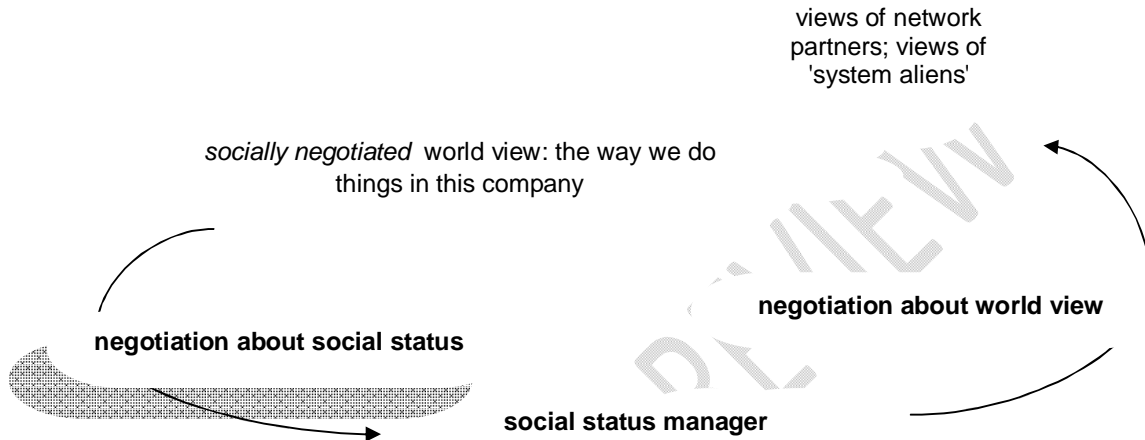


Fig.3: The Battle of the Egos: Socially Negotiated Order and Negotiated Social Hierarchy

5.4 Step 4: Arena 3: the network level

5.4.1 The typology of networks

Given the outcome of the discussions and decisions leading to a particular choice for the type of preferred external strategies – both in procurement and marketing – the company meets and has to deal with its chosen network partners. The assumption of temporal embeddedness is used for drawing up the typology of networks companies may participate in: (1) networks based on *long-term relations*; (2) *consortia* with separate short term relations; (3) *exploitative* networks and (4) volatile *spot buying* networks. Companies may be part of different types at the same time, for instance in fashion, companies may be part of the first (long term based) networks which also may be used for advertising purposes, but may use the third type (exploitative) relations at the same time for a significant share of their volume. This ‘duality’ may play a disturbing role when visualising networks - using surveys and interviews - tracking ‘trust’.

5.4.2 Power, uniqueness and other aspects

From interviews expired that one factor seems to play an important role when discussing what happens within networks and why: *power*. Usually based on uniqueness, size, turnover, market share, volume percentage, patents and linking pin role creating required access (figure 4). The distribution and role of power in networks have been studied for

some time [32]. This study is not so much interested in trying to *measure* this latent concept, but rather is making notes of the various components of apparent power, as mentioned in interviews that *apparently* play a role. Power, in relation to the forced adoption of blockchain, or the opposite, blocking the very adoption because of the power of third party objections. Hence, the role of aspects of power in relation to the adoption decision.

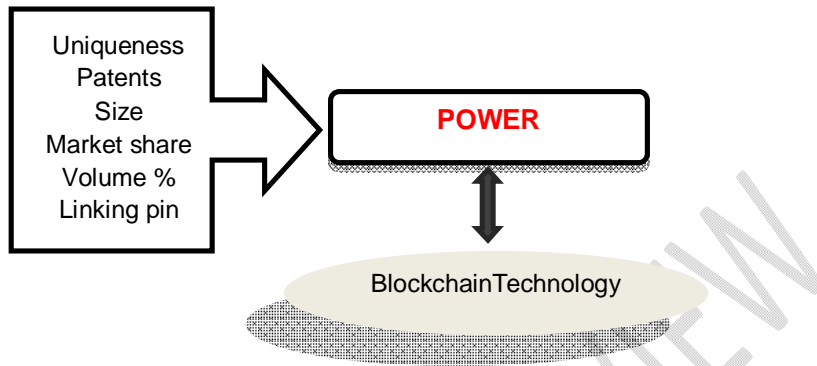


Fig. 4: Factors determining the power of network participants

5.4.3 The external environment

This all takes place in a differentiated external environment that may and will show differences in cultural, physical and geographic aspects[cf. 33].

5.4.4 Relevance of blockchain

Of the possible networks in the typology just described, three types of networks are likely to find blockchain technology too expensive or even a threat for their way of doing business. For *consortia* with their usual short term relations, possibly separated from the networks of the participating companies, it is likely to be cumbersome, too expensive and less relevant. The *exploitative* networks are rather shy about how they do business so these are not in favour of transparency and traceability. Volatile *spot buying* networks have by definition mostly one-off-time deals, even possibly in a series of independent deals with the same partner, but usually with different partners. That leaves only the networks with long-term relations as possible networks where blockchain technology might be welcome. Hence, for three out of four types of networks, blockchain technology may not be relevant at all. Only for one, still depending of the power distribution and whether the dominant partners are in favour or not.

5.5 Overall picture

Figure 5 shows the overall model reflecting the decision flow through the three arenas.

