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Unique or Adjustable Business Model for Distributed Ledger Technology?

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Abstract

We examine whether business model concepts, that demonstrate significant convergence to Distributed Ledger Technology (DLT) attributes, fit to DLT ecosystem characteristics and identify similarities and deflections. We answer the question whether the appropriate DLT business model is totally unique or adjustable and what conditions need to be met. The study follows a conceptual approach that is based on critical examination of three business model types that demonstrate similarities to the business model that an organization needs to adopt in order to fit in DLT ecosystem characteristics. Although each one of the network, digital and information business model types demonstrate similarities to DLT business model and reveal some resemblance with it, there are critical parameters that are neither addressed nor partially met. The main contribution of study is the exploration of the adjustable nature of the DLT business. Moreover, we highlighted the challenge for DLT ecosystem sustainability, defined and reviewed the conditions that need to be considered for DLT business model design.

Introduction

Technology itself has no singe objective value. When it is commercialized in some way by a business model, then its economic value becomes apparent (Chesbrough, 2010). Trust among interacting parties and data openness lie in the center of Distributed Ledger Technology (DLT) innovation, which promises disintermediation, transparency and visibility through a new decentralized way of information processing and sharing (Kuhn, Yaga, Voas, 2019). DLT, such as blockchain, creates attractive opportunities, since

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it changes the way that organizations interact, exchange information and create value (Van Rijmenam, 2019). There is a clear potential of DLT adoption but it has to make fit to the business model.

Business model can be exemplified as an activity system (Amit and Zott, 2012) conducted to address the customer, the value proposition, the organizational architecture and the economic dimensions (Fielt, 2013). Due to DLT traits and benefits that it brings at transactional level, such as disintermediation, transparency, data security, traceability and visibility triggered by near real time access to trusted information without the need of intermediaries and the significant impact that it has in ecosystem value generation, we recognize the need for either business model change or innovation to high level address all four business model basic notions mentioned earlier. DLT brings fundamental changes in the way that value is exchanged, the way the transactions that are executed among ecosystem actors, that way that ecosystems interact, the relationships among ecosystem actors and the way that resources and capabilities change based on capture of new knowledge.

This study seeks to explore the potential uniqueness of DLT business model investigating whether existing typologies fully address DLT business model features. Due to DLT characteristics we will emphasize DLT network facet and the dynamic character of the respective DLT business ecosystem. Our study provides scholars an insight into how the extant business model literature addresses the traits of the DLT conceptualization and to what extent it fits to DLT business model semantics. It allows managers to identify to what extent the business model types that seem to be closer to DLT business model conceptualization fit to DLT business morphology. Literature focuses into the technical aspect of technology and little research has been done on how DLT fits to the respective business model. Literature that addresses business model and business model innovation mainly focuses on DLT benefits that impact business model redesign needs, such as those addressed through operational capabilities that can be supported by blockchain (Li, Xue, Li and Ivanov, 2022; Morkunas, Paschen, and Boon, 2019). Other studies focus on the adoption of blockchain and what it means in

terms of triggering business model innovation (Purusottama, Simatupang & Sunitiyoso, 2022; Tiscini, Testarmata, Ciaburri, and Ferrari, 2020). Archetypal patterns of business models levering blockchain technology investigate how blockchain impacts the main pillars of business model literature, meaning value creation, value creation, value propositions (Weking, Mandalenakis, Hein,et al. 2020; Tönnissen, Beinke, and Teuteberg, 2020).

To answer the question of whether the DLT business model is totally unique or adjustable, we need to address the conditions that stem from a sustainable DLT business ecosystem. A business model answers the question of how the benefits, driven by DLT adoption, flow back into the company in the form of revenue (Schlecht, Schneider and Buchwald, 2021). It does not assess the attractiveness of the opportunity. While we intensively related to business model literature, we did not use a systematic literature review into business model definitions. Business models have always been discussed and described in the context of the organizational concepts of value creation and design (Bock and Gerard, 2018). The organizational design aspect is defined by the interconnected and interdependent activities of each business DLT ecosystem actor and its directly related with the business model value logic. In a DLT business ecosystem the 'how' dimension of an organization's value logic is clearly designated by the organizational and ecosystem architecture. The 'why' dimension of the value creation, is associated with the realization of network effects in the ecosystem. In short, a business model creates and captures value (Chesbrough, 2007). The latter, for an organization that adopts DLT, is related with the information flow under a data-as-an-asset perception, that supports and reinforces the competitive advantage of the company.

