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Blockchain innovation and framing in the Netherlands: How a technological object turns into a 'hyperobject'

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ABSTRACT

Blockchain emerged as a well-defined technological object with limited applicability applications (e.g. Bitcoin). Embraced by more and more 'stakeholders', Blockchain has turned into a bounty of possibilities and promises. This raises the question whether Blockchain is turning into an overextending, affective 'hyperobject'. Adopting a post-ANT topological perspective, and using mixed-methods analysis, this paper traces Blockchain's recent developments in the Netherlands. A media analysis of newspaper items shows a telling divide between stakeholders (including incumbents) stressing Blockchain's radicalising prospects and those (notably involved knowledge and policy workers) warning of its overhyping and lack of governance capacities. A detailed analysis of strategies and operations of the key enabler, the Dutch Blockchain Coalition, reveals how much effort has gone into face-to-face encounters and communication to frame and script the object. Yet, this also causes Blockchain to proliferate in all kinds of directions, turning into a hyperobject beyond the reach of intellectual and practical grasp.

1. Introduction

The Internet has revolutionised the way we communicate, work, trade, shop, travel, interact, et cetera. In all its sophistication, however, it continues to pose major challenges with regard to the identity and integrity of the connected parties and the secure and trustful recording of their activities and transactions [1]. Blockchain, as a fully automated system for a distributed ledger, is a promising technology meeting this challenge. Blockchain technology already exists for decades, with successful applications notably in cryptocurrencies (Bitcoin). Since a few years, Blockchain has become promoted more widely, and even presented as the next 'revolutionising' internet technology, with a huge range of possibilities beyond cryptocurrency [2]; [46]; [3,4]. However, the usefulness, efficiency, benefits and even coining of Blockchain technology are also strongly debated [5]. There is serious doubt about the effectiveness and efficiency of Blockchain regarding for instance issues of digital identities and secure transactions, and claims concerning more private applications (e.g. Ref. [6]). What is questioned, in particular, is the way this decentralising technology has been embraced by a host of 'central' players with incumbent powers, such as banks, authorities, insurance and pension companies, logistics and trade companies. Blockchain, accordingly, may present not much more than a hype and 'network fever' [3] that serves companies to get attention and support, and not to miss the 'boat' in which industry, government and other partners co-create industry and technology policy.

This paper focuses on the proliferation of Blockchain from a well-delineated technological tool to a captivating concept holding a bounty of promises and possibilities. The core premise is that, as a result of its proliferation, Blockchain has evolved into a 'hyperobject' [7]. A hyperobject is a concept of such spatial and temporal reach, and such viscosity, that we can only understand through its local manifestations and presences, such as global warming, the Internet or nuclear power [8]. Hyperobjects are so extensive and mutable, that common frames to characterise and grasp them comprehensibly are lacking. Rather than a set of common frames and characterisations, hyperobjects are shaped through multiple processes of 'object and subject formation' involving highly diverse frames and associations [9]. To understand to what extent Blockchain can be seen as a hyperobject, we use a topological perspective based on (post)Actor-Network Theory. The focus is thus on the association and alignment of technological objects, frames and subjects ('stakeholders') in search of meaning, purpose and operational practices. This responds to the call for understanding innovation from the perspective of the intersections and interactions between different stakeholders [10].

As a case study, this paper explores the recent development of Blockchain technology in the Netherlands. The Netherlands provides an

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Table 1
Topological perspective on key moments in object/subject formation.
Source: based on [12,13]; for further examples on (im)mutable (im)mobiles, see Ref. [24].

	Mobile ('effective')	Immobile ('affective')
Mutable 'possible'	Mutable mobiles ('***fluidity***'); practices, routines, adaptable technologies	Mutable immobiles ('***fire***'): internal projections of outside world
Immutable 'concrete'	Immutable mobiles ('***network***'); stable devices and tools	Immutable immobiles ('***contagion***'): 'intimate' encounters'

interesting case because of the recent founding of a central orchestrator, the Dutch Blockchain Coalition (DBC), advocating innovation and development of blockchain applications nationwide. This development stems from a strong tradition in The Netherlands to build triple helix (so-called 'polder') alliances between business, state and knowledge institutions (both public and private), with the aim to nurture start-ups as well as channel technological advancement and economic intelligence into incumbent companies [11].

Before doing so, the paper first introduces the theoretical framework and research approach.

1.1. (Post)ANT-based topology

To map and trace Blockchain technology, this study adopts a topological perspective, drawing on (post) Actor-Network Theory (ANT) [12,13]. In a topological approach, objects/subjects are actor-networks gaining their shape, agency and meaning through the work of *forging associations* [14]. Importantly, connectivity does not refer to the linking of two separate objects, as in social network approaches. Rather, connectivity refers to the way objects are *constituted* through associations, deriving their capacity and agency from the network they are composed through [15] Blockchain technology, for instance, is composed through enrolling and mobilising technical devices and codes, user protocols and rules, flows of energy and data, framed by underlying concepts such as 'Proof of Work', 'Proof of Stake' and decentralised verification [16].

ANT-based thinking identifies two key aspects of topological connectivity (or 'association'), namely '(im)mobility' and '(im)mutability' [17]. These two aspects will be central to our theoretical argument and the definition of a hyperobject. The first aspect, (im)mobility, refers to the *capacity to mobilise and channel flows*. Mobility helps objects to reach out and expand their constitution by forging new associations. Mobility underscores the circulation and performance of concrete entities such as money, data, energy, resources, as well as of more abstract entities such as ideas, templates and knowledge, making the world run in an 'effective', script-based manner. Immobility, on the other hand, refers to associations which are not based on flows, but on communication. Communication is meant in a Luhmannian sense, in which one object 'irritates' ([18]: 5), perturbs, or, the term preferred here, 'affects' another object [19]. The communicative aspects reside in the fact that such 'affecting' is based on the bringing to presence of an object within the cognitive realm of another object. An example of an immobile object is the Bitcoin network as a whole. Obviously, there is a lot of mobility *within* the Bitcoin network (data), but as a whole, the Bitcoin network has a fixed topological position. One cannot enrol the Bitcoin network as a whole in another actor-network. The only thing another actor-network can do, topologically speaking, is to *bring* the Bitcoin network to *presence* through means of communication [20]. Such presence takes the form of cognition or a mere sense of another object's presence, assisted by texts, symbols, intuitions etc. Such presence is always selective, thus also creating absence. So, in summary, where mobility supports the composition of *effective* ('network') objects, immobility supports *affective* relations between separate objects through communication.