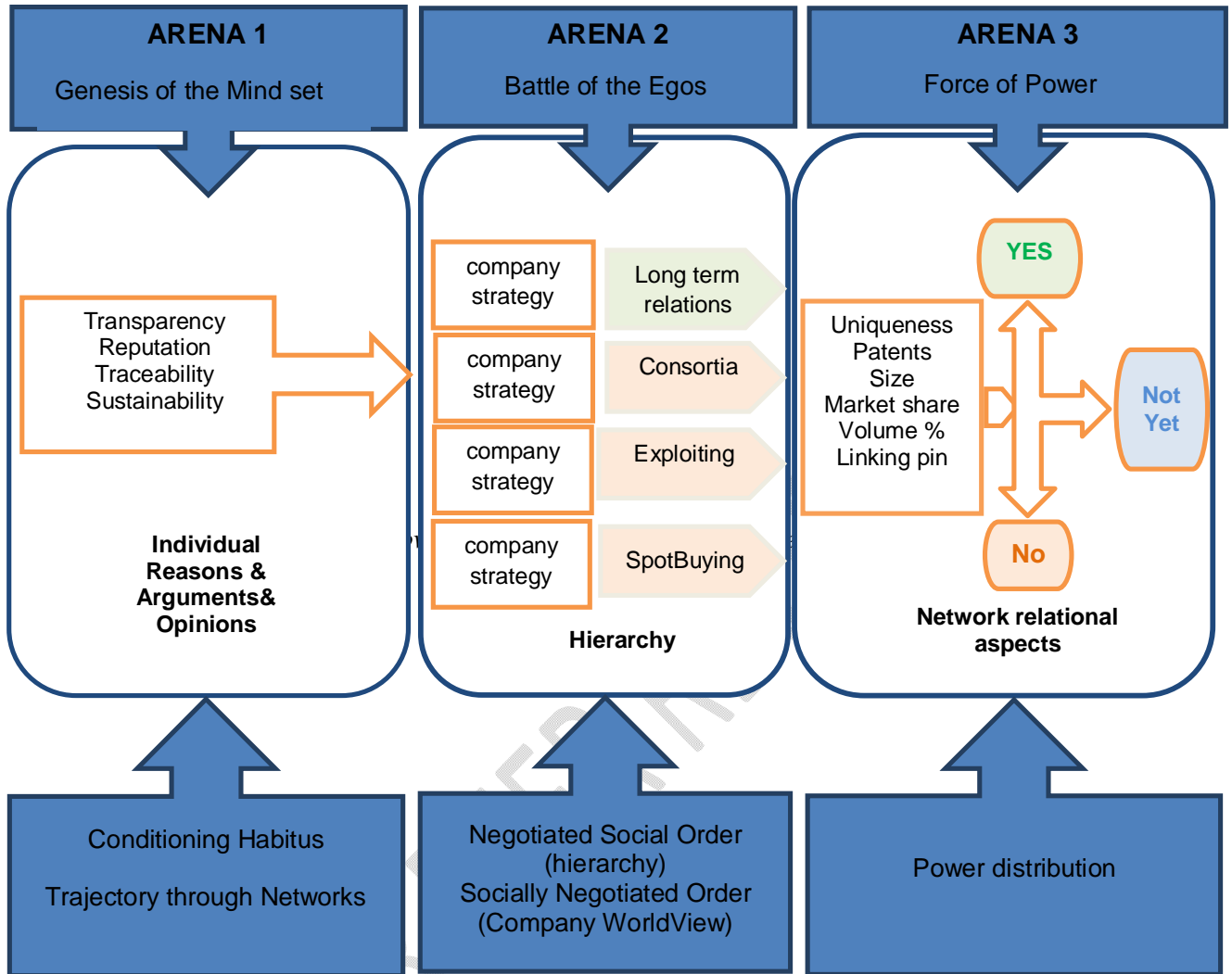


Fig. 5: The decision flow about adoption of Blockchain technology through three arenas

6 DISCUSSION

6.1 Just qualitative

This study is based on time consuming long and intensive interviews of interested experts working and living in a variety of countries. The analysis using Atlas.ti has given clear, qualitative analysis based descriptions of what happens in the Real World. The study preferred to isolate the key-qualitative aspects and make their role clear, before the stage of quantitative surveys would start, based on the motto that one should know first *what* plays a role before attempting to measure *'it's'* size, whatever *'it'* is.

6.2 Stimulating trust and cooperation

Returning to the topic of trust, one could follow Schneier [34] that, to create trust and security, four ingredients work together: (1) morality; (2) reputation; (3) institutions that enforce norms and laws; (4) security systems. However, this only adds four more latent constructs that would require further operationalisation by means of manifest observable variables.

If - maybe more modest - *cooperation* between network actors is aimed for or required, it was found that "Durability rather than trust is a prerequisite to let cooperation emerge." [18, p.32].

In addition, "When the same individuals have to deal with each other in a series of projects, cooperation is more likely to occur than when they deal with a different individual in each project" [18, p. 28].

Finally, as stated earlier, there is a different effect of temporal embeddedness when taken at organisational level or at the individual level [17, p. 37].

7 CONCLUSIONS

The decision to adopt blockchain technology is likely to follow a path through three arenas. In each arena, specific drivers and rules of the game play a role. At the end, blockchain usage seems mainly relevant for networks based on long-term relations, not so much for consortia, exploitative networks and spot buying networks. Whether or not a company wants blockchain depends of the network participated in. Which network a company choses to participate in depends on the worldview of the company as a result of the distribution of hierarchies of the participating decision makers. Each manager has its individual specific mental map, resulting from past education and experiences, position and is subject to the various types of isomorphism. While being unique, the conditioning process each manager went through causes some similarities between their mental maps.

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