What is DLT and How it Works

DLT allows multiple parties to add cryptographically protected transactions to the ledger in an immutable way that promises decentralization. In short, when digitally signed transactions are posted to the ledger, competing nodes need to approve them and after their validity is verified group them into a block. The

blocks are totally ordered, hence preventing a block from being appended if it contains transactions that conflict with transactions of the previous block (Mohan, 2019). The latter along with the fact that each DLT network member holds a copy of the shared ledger promise decentralization and immutability in the peer-to-peer network created. Decentralization is achieved since the block is broadcasted into the network using the consensus mechanism that, has been initially defined based on the DLT architecture. Consensus mechanism is a vital characteristic of DLT architecture, since it represents the method used by network members to reach agreement on whether the information transmitted can be committed to the extant chain of blocks (Zhang, Xui and Liu, 2020). DLT evolution introduced the idea of smart contracts and the development of decentralized applications (dApps), that extend the areas of DLT adoption through the new capabilities they promise. The former refers to the idea of a programmable DLT, where a computer program code stored in DLT blocks is self-executed when predetermined terms and conditions are met (Salviotti et al. ,2018).

Due to the inherent characteristics of the DLT, in respect to its network facet and the network effects created, we approve a business ecosystem approach for our research. Similar to the business ecosystem set up, DLT actors create value for actors, while at the same time they maintain their roles in the ecosystem and their loose interconnection. The business ecosystem approach that needs be conceptualized for a DLT network of interacting actors is also supported by the fact that in both formats the large number of interconnected participants and their interdependence for their mutual survival are among their foremost key characteristics (Iansiti and Levien, 2004). Network effects are created in the DLT network, meaning that the more ecosystem actors, the higher the benefits perceived for each individual in the system and the higher the value created by the system define the DLT network facet. The latter is vital for DLT ecosystem sustainability, since DLT ecosystem expansion is crucial for the security of the network (Mohan, 2019).

The more the actors that adopt DLT and interact, the more value perceived by each individual and

the higher the value created by the system. In turn this incentivizes more actors to join the network and therefore the network effects created fuel the expansion of the ecosystem (Shapiro and Varian, 1999). Niche players, as referred in business ecosystem literature (Moore 1993; Cusumano and Gawer, 2002), constitute the group of actors that do not hold a dominant position in the ecosystem, neither control the maximum number of nodes in it, nor aim for leadership by regulating it. However, their participation is critical for the ecosystem expansion and consequently its survival and that role is usually delivered by SMEs that complement the dominant actors in the DLT business ecosystem create the critical mass participants that its preservation and expansion is directly related with DLT ecosystem sustainability.

DLT Business Model Comparison Against Other Business Model Types

To identify the unique or adjustable nature of the DLT business model, we critically examined the business model types that are closer to DLT conceptualization (see Table 1). Due to its specific characteristics of information exchange, access and validation, DLT defines the type of transactions, interactions, relationships of an organization. It eventually affects decisively the value created and exchanged between interacting parties in the ecosystem. It is therefore evident that the networked and information business model types are concepts close to the DLT business model approach. In addition to that, we examined the digital business model concept, compared against the DLT business model perception due to the fundamental role of information technology in both notions.

Why DLT business model is not fully addressed by the networked business model type

In business model literature there are studies that highlight the network perspective of business models. These studies identify the network of actors as an important business model substance (Helander and Rissanen, 2005; Komulainen et al., 2006), which at first sight seems to be a good match to the DLT ecosystem concept. However, network business

Table 1.		
Business model types relative to DLT ecosystem and their main attributes		**DLT Business Model attributes that differ**
Network Business Model	Coordinated cooperation between a finite set of parties that promote long-term strategic cooperation	DLT ecosystem actor relationships can be cooperative, competitive and/or co-opetitive
	Value creation in organization's strategic business net	DLT ecosystem expands beyond the strategic business net of each one of its members
	The scope is to gain or sustain competitive advantage through information access or technology	Information access is a value generator but the objective is not necessarily to gain competitive advantage
Digital Business Model	Platform organizes the wealth creating activities	DLT architecture sets the boundaries of value creating activities but does not organize them
	Customer, value, partner and financial dimensions are imposed by platform characteristics	Value creating system is affected by the platform but is not relied on it
	Enterprises compete digitally with their content, customer experience and digitized platforms	DLT actors do not necessarily compete on any of these traits.
	Supplier, omnichannel, modular producer and ecosystem driver are the business model categories based on a "know-your-customer" perception	Only the platform provider in the DLT ecosystem may fall into one of those categories without the need of "know-your-customer" perception
		Transaction validator actors perform a specific role that is not related to the platform provider business model
	Role of complementors to digital or platform ecosystems	There is not any such equivalent role in the DLT ecosystem
Information Business Model	Explains how information is collected stored and delivered internally and externally	Interconnectedness and interdependency is supported and powered by information system integration but value capture, creation and delivery is only partially defined by the architecture.