The second dimension of topological connectivity is (im)mutability. Objects are immutable when they can make connections without changing their basic shape, agency and meaning. Immutability does not refer to paralysis or stasis, but to topological stability of the object itself (described as network-object). A core insight from ANT literature is that immutability allows nonhuman objects to forge connections in large quantities and at large distances, as exemplified by currencies, tools and memes [21,22]. Objects thus gain, to quote Allen ([45], 79), 'power of reach' while remaining topologically stable. On the other hand, objects are 'mutable' when associations lead to 'fluidity', something more explored in 'post-ANT' work [23]. Mutability opens possibilities. Mutable objects assume the shape of ideas, guidelines, templates, stories or sense allowing them to create new variants of concrete objects. Applying Blockchain technology to other fields of operation, for instance, requires adaptation of techniques, codes and protocols. Taken to extremes, mutability may transform the constitution and integral nature of the object, giving shape to a new object. An example here is the 'quiet coup' ([47]: 5) through which the Bitcoin recently forked into a 'core' and 'cash' variant, in response to the cryptocurrency's speculative boom.

The two dimensions of (im)mobility and (im)mutability create four moments of object/subject formation leading to a topological fourfold (Table 1). What drives this fourfold, notably the transition from one moment to another, is what Callon [25] calls 'framing', the topological work shaping identities and associations of objects and actors (Table 2). In the words of Callon: "To frame means to select, to sever links and finally to make trajectories (at least temporarily) irreversible" [26]: 140). In brief, these 'framing' steps entail:

- *Problematisation*: finding out what is at stake, who holds a stake (stakeholders), and mapping the wider topological space of the problem; problematisation emerges from primary moments of encounter in which different actors, objects and issues intersect.
- *Interessment*: bringing an issue to presence with other (potential) stakeholders, to motivate and persuade them to collaborate and embrace Blockchain techniques and applications [27,28]; this corresponds to the way the concept of framing is used in literature on (science) communication setting. Nisbet and Scheufele ([49]: 1170), for instance, describe framing as "lending greater weight to certain considerations and arguments over others, translating why an issue

Table 2
Framing typology.
Source: inspired by Ref. [27].

	Network framing	Affective framing
Possible	Enrolment: frameworks, guidelines	Interessment: stories, images, persuasion
Concrete	Mobilisation, scripts, protocols, tools	Problematisation: material and bodily encounter

might be a problem, who or what might be responsible, and what should be done. In this manner, frames provide common points of reference and meaning between scientists, the media, and key publics"

- *Enrolment*: the actual bringing in line of stakeholders in the process of network-building, negotiating their possible identities and object/subject position, and enrolling them in organisational practices; such negotiation, moreover, is fully reciprocal: while there may be core drivers of object/subject formation, and differences in power and dependencies, for a network to become effective it needs to affect stakeholders (through 'interessment') and align with their own practices, creating 'collaboration readiness' [15].
- *Mobilisation*: full stabilisation of the network through the completion and implementation of scripts, protocols and tools. Mobilisation gives rise to concrete functional 'network-objects' able to forge associations with wide topological reach.

Drawing on post-ANT thinking, the 'problematisation-mobilisation' trajectory can be seen as a movement from immutable immobile, via mutability, to immutable mobile. We will now zoom in onto the four moments, and the role of framing, in this order.

2. The fourfold of (im)mutable (im)mobiles

2.1. Immutable-immobile (problematisation through 'contagion')

A trajectory of object/subject formation starts with vital experiences of groping, grasping, sensing, and living through direct encounter [29]. In such immutable-immobile moments, objects experience their relational constitution as an event of affective encounter *in and for themselves*. In a social context, subjects generally devote considerable time to make sense and liaise with objects they encounter. In doing so, subjects try to (re)construct identities and narratives to create congruence in their bodily and lived experience [30]. In their work on complexity and social movements, Chesters and Welsh [31] stress how the affective domain impacts on the way individuals feel satisfied or dissatisfied as part of a movement, shaping their subjectivity through encounter and communication.

For Blockchain technology, such intimate encounters and bodily appraisals occur within the settings of concrete experiments with Blockchain applications, resulting in new insights and sparks of inspiration as well as tension. They also occur in the meetings during which visions and strategies are made and discussed with internal and external stakeholders. During these encounters, values, beliefs, and narratives are shared, shaped and enacted in novel ways. In all these cases, physical encounter presents a vital aspect of how subjects make sense of, and shape motivation for, the entrepreneurial-creative process based on shared problematisation. However imaginatively Blockchain may epitomise a digital, online, non-spatial technological world, the need for physical encounter remains pressing. Encounters present series of creative (or destructive) moments of 'affective contagion' [32]. Through means of communication and body language, close encounters serve to explore, sound out and frame the stakes, stakeholders, and key associations, thus engendering 'contagious moments' of affective framing. Moreover, such problematisation does not only create presence, but also absence. Issues and stakeholders that are not mentioned, deliberately or accidently, in a close encounter are also less likely to be brought to presence to stakeholders at a distance, that is, to serve 'interessment'.

2.2. Mutable-immobile (interessment through 'firing')

Before stakeholders can be enrolled in a network, a problematisation needs to be impressed in their own (monadic) context. They can do so by bringing certain issues 'to presence' and affect other objects through means of communication. Making certain items and values present to subjects, while hiding others, may prompt and favour certain views and actions. This impact is indirect, however. It always depends on the subjects' cognitive and interpretative capacities. Incoming prompts may be enhanced and propagated as well as filtered and blocked. When a new prompt induces a pattern of presence beyond primary recognition and acknowledgment, it may induce 'interessment'. The reverse happens when an existing presence is silenced and fades away. The result is what Law and Singleton ([13], 343) describe as a 'pattern of presences and absences'. In the case of Blockchain, positive frames (e.g., regarding the economic and social value of Blockchain) can motivate a community to engage in communication, development and/or implementation of Blockchain, in what is called a 'crypto-friendly' way [33]. In contrast, negative frames (e.g., concerns about security, scalability and lack of control) may trigger opposite moves.