Table 1: Comparison of DLT business model attributes against other business models

models describe the way that strategic business nets create value (Palo and Tähtinen, 2011). DLT business ecosystem is not necessarily the coordinated cooperation between a finite set of parties that promote long-term strategic cooperation (Zhou et al. 2022). In DLT business ecosystem, member relationships can be cooperative, competitive and co-opetitive (Carayannis et al., 2018). On the top of that, DLT business ecosystem expansion beyond the strategic business net of each member, is rather a fundamental factor for the ecosystem sustainability (Kwame, Kecheng and Effah, 2019).

Why DLT business model is not fully addressed by the digital business model type

Platforms are considered to be the technological resources that organize the wealth creating activities (Shaughnessy, 2016). An organization that adopts DLT, needs to acknowledge that the technology, meaning the DLT architecture, is vital to ecosystem value creation but it is not the driver of the ecosystem benefits that flow back to the company in the form of revenue. It is the leverage of data, seen as resources, that are considered as a value driver. In digital business models the customer, value, partner and financial dimensions are imposed by the platform characteristics (Schallmo et al., 2017). In a DLT business net, the set of activities that define the value creating system is affected by the platform but is not relied on it (Schlecht, Schneider and Buchwald, 2021). Digital business model frameworks consider that enterprises compete digitally with one or more of three capabilities: their content, customer experience and digitized platforms (Woerner and Weill, 2018). Although this approach can be perfectly applicable to e-business companies, it neither addresses the strategic intent nor can it be considered as measure of effectiveness of any organization that participates in the DLT business network.

Why DLT business model is not fully addressed by the information business model type

Information flow, knowledge management and data management are heavily determined by DLT infrastructure and are factors that promote ecosystem value creation (Lacity and Remko, 2021). However, the effect of the technology itself in DLT ecosystem should not be confused with the information model concept. At company level, the information model explains how information is collected, stored and delivered internally and externally (Korpela et al., 2013). In digital business or other platform ecosystems, the information model is almost equivalent in value to the business model. It would describe how ecosystem members integrate their business processes in information systems. In DLT business ecosystems members' interconnectedness and interdependency is supported and powered by information system integration (Xiwei, Weber, Staples, 2019). Trust created in the ecosystem, data management and knowledge creation prospects drive DLT ecosystem value genesis and share logic, irrespective of the DLT architecture adopted (Moore, 2006).

The Need of a Business Model That Addresses DLT Ecosystem Sustainability

Role changes, volatility in ecosystem member relationships and knowledge genesis form DLT business ecosystem dynamics (Kandiah, and Gossain, 1998). Subsequently, DLT business ecosystems are not static. The business model of a DLT business ecosystem member should be dynamic and constantly evolve. Organizations that join the DLT business ecosystem constantly learn new and better ways of doing things. They are engaged in multiple differentiated relationships and have the prospect to take up different roles (Kandiah, and Gossain, 1998). Dynamic capabilities literature recognizes that the external environment affects learning (Burgelman et al., 2021). At network level, DLT ecosystem dynamics influence learning. New knowledge is created both through problem solving and inter-firm knowledge transfer. Access to data and streamlined information flow are inherent characteristics of DLT, that when adopted lead to knowledge genesis in the ecosystem. On the top of that, DLT ecosystem sustainability depends on true member collaboration. We consider that there are specific DLT business ecosystem attributes and dynamics that foster business model changes for the members that need to sustainably participate in it.

Dimensions of DLT Business Model for Ecosystem Sustainability

To conceptualize the DLT business model we need to consider not only the characteristics that it pertains from the business model concepts closer to it but also realize the dimensions of a sustainable DLT ecosystem. The ecosystem approach and its sustainability aspect are notions inextricably linked with the value created and shared through DLT due to the necessity of positive network effects. We reckon trust, power attitude of actors, value of data ownership and relationship type between ecosystem actors as the conditions for DLT ecosystem sustainability (see Fig. 1).

The dimension of trust

In DLT business ecosystem, trust is established by collaboration, cryptography and some clever code, without the need of trusted intermediaries (Xiwei, Weber, Staples, 2019). Trust should be recognized not only as an outcome but also as a condition, which needs to be evaluated when an organization that adopts DLT forms or reviews its business model (Conway and Garimella, 2020). To preserve the dynamic attribute of DLT business ecosystem, we acknowledge that relationships among actors not only switch between competitive, co-opetitive and cooperative but also that these behavioral shapes coexist in the ecosystem (Yoon, Moon, and Lee, 2022). Based

on literature, trust has been found to have positive effects on network performance (Rus, 2005). For small medium-sized enterprise (SME) networks, trust has been proven to be essential for SMEs to become productive and deliver according to their innovation potential (Pittaway et al., 2004). SME participation in DLT ecosystem is vital for its expansion and sustainability. Since they hold the role of non-dominant players, that create the critical mass for ecosystem safety and survival.

Collaboration among ecosystem actors requires some level of minimum trust. Access to undisputable trusted evidence is precisely what DLT supports. We therefore set trust as the basis of the relationships required for an organization to collaborate and also to improve its efficiency (Papanikolaou, Angelis and Moustakis, 2021). Direct evidence, or else direct trust as mentioned in trust literature (Mayer, Davis, Schoorman, 1995), is supported by the decentralized way that data are kept, shared and accessed, without the need of any intermediaries to validate their trustworthiness. Data openness, decentralization, immutability, visibility and transparency promised by the nature of DLT transactions allow previously unknown actors to collaborate and set the basis for many forms of value creation for each individual DLT network member (Angelis and Ribeiro da Silva, 2019). Access of trusted data sets a strong trust base between interacting parties before they
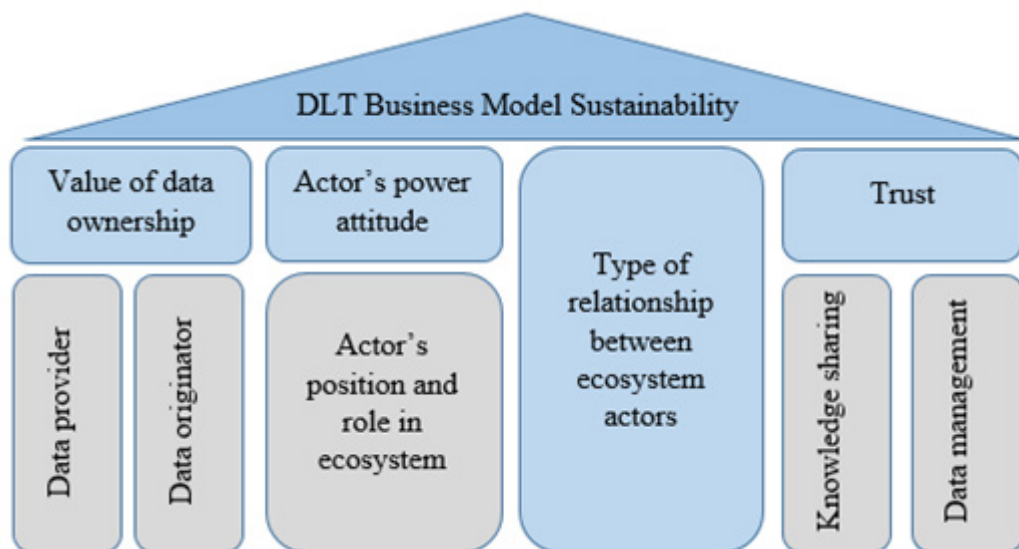

Figure 1: Pillars of DLT business model sustainability

establish their relationship. Moreover, during their interaction, irrespective of the relationship established among interacting parties, visibility and transparency achieved through DLT adoption due to trusted data access has been proven to be closely related both with their performance. The way that data are accessed, the transparency and visibility demonstrated offer DLT network members the perspective to exploit data and create new data driven knowledge. In DLT networks future participants are incentivized both by knowledge creation prospects and access to collaborative knowledge promised to reinforce the validity of their data driven decisions and evolve their capabilities (Papanikolaou, Angelis and Moustakis, 2021). It is therefore obvious that trust among interconnected parties affects mainly the business model value creation aspect, due to advance opportunities for analysis based on trusted data and capabilities reinforcement through new knowledge creation.