Prompting 'patterns of presences and absences' can be described as framing that is *affective*. To use another term of Law and Singleton, affective framing entails the 'firing' of references and values, to induce 'interessement' amongst target subjects through means of communication. Drawing from social-communicative framing literature, the resulting frames simplify reality by "keeping some elements in view while hiding others" ([34]: 1174). Frames help actors to understand what to think of objects and how to associate with it. Actors thus use framing in an attempt to influence the frames of other actors [35,36]. For Blockchain, frames include stories and images about Bitcoin, the creation of a decentred ledger, possible and experimented new applications, specific incidences of failures and abuse, etc. [33]. Values include associations with openness, transparency, efficiency, democracy, but also with ineffectiveness and lack of control.

Topologically speaking, affective framing produces associations that are immobile yet mutable. Immobile, since no direct link is (yet) established, as happens with enrolment. Yet mutable, since interessment may induce changing subject/object positions. Because of this topological characteristic, the impact of affective framing can be rather erratic and explosive, and hence quite difficult to predict and manipulate. Certain stories and images may go viral, and become highly 'present', while others fall on deaf ears, and remain 'absent'. Extents of affect depend on social-cultural affinities and pressure, on the ways certain signals are able to intuitively and emotionally 'irritate' and 'touch' subjects. Recently, this ability has dramatically grown due the rise of the internet and social media. Rather than advancing a technological solution, 'interessment' may thus primarily bring together previously disassociated actors around a joint fascination and orientation, turning something like Blockchain into a 'convening technology' [4]. Widespread 'interessment' thus present a major factor in the rise of and euphoria around a 'hyperobject'.

2.3. Mutable mobile (enrolment through 'fluidity')

To create functional network-objects, stakeholders need to be enrolled. To do so requires openness and mutability, or what De Laet and Mol [23] describe as 'fluidity'. Topologically speaking, the trajectory of network building now flips from immobile to mobile, putting the 'association' centre-stage. Rather than as an element of close encounter and communication, the 'stakeholder' is now seen as part of sociotechnologic activity. In brief terms, stakeholder identity stems from human-tool interaction. To illustrate the link between fluidity and this interaction, De Laet and Mol [23] give the well-known example of the Zimbabwean bush-pump. Introduced in many different regional contexts, the bush pump manifested strong adaptive capacities, technical as well as social to fit different circumstances and meet different purposes. In the case of Blockchain, we can see such mutability in the search for new applications, demanding changes in how the technique is configured and how it is applied in concrete settings of identification and transacting. Such mutability requires the object to be framed in a more abstract mode, allowing for object variations. This allows, essentially, a

process of 'crystallisation', "a process in which stakeholders (…) gain clarity of what the infrastructure should be" ([37]; p. 212).

The need for fluidity applies to the phase of forging new associations as well in the phases of 'crystallisation' and network maintenance. The result is that, besides the fluidity within stakeholder enrolment itself, mutability becomes inscribed in the organisational practices accompanying the development and operations of network-objects. Such practices warrant framing through concepts, frameworks and guidelines. Examples are the multilingual instruction manuals accompanying devices, protocols and courses on technology implementation and maintenance, and the crucial work of 'interim' managers in recalibrating and revitalising business operations. Indeed, it is an ironic fate of many organisations and sectors that the efficiency won by the reach of network-objects is countered by the high costs of effective (re) framing and adaptation through the daily work of managers, consultants and incessant flows of policy-making. Despite the lure of self-propelling network-objects, the work of enrolment and mobilisation never ends. For Blockchain, this ambivalence certainly holds. As a network-object, Blockchain promises to sustain a fully automated system for a distributed ledger operating according to script. Yet, both its evolution and its maintenance warrant accompanying practices of technical corrections as well as capacities for adaptation. From an ethical point of view, enrolment also raised the question of who, in the end, becomes enrolled in what manner, and what practices have resulted in that selective association [4].

2.4. Immutable mobile (mobilisation into 'network-object')

If problematisation, interessment and enrolment succeed and proceed, an object emerges as an immutable mobile manifesting tight alignment and full mobilisation of materialities and processes. The challenge of network framing is to configure all relevant contexts as to provide the network-object smooth and unhindered access. This then allows the object to extend its reach without the need or pressure for mutation. Such an ideal situation, however, is hard to achieve. There are always contingencies and voices of dissent hampering smooth access. There is, as Callon [21] aptly describes, always 'overflowing'. Apparently seamless systems warrant much 'seamful' work [5,38]. However good the framing, most immutable mobiles are in frequent need of repair, remodelling and even reframing. This fragility is due to a critical condition of immutable mobiles: the context in which they operate needs to remain precisely attuned and motivated to their own operations. Particularly when a network-object diffuses (such as disseminating a Blockchain application), the challenge of framing is to prepare and attune all relevant objects so that they can be enrolled without resistance or disturbance. Making Blockchain applications successful and secure requires digital networks to perform adequately and users to follow the protocols properly, thus prompting system convergence and standardisation [39]. Disruptions, underperformance or other forms of 'overflowing' warrant repairs and new rounds of framing. Such overflowing, in turn, requires network-objects to grasp and engage with differences and contingencies beyond technical scripts and (re)mobilisation. This may not only warrant openness and adaptation, but even, to come full circle, induce new encounters and overhaul current problematisations.

Turning immutable-mobile, in sum, may reduce the heat of a hyperobject, transforming it in a more ordinary object, until a new round of problematisation takes off (cf. Table 2).

3. Approach

The topological vocabulary presented so far will now be applied to the way recent framing of Blockchain has resulted in object and subject formation, and how this has created associations amongst stakeholders and technologies, focusing on Blockchain community in the Netherlands. The key question is how far associational work has progressed from problematisation to mobilisation, to what extent is Blockchain technology (still) a 'hyperobject', manifesting a persistently high level of mutability? In other words, to what extent is Blockchain development 'stuck' in moments of interessment and enrolment, with few manifestations of concrete mobilisation?

Our analysis entails three parts: (1) media framing analysis, (2) participatory observations, and (3) in-depth interviews.

An analysis of *media framing* allows us to obtain an overall picture of 'presences and absences' in extending the meaning of Blockchain and its association with stakeholders. We are particularly sensitive to the role of broader societal values, and to the resonance of more critical messages, notably concerning sense and feasibility of Blockchain. While it is easier to detect presence than absence, focusing on resonance may help to uncover patterns of absence. Data stems from the collection of media items from nine Dutch newspapers between December 2013 and June 2018. A comprehensive search yielded 448 items, in which 679 relevant framings of Blockchain were found by 235 stakeholders (including 47 linked to DBC). Using inductive tagging techniques [40], the observed expressions have been reduced to 55 subframes (unique expressions on Blockchain), which have been grouped in 14 'master frames' [31,41]. While obviously the newspaper corpus only contains a subset of all relevant verbal framings, it has provided us with a rich dataset covering the stories and reflection from the field.

Subsequently, we zoom in onto framing and object/subject formation in the context of the DBC. We collected data through *participatory observation*: members of the research team were enabled to participate as independent observers in the DBC's strategy meetings (December 2016, January, February, March, April, May and June of 2017) and its activities (IPO[t] and action group meetings 3–4 times per month, Sept–Dec 2017). It revealed framing and object/subject formation through close encounter and contagion, as well as into the development and role of practices of stimulating innovation, collaboration and gaining support.

In addition, fourteen *interviews* with members of the DBC provided further details on practical modes of framing as well as conceptual adaptations, notably within the DBC. The interviews were conducted in the period October–December 2017, lasted for 1 hour on average and specifically focused on the practices of collaboration and coordination, and on the use of communication. The interviews were transcribed and coded by using AtlasTi. The interviews and observations served, in particular, to understand how Blockchain objects and subjects stem from a wide array of framing practices, and how the practices evolve (for more details see [50]).

4. Applying the fourfold: the formation of Blockchain technology in The Netherlands

4.1. Prelude: Bitcoin

Blockchain development in the Netherlands can be seen as a second-generation phenomenon, taking off in the mid-2010s. The first-generation Blockchain came to the Netherlands as a full-blown concept as part of globally operational cryptocurrencies. Globally, the first elaborate idea of the Blockchain stemmed from the early 1990s. Its first application was detailed in 2008, in a paper founding the 'Bitcoin' written under the pseudonym of Satoshi Nakamoto [42]. In topological terms, object and subject formation of the first-generation Blockchain primarily occurred through concrete moments, through a close nexus between immutable immobiles (close encounter) and immutable mobiles (network-objects). On the immobile side, dedicated software producers worked in the intimacy (even concealment, as in the case of the mysterious spokesperson of Satoshi Nakamoto) of their programming 'cells' and communities. Capacitated and motivated by the possibilities of rapidly growing, globally connected computational capacity and easy public access, mutual framing in this professional network occurred through 'affective contagion' of the ideal to build a utopia of a

fully decentralised financial system [37]. A dedicated community thus created Blockchain as a superbly inscribed and imprinted immutable mobile, in the shape of a fully automated distributed ledger.

Mutability, both effective and affective, played a role in the background. The effective side constituted primarily of modifying and implementing methods of digital platform coordination and maintenance. More specifically, a repository of rules emerged, under strict protection, by an 'inner circle' of Bitcoin developers, occasionally meeting in global conferences [37]. The affective side (interessment) was reflected, most notably, in some references the Nakamoto paper made to breaking the power of central banks and banking. Stated in the year of the global financial earthquake (2008), this message clearly struck a chord. The crave for disruption was associated with two underlying values, that of anarchism, and a return to pre-financialised, merchant capitalism. What did not emerge, however, was a more concrete setting for framing and coordination of enrolment. As indicated by recent developments, this became a problem when the Bitcoin was 'hijacked' by speculative forces [43]. As argued by Kow (2018, p. 224) "when left in an abstract form, the Bitcoin utopia without human intermediaries can be seen as an 'incomplete utopian project.". Against this background, what happened to the 'utopian project' of connecting Dutch society and economy to the Blockchain?

4.2. Problematisation in the 'intimacy' of the DBC

In a context of growing attention for Blockchain, the challenge to provide practical support and guidance for the development of Blockchain technology was taken up by the Dutch agency for promoting digital technology, Dutch Digital Delta. This agency is part of the revamped technology policy in the Netherlands, which emerged in 2011 under the label of 'topsectors'. In 2016, Dutch Digital Delta set up the Blockchain Core Competence Centre (BC3). In March 2017, the centre was formally launched under the new name of 'Dutch Blockchain Coalition' (DBC). The DBC has a physical 'homebase' at Delft University of Technology, including a small office and workspace. It is largely financed through its members, with some support from the Ministry of Economic Affairs.

The DBC is part of a national drive to embrace the Blockchain, to create economic and societal benefits. Triggered by accounts from the first-general Blockchain, the main motive is that the Netherlands is a forerunner in digital development, but that one has to act now in order not to miss the boat. 'Meeting economic opportunity', 'scope for coordination' and 'radical change' are the key messages expressed by the DBC members. DBC thus seeks to take and support initiatives for Blockchain development, and to promote Blockchain in policy and public domains. To do so, and to reach out both practically and verbally, the DBC is organised in various circles of stakeholders, from the inner core to informal contacts. A continuous activity is the building of the stakeholder network, through the organisation of meetings, events and online newsletters and social communication. The DBC is in contact with other networks and alliances investing in Blockchain, in which similar buzz and outreach can be noted (Blockchain Pilots, EU Blockchain Observatory and Forum World Bank Blockchain Lab).

The early explorative and initiating phase of Blockchain development strongly featured physical meetings (observations of seven meetings between December 2016 and June 2017). Still, the DBC holds regular weekly meetings of the 'core team', quarterly meetings of the coalition council, and the action groups (based on observations of the meetings since 2017). Alongside strategic meetings, there are two kinds of action-oriented meetings, namely the weekly encounters of the IPOT ('Integrated Product Owners Team') and occasional 'deep dives' like the Conference 'Deep Dive into Identities' (June 2017, Heerlen), the 'Deep Dive Human Capital Agenda' (April 2018), the 'Open Source Deep Dive', or the 'Deep Dive Sovrin' (April 2018) events. These Deep Dive meetings serve as knowledge sharing events. In its current developmental and expansionary state, much of the communication entails introduction, persuasion and negotiation. To do so, for instance, in 2018 and 2019 the IPO quarterly hold 'Groot IPO' (Extended IPO) events, in which concrete achievements and reports were presented and discussed with a broader set of stakeholders (based on observation of the events).