The dimension of cooperative relationships between ecosystem actors

The combined effort of businesses, that bring together their values to achieve a common purpose of higher results, includes cooperative relationships between businesses with the same focus (Lundan, 2002). In cooperative relationships ecosystem members act for common purpose and for common benefit. In a cooperative relationship enhanced by trust, the potential for organizations to share their expertise and knowledge for a common purpose and benefit is increased (Ross and LaCroix, 1996). Although literature demonstrates inconsistent findings in respect to whether cooperation is promoted by trust or the other way round (Yamagishi, 2005), it is evident that trust is positively correlated with cooperation (Lewicki et al., 2003). DLT business ecosystem members engaged in a cooperative relationship enjoy trust benefits, which in turn leads to higher level of cooperation. That is more obvious in the early stages of the relationship, where cooperation drives trust (Conway and Garimella, 2020). This specific attribute can be considered as a high value motivational trait for DLT business ecosystem engagement (Conway and Garimella, 2020). Trust boosts ecosystem actor cooperation, since it reduces control, coordination costs, conflict levels

and influences knowledge sharing (Mooradian et al., 2006). The latter plays a significant role for DLT business ecosystem value creation.

The dimension of co-opetitive and competitive relationships between ecosystem actors

Working together with another ecosystem member that is a competitor in a way that benefits both parties or striving for a goal that cannot be shared, are actor's traits present in the DLT business ecosystem (Mäkinen and Dedehayir, 2012). In a DLT business ecosystem, cooperation and trust reinforce each other and enhance its sustainability. Complementary to that, competitive and / or co-opetitive relationships and trust in business model design need to be approached with attention. As the business network expands, the probability that disagreement and conflict among some of its member increases. Apart from the obvious probability that cooperation between ecosystem system members might change to competitive or co-opetitive relationship, the designed DLT business model must meet another significant challenge. This is related to knowledge sharing (Yoon, Moon, and Lee, 2022; Xiwei, Weber and Staples, 2019). In DLT ecosystem, all economic operators gain better visibility along the network and enhance their information capture capabilities. In the case of non-cooperative relationships, the knowledge sharing attribute of the business network might lead ecosystem actors to reconsider their decision to join the respective DLT ecosystem.

One of the benefits when participating in DLT business ecosystems is increased transparency. All economic operators gain better visibility along the network and enhance their information capture capabilities. It is therefore evident that trust not only facilitates but promotes and enhances knowledge sharing in DLT business ecosystem. In the case of non-cooperative relationships, such as competition and co-opetition, the knowledge sharing attribute of the business network might lead ecosystem actors to become more skeptical towards joining or even leaving the DLT ecosystem. In that case business model design should consider trust conditions under the prism of the type of the knowledge shared and the complementary of business ecosystem actor interests. The underlying logic on that conclusion

is that these two factors have a direct impact on the cooperative or non-cooperative initiatives (Gausdal, Svare and Möllering, 2016).

Under those conditions, business model design should capture trust under the prism of shared knowledge and the complementarity of ecosystem actors' interests (DeMaio, 2001).

Ecosystem actor's power dimension

Although the concept of power is perceived quite differently by academic disciplines, we considered the definition of the power as an organization's capacity to influence change in another company (Phillips and Srai, 2018). That approach refers to all kinds of influence, including those exercised in exchange transactions (Hart and Saunders, 1997). To achieve deep versus superficial collaboration, as a prerequisite for DLT business ecosystem sustainability, we need to consider DLT expansion but not under the logic of coercing the weaker actors. Although in literature power is discussed as the functional equivalent to trust (Luhmann, 1979), for DLT business ecosystem expansion trust and power should be examined separately. Some authors see power as the greater deterrent to trust, while other researchers underline that when power is used for the purpose of dominance, it diminishes trust and weakens collaboration (Kähkönen, 2014). The same applies on DLT ecosystem, where power exercised between two actors is relative to their current ecosystem position and the relationship they wish to develop, to gain a different position in the future (Phillips and Srai, 2018).