Our observation of the meetings and reflections during the interviews showed how critical and sensitive 'problematisation' was, and how much it depended on face-to-face contact. Being with a person or group, experiencing the passion and intelligence of (other) stakeholders helped to forge affective connectivity and to grasp and sense the meaning of the development of Blockchain technology. When introduced to a new application (digital identities, smart transactions, mortgage application, etc.), participants often asked what exactly the shape, role and use of the technology was, and what broader change it would bring. Moreover, members worked from the position that they participate on the basis of their own commitment and investments. For example, we observed an interactive workshop, organised by one key member, in which founding members explored common ground and articulated common goals and common ambitions (based on observations of the Coalition Kickoff event preparatory meeting in Utrecht in March 2017). At this early stage, participating partners enjoyed the privilege of determining the agenda, overall scope and the coalition's direction. This resulted in a strong advocacy for a "Man on the moon" image to steer the agenda and to evoke wider 'interessment'. In later observations of 'IPOT' meetings, stakeholders expressed concerns about methods of communication and decision-making, about the scope of their roles and their say in agenda-setting. They also repetitively insisted on a practical, hands-on orientation towards developing Blockchain technology as network-objects. Clearly, while the DBC sought to move from problematisation through its homebase and 'Deep Dive' meetings to broader interessment and enrolment, facilitating affective and effective mutability, business and policy stakeholders wished to move as quickly as possible to (immutable-mobile) network-objects. Tensions even impinged upon affected levels of attendance. In response, 'IPOT' was converted into 'IPO' ('Integral Portfolio Meeting'), with a more open, bottom-up approach, alongside a major overhaul in the overall communication and governance of DBC's activities (based on observations of the IPOT and IPO meetings between September and December 2017).

4.3. Interessment: patterns of 'presence and absence'

To induce stakeholder enrolment as well as obtaining wider public support, the DBC sought to bring its achievements and prospects of Blockchain technology to presence to a wider public. This occurred through well-publicised events such as the Kickoff on 30 March 2017 and the first national Blockchain conference on 21 June 2019 in Utrecht. Initially, the expectation was that wider interest and engagement would follow automatically from the exposure through the Kickoff, general publicity and the involvement of network partners. Both within the DBC 'homebase' and at the Council, it was soon realised both that the impact of exposure was too limited and that there was more need for 'firing', to use our term. Therefore, DBC decided to make a serious investment in organising external communication, and recruited a communication and marketing officer. Also, it decided to liaise more closely to government officials and to take on board a national ambassador, namely the former Mayor of Eindhoven, Rob van Gijzel.

Concerning broader media exposure, DBC just presents one of the many spokespersons for Blockchain technology. Therefore, a key activity is to monitor media exposure, to measure the overall sentiment towards the technology, and to make selective contributions. Based on this monitoring, our media analysis reveals a detailed picture of the verbal patterns of absences and presences evoked by different groups of stakeholders. We found 14 master frames of which eight manifesting predominantly positive and six more negative sentiments towards of

Table 3
Scores of expressions per masterframe and stakeholder group.

No.	+/−	Label	Govern-ment	Finance and accountancy	Technology (startups)	Business (platform)	Science	Media	Total	DBC
1	+	trust +	22%	13%	17%	38%	14%	16%	17%	17%
2	-	*trust-*	*2%*	*2%*	*5%*	*5%*	*17%*	*5%*	*6%*	*4%*
3	+	connectivity +	0%	0%	1%	5%	1%	2%	1%	1%
4	+	sustainability +	2%	0%	1%	0%	0%	1%	1%	1%
5	-	*sustainability-*	*0%*	*1%*	*3%*	*0%*	*3%*	*0%*	*2%*	*1%*
6	+	efficient +	13%	22%	16%	14%	6%	16%	15%	20%
7	-	*efficient-*	*0%*	*2%*	*0%*	*0%*	*4%*	*0%*	*1%*	*1%*
8	+	econ. opportunity	9%	13%	4%	0%	1%	8%	6%	7%
9	+	radical change	9%	12%	15%	24%	13%	15%	14%	12%
10	-	*hype*	*4%*	*7%*	*12%*	*0%*	*10%*	*3%*	*9%*	*5%*
11	+	applications +	15%	14%	19%	10%	10%	19%	17%	19%
12	-	*applications-*	*2%*	*2%*	*1%*	*0%*	*0%*	*4%*	*1%*	*2%*
13	+	coordination +	13%	6%	5%	0%	10%	6%	6%	9%
14	-	*coordination-*	*11%*	*4%*	*2%*	*5%*	*10%*	*3%*	*4%*	*3%*
	+	Positive frames	82%	81%	77%	90%	56%	84%	77%	85%
	–	Negative frames	18%	19%	23%	10%	44%	16%	23%	15%
		Sum	100%	100%	100%	100%	100%	100%	100%	100%
		Distribution	8%	12%	51%	3%	11%	14%	100%	24%
		Count	55	83	349	21	78	93	679	162
		positive −2017	80%	82%	66%	90%	53%	82%	74%	*87%*
		positive 2018	100%	100%	87%	na	55%	100%	86%	*90%*

Source: own frames database; negative cites in italic.

Blockchain (Table 3). Results are broken down into six stakeholder groups, including media itself. We regard the media here as a rather neutral conveyer of stakeholder views; this implies that, where media items quote other stakeholders, the latter category is reported. If a media item provides a view or opinion without reference to a stakeholder, expressions are assigned to 'media' (14% of all expressions). About half of the expressions stem from technology start-ups. From the DBC, finally, the media analysis contains 15 expressions (Table 3, column DBC). Besides the stakeholder category, Table 3 also counts expressions stemming from DBC staff and partners, which count for 24% of all expressions.

Aggregate results show a predominantly positive sentiment (77% of all expressions). Not unexpectedly, DBC partners manifest a positive bias, although this is trumped by platform companies. Prominently positive masterframes are about efficiency, possible applications, trust and (positive) radical change. Negative masterframes concern hype, lack of trust and insufficient societal capacities for coordination. Table 4 lists the subframes with the highest frequencies (15 out of 55 subframes in total). In a positive sense, Blockchain is a general-purpose technology with many possible applications, yielding efficiency and trust. Oft-cited negative expressions concern hype and relation to crime. The corpus manifests a general consensus that Blockchain implementation requires standards and policy coordination (70 expressions labelled 'coordination'). However, opinions are split about whether there is sufficient political and institutional drive and capacity to meet this (40% sceptical against 60% confident). It is interesting to see how this split opinion echoes *within* the two groups of stakeholders most involved in coordination, government (policy) and science. This contrasts with the positive stance from start-ups and negative stance of platform companies (energy grid, IT. etc.) towards coordination.

Controversy also emerges around the theme of change (masterframes 9 and 10). Against dire warnings that Blockchain is overhyped, stands the strong expectation of Blockchain as harbinger of radical change. To underwrite their enthusiasm, numerous spokespersons expect breakthroughs within two to five years. Interestingly, many cautionary tales come from start-ups, while bright futures are sketched by user firms (finance/accountancy and platform companies), supported by the media. The nature of change raises further controversies, notably in relation to finance. There is a strong sentiment, cited 22 times, that Blockchain will seriously disrupt the current business domain of finance and accountancy, by breaking up and replacing the current financial and consultancy behemoths by new firms and platforms closer to the people and merchant enterprises. In contrast, there is also the expectation that Blockchain will deliver growth to incumbent firms (39 cites under masterframe 8). Both sentiments are positive in the sense that they foresee a future for Blockchain, albeit quite different futures.

Further popular themes are trust (153 expressions) and efficiency (109). Positive observations on trust (75%) stress how transparency, immutability and traceability yield trust. Platform companies are most positive here, followed by government voices. More critical observations (25%) concern technological fallibility, incidences of crime, the

Table 4
Subframes with counts above 15.
Source: own frames database

Rank	Contents	+/−	Freq
1	BC + has one/more new important applications[a]	+	47
2	BC + provides transparancy (total, real time)	+	36
3	BC + has more significance than what now gets most attention, the bitcoin	+	36
4	BC + prevents fraude	+	35
5	BC + makes transactions more efficient (in terms of time or effort)	+	35
6	BC- blockchain is a hype	–	29
7	BC + cost efficient	+	25
8	BC + brings innovation and efficiency to the financial sector	+	25
9	BC + will overhaul the current financial sector (radical innovation through 'fintech')	+	22
10	BC + needs coordination which is present (political, institutional)	+	20
11	BC + blockchain is (one of the) new technologies that revolutionizes the world economy	+	18
12	BC + removes intermediate transactions	+	17
13	BC + blockchain is life/world changing, very important	+	17
14	BC + provides trust	+	16
15	BC- bitcoin is associated with crime and fraud	–	16

[a] Applications mentioned are: variety of finance, insurance and accountancy, mortgages, notaryship, big data collection, donations, energy, government services, IoT, software, medical, smart cities, music publishing, stockmarket, sharing economy. tax office, warranty documents, trading and certification, land registry, port handling, reporting climate change measures.

illusive nature of anonymity and the danger that lack of understanding creates a blind trust in the technology. Efficiency is seen in overwhelmingly positive terms (94%), with two caveats. First, it will take time before the technology is mature and diffused enough to lower transactions costs. Second, high efficiency will make many intermediaries (accountants, notaries, certifiers, etc) redundant, implying a major sectoral shift in the economy. Negative observations primarily refer to the problem of scalability. An oft-heard story is that, even with the recent changes in the software, upscaling poses a major hurdle, because of the data volume and demanding process of verification. The fully distributed nature of the Blockchain and the need for Proof of Work or (less) Proof of Stake incur increasing costs and efforts, notably with large numbers of small transactions (like most consumer finance or platforms).

There are two themes that, like the need for coordination, do not meet any negative sentiment, namely connectivity and economic opportunity. Somewhat surprisingly perhaps, connectivity is only mentioned occasionally (7 cites), and mainly as a technical feature. Economic opportunity largely covers the 'business-as-usual' prediction for the financial sectors already mentioned; besides, it contains a subframe, cited 7 times, expressing the need to boost national competitiveness and to outpace others, like the US and China (six cites). While only showing a modest appearance in our corpus, Blockchain's potential contribution to national competitiveness features strongly in documents from the DBC and other policy items (e.g. Ref. [44]). A final issue, although only cited sporadically, is that of sustainability. While 4 quotes assert the positive impacts of Blockchain on sustainability, for instance through supporting a distributed energy system, 13 are negative. There is a general fear that expanding Blockchains will lead to exponential growth in energy use. One expression, originating from an industrial software company in the Dutch Bible belt, even spells general doom resulting from escalating digital technology, since this "delivers the antidivine powers to destroy humanity" (Reformatorisch Dagblad, 30 August 2017, our translation).

Although our survey only entails a short time-span, there is a clear indication of positive change over time. In 2018, the rate of positive expressions has risen to 86% (175 cites). A breakdown into masterframes (Fig. 1) shows that trust, the potentiality of radical change and new applications manifest growth. What is noticeable is the far more positive response from start-ups, which also have become more vocal recently (Table 3).

In sum, these results represent the overall 'patterns of presences and absences' concerning Blockchain in the Netherlands. An interesting result is to see the 'platform' businesses voice the most positive qualifications (90%), even more than DBC members (85%), and science the most critical (44%). Moreover, in light of global debates on Blockchain, a broad range of issues appears to be covered. The search for focus and applications of second-generation Blockchain clearly encourages fundamental discussions about the Blockchain, juxtaposing hype and change, efficiency and upscaling issues, strong and poor coordination capacities, amongst others, even *within* stakeholder groups. A nice illustration of this internal debate comes from a quote from a DBC participant working at Netherlands Organisation for Applied Scientific Research (TNO), Oscar van Deventer:

"We are talking about the euphoria surrounding blockchain, the technology supposed to make banks and governments superfluous. It reminds us of the early days of the Internet, a decentralised network that would topple world order. Reality turned out differently: the web was split in well-kept domains with Facebook, Google, Amazon and Apple in charge. Not anarchy, but capitalism won. Blockchain is also being co-opted by established institutions (..). Banks and governments are already experimenting with their own blockchains. Insurers want to supply 'smart money', which can only be spent for a certain purpose. (…) The internet was built on computers that blindly trust each other - an error. Blockchain can repair that construction error. Less corruption, less bureaucracy, a more democratic management of the web and a safer internet of things: benefits for all. More useful than the crypto-casino, which only makes the rich richer." (NRC Handelsblad, 26 August 2017, our translation).