Rules of collaboration in a DLT business ecosystem are affected by the position and power dynamics developed in the network. Power relations affect actors' intentions to exercise influence other actors or partners, hence imposing a superficial collaboration. In addition to that it configures the motivation of the potential DLT business ecosystem participants to join the network. Niche player participation is critical for the DLT ecosystem expansion and survival. Dominant players in terms of network relationship, power dynamics, brand or financial strength are positioned at the center of the ecosystem and initially set the rules of collaboration (Cusumano and Gawer,

2002). This underlines primary the keystone, or else dominant, DLT ecosystem players need to consider the power dynamics that stems by their ecosystem position so that they do not impose superficial collaboration to niche players or allow them to enjoy a disproportionate amount of value created in the network that will eventually discourage their participation in it.

Value of data ownership

Increased transparency in a DLT business ecosystem raises some issues with respect to the incentives of its members to disclose formerly private information. One of the main challenges of DLT diffusion is the minimal data to be opened to network (Beck et al., 2018). In DLT business ecosystem, certain parties might refuse to do business with each other because they might feel they are providing excess power to the entity that owns and manages data (Conway and Garimella, 2020). Visibility of unique identifiers and related transactional histories raises privacy concerns (Bφhme et. al, 2015). Transparency is one of the major drivers and properties of DLT (Lee and Pilkington, 2017) ince digital records are auditable by a predefined set of participants, albeit they are more or less open. DLT applications are based on the benefits of the technology pertaining to decentralization and transparency (Rφckeshφuser, 2017). They might see the value of participating in the ecosystem but due to data ownership and management by other entities they might also become skeptical in joining the ecosystem and request restrictions or specific legislation before doing so.

It is beyond the scope of this study to dive deep into the mechanism of information interoperability, meaning the exchange and sharing information between distributed and random systems and entities. However, acknowledging that the real value stems from the ownership and management of the data shared, it is nonetheless important to consider that enabling access to and analysis of these new collections of data and information will enable ecosystem members to generate new knowledge (Treiblmaier and Beck, 2019). Data is an asset to the company. Data view and transaction driven data sharing among ecosystem

members leads to increased value to the entity that owns and manages data (Lake and Crowther, 2013). To explore data manipulation possibilities in relation to actor roles in DLT business ecosystem, we focused on the roles of data provider and data originator. Data origination is related to data provenance. Data provider role is held by the ecosystem actors that can retrieve data from relational data sources. In DLT business ecosystem data originators contribute to data providers' value creation (Janssen and Zuiderwijk, 2014; Zuiderwijk and Janssen, 2014)

Since almost any DLT ecosystem actor can become a data provider, what is at stake is the visibility depth of data collected by its first tier partners (Lee and Pilkington, 2017). That will consequently define the value of analysis performed, the knowledge gained and finally the power gained from data access. On the other hand, data management alternatives in DLT business ecosystem give data originator the flexibility to select the level of openness of disclosed data. Obviously, this will have a direct impact in data provider's gained value (Kitchin, 2014; Grover et. al, 2018). We could therefore conclude, that in terms of the power gained from data ownership and management in a DLT business ecosystem, actors need to select which role they will adopt in it and how they will capture the network value stemmed from their data management approach. Put differently, the condition that needs to be considered is what incentivizes data originators to feed data providers and what is the depth of visibility of the data granted. Based on that decision the respective business model will acknowledge what routines need to be formulated to capture the value created by the data management approach, as described above.

Conclusion and Discussion

DLT is currently receiving significant attention but its commercialization through a business model will unveil its creating potential. In our study we discussed business models under the organizational concepts of value creation and design and adopted an ecosystem. We critically examined three business model types that demonstrate similarities to the business model that an organization needs to adopt in order to fit in the DLT ecosystem characteristics. We explored the main attributes, similarities and differences of each one of the network, digital and information business model types against the DLT business model. We conclude that although each one of those types demonstrates some resemblance with DLT business model, there are critical parameters that are neither addressed nor partially met. To explore the adjustable nature of the DLT business model we addressed the dynamic character of DLT ecosystem. We highlighted the challenge for ecosystem sustainability, defined and reviewed the conditions that need to be considered for DLT business model design that are: relationship type between ecosystem actors that co-exist in the DLT ecosystem, trust, power dynamics between actors and the value of data ownership based on the data provider and data originator traits of the interacting actors.

Further development of this study could focus on defining what elements could have been included in the DLT business model and how would they fit in an existing or a new business model ontology. Organizations that adopt DLT need to decide what elements constitute the value creation and value capture aspect of their business, considering the conditions described in our study that address DLT ecosystem sustainability.

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