So, with this presence, what was absent that could have been more present? What is silent? Aggregate data may give the impression that little is excluded. However, apart from sporadic mentioning of non-capitalist, anarchic economic and political orders, limited attention is paid to other, alternative socio-economic options and futures. On reflection, what may strike as most absent is thinking about concrete alternatives for Blockchain: the debate hardly pays any attention to

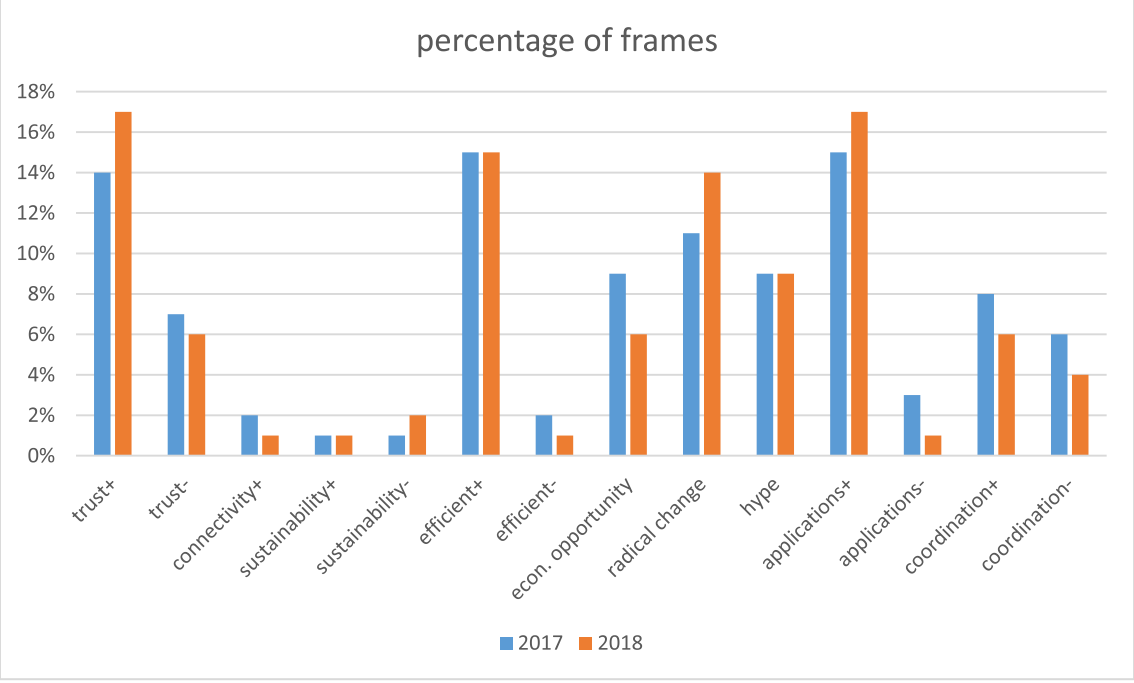

Fig. 1. Shifts in frames 2017–2018.

whether other platform technologies may meet the same goals of efficiency, transparency and trust in more effective ways.

4.4. Blockchain object and subject formation through DBC's organisational practices

After boosting 'interessment', through the creation of 'presences' and the facilitation of close encounters, DBC's main challenges has been to enrol stakeholders. Since its launch, the DBC has been struggling to find appropriate governance models and practical strategies to do so, through building and operating adaptive practices of alignment and enrolment. During initial negotiations, the main practice involved the mapping of the needs and wishes of members already working on Blockchain-based applications to come up with a project with a joint goal, under the umbrella of Dutch Digital Delta. This resulted in a strategy ('BC3'), entailing a combination between a mixed research and education programme (covering basic issues in technology, ethics, law and business) and templates for partnering models and 'co-creating' through field-labs. The idea was to work with 25 researchers from different universities and from the TNO (Netherlands Organisation for Applied Scientific Research), representing different disciplines to develop and share knowledge on the blockchain technology and its impact on society, primarily through PhD projects.

However, the idea of a research programme met insufficient support from the business partners, who were obliged to make a substantive financial contribution. Rather than scientific research by PhDs, business partners preferred a hands-on model with short-term hands-on deliverables. Core spokespersons saw scientific practice as too much of an opaque 'black box', with too many uncertainties about the return on business investments (money, time, use cases) (consortium meeting, December 2016). So, the coalition decided to drop research from their agenda: *"We shift from the upfront model to a demand-driven model. No research agenda. BC3 can also* support *a lean model of two analysts and one consultant [to relay demand]*" (consortium meeting, January 2017). Subsequent discussions resulted in three action lines, around the themes of 'digital identities', '(social, legal and economic) conditions for smart contracts' and 'human capital', each adopting and adapting the 'agile' forms of coordination and consultation. The launch plan produced around DBC's (2017) Kick-off state that the initiative should: *"inspire, stimulate and motivate partners in addition to directing the work in cooperation with the coordinators for each action line and the program office"*. To start, after the official Kick-off meeting, each action line organised several 'resourcing meetings' with the partners to work on detailed work plans. So, it is within the action lines and projects that we see 'crystallisation' at work at a concrete level. The choice for 'agile', and also for 'lean', 'simple' and 'scrum' approaches clearly echoes the craving for the concrete and effective (consortium meeting, May 2017, amongst other). Various partners have indicated that successes made in the action lines stem from the 'agile' approach. This also required some adaptation, however. Initially, participants felt that in some cases the choice of activities was too much imposed by 'scrum masters' who already had leading roles in the coalition. In response, certain scrum masters' roles were taken over by coalition members with stronger commitment to the teams' interest and motivation.

Besides organisational and communicative practices, the interviews probed the way members (re)consider the role and meaning of Blockchain technology (object), and that of the actors (subjects) applying the technology. Table 5 lists the relevant outcomes from the interview transcriptions, to which we have included the recently published DBC Manifesto 'Blockchain for Good'. While obviously this only presents a limited sample, it reveals the broad spread of view of what Blockchain objects and subjects may entail. Because of confidentiality, we can only report on source and contexts in general terms. Starting with Blockchain technology as object, the following associations are made: efficient and network technology (3), democratic and bottom-up transition (2), a fundamental radical and smart technology (2), trustful

Table 5
Interviewees' Blockchain object/subject formation.
Source: own interview transcripts

#	Organisation (stakeholder type[a])	Blockchain technology object	Associated subjects	Interview quotes
1	accountancy (2)	radical technology (in search of application)	collaborating partners (rather than protective market agents)	*"Also to see where the entire thing goes now."*
2	grid company (4)	democratising information technology	self sovereign entities' working beyond their silos	*"All those transitions that are now coming together in the years ahead and that make it all the more important that we do address these kinds of issues not from a silo perspective, but rather in a coalition context."*
3	DBC (1)	highly efficient, resilient distributed system	small versus large trading partners	*"New markets are emerging because these transaction costs are reduced so much, and that may be the end of the big corporations"*
4	insurance (2)	business network	collaborating firms collectively engaging state partners	*"[Actors] who work together to get something off the ground on a national scale and thus also to get the required government parties just interested and enthusiastic,"*
5	insurance (2)	network technology	joint developers and users	*"Blockchain is a network technology and that means that you always have to do it together, not only arrange it together, but also use it together, otherwise it is pointless."*
6	DBC (1)	core of wealth and welfare	cohering and representing societal domains and economic sectors	*"Blockchain can do more to solve the climate problem than adding more windmills"*
7	insurance (2)	General Purpose 'smart' Technology	coalition exploring future options	*"I think it's a kind of promise for the future that you don't really want to be behind."*
8	business (4)	enabler of bottom-up transitions	motivated citizens working on transitions in energy, mobility, etc	*"You see that people in society just claim more and more autonomy and, well, that just fits very well [with Blockchain] I think"*
9	grid company (4)	protector of ordinary consumer	consumers	*"In this way we are working against commercial market parties, but in the benefit of the citizen,"*
10	DBC[b] (1)	security, trust, growth ..	collaborating 'Triple Helix' actors	*DBC's vision is that Blockchain technology contributes to the fundamental trust in our social infrastructure through its transparency and irrefutability".*

[a] See Table 4, Row 2.
[b] 'Blockchain for Good' manifest [44],

and protecting (2), and contributing to wealth and development. Regarding core subjects warranting alignment with the object, the attached roles are cross-sectoral collaborating and cohering (4), with one interpretation stressing the need to engage state partners, joint explorers and developers (2), consumers/citizens (2), and sovereign parties forging transactions (2). In the object-subject connection, collaboration aligns more closely with grander notions of technological change and wealth creation, while a stronger emphasis on the individual (trading, consuming, changing) members is associated with more organisational (network and transactional) roles of Blockchain technology.

The interview quotes testify to the variety and openness towards Blockchain anticipated roles (Table 5). There is considerable emphasis on the prospects of (fundamental) change and transition (#1, #6) you should not miss out on (#7), responding to calls for more autonomy (#8), trust (#10), working against vested interests (#3), warranting collaboration (#5) across domains (#2), and proper government involvement (#4). These prospects come from quite different sources, although there is a general pattern of incumbents stressing collaboration and smaller parties forecasting more radical change. The interviews clearly voice the Janus-faced nature of the Blockchain. While the arguments draw on the immutable mobile (network, irrefutable) nature of the technology, as a practice Blockchain means something different to each party. It is this mutable mobile aspect of Blockchain which support its broad 'interessment' and the enrolment of a wide set of stakeholders in a diversity of 'agile' configuration. However, in turn, this diverse base requires the DBC and its networks to constantly restate the need for collaboration and for concrete results.

5. Conclusions

Blockchain technology was initially designed with a rather clear object and subject in mind. It presented a well-delineated 'radical' technology to create immutable, widely vouched and shared records of transactions enabling trade in a fully decentralised and irrefutable manner. Yet, in time, Blockchain has become deeply immersed in the webs of incumbent organisations and industrial policy-making. As an object, accordingly, Blockchain has proliferated, expending its set of actual and conceived objects far beyond the original concept, connected to a proliferating bounty of possibilities and promises and associated stakeholders and agendas. How has this happened? Drawing on Callon's seminal work and his concept of 'framing', and a more recent post-ANT elaboration of the fourfold of (im)mutable (im)mobiles, this paper has sought to map the diversity of moments through which Blockchain objects and subjects have evolved. Crucial in this evolution are the shifts in, and intersections between (im) mutability (pressure, adaptability, standardisation) and (im)mobility (effect, affect). Methodologically, rather than zooming in onto one empirical trajectory (encounters, framings, *or* experiments, etc.), a more synthetic approach has been pursued, capturing the wider topology of Blockchain development. In particular, complementing the common orientation towards stakeholder negotiation, adaptation and standardisation, this study has focused on the *affective* side by examining processes of *encounter* ('homebase', 'deep dives') and *framing-firing* ('revolutionary', 'promise for the future', 'in the benefit of citizens'). While, admittedly, our case descriptions amount more to a synthetic sketch than a full-fledged topological analysis, it does, in our view, illustrate well how the application of the fourfold yields novel insights into the role and proliferation of new technologies.

So, what have we learnt about Blockchain? In part, the results confirm a development typical for fashionable technologies, namely how Blockchain turned into a 'convening technology' [4] amassing incumbent stakeholders. Who is convened, accordingly, increasingly consists of powers-that-be, not so much because of active selection, but of the alignment of DBC's framing with prevailing economic and political framings and practices. Given the lure as well as threat of Blockchain, incumbents are eager to be on board to check and respond to emerging opportunities. Blockchain exerts major appeal; actors are in awe; stories become highly contagious. Yet, there is more to it. The analysis here has revealed how, in the Dutch context, Blockchain has evolved through intense processes of object/subject formation, creating novel identities and subject-object engagements. The affective dimension plays a crucial role, as manifested by the growth in encounters, and more positive 'firing'. The latter also comes from the side of the more knowledgeable, and traditionally more critical stakeholders of technology start-ups. This shift has not been met by a notable surge in concrete Blockchain applications (as network-objects). We can thus observe how the technical object morphs into a hyperobject. Subject formation diversified far beyond the original developers' and users' communities, increasingly encompassing established businesses, policymakers, etc. Not only has it transcended the original coining, stakeholder-network and application, this extensiveness is far beyond the reach, grasp and frames of prominent actors like the DBC, despite their illusion and attempts to do so through 'agile' and 'lean' routines. While it may be elusive, even counterproductive, to contain Blockchain development ('de-hype', so to speak), it will be useful to develop a stronger sensitivity to how further strides in Blockchain's proliferation, including its 'firing', impinge upon perceptions of the technology as a whole, and to see what different domains of application actually have in common. For the phenomenon at large, only the future can tell how the concept will evolve.

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