Data as oil, infrastructure or asset? Three metaphors of data as economic value

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Data as oil, infrastructure or asset?

Three metaphors of data as economic value

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Purpose: Principled discussions on the economic value of data are frequently pursued through metaphors. The current text explores three influential metaphors for talking about the economic value of data: *data is the new oil*, *data as infrastructure* and *data as asset*.

Design/methodology/approach: With the help of conceptual metaphor theory, various meanings surrounding the three metaphors are explored. Meanings clarified or hidden through various metaphors are identified. Specific emphasis is placed on the economic value of ownership of data.

Findings: In discussions on data as economic resource the three different metaphors are used for separate purposes. The most used metaphor, *data is the new oil*, communicates that ownership of data could lead to great wealth. However, with *data as infrastructure* data has no intrinsic value. Therefore, profits generated from data resources belong to those processing the data, not those owning it. The data as asset

metaphor can be used to convince organizational leadership that they own data of great value.

Originality/value: This is the first scholarly investigation of metaphors communicating economic value of data. More studies in this area appear urgent given the power of such metaphors as well as the increasing importance of data in economics.

Introduction

Is there an economic value in owning data? Should people be reimbursed when they provide data for purposes of data-driven innovation? Should the data economy only yield profits for those who process data, not for those owning it? Those attempting to articulate the economic value of data have found that data is a slippery and difficult concept. When closely inspected, multitudes of implicit meanings emerge. This means that an exceptionally vague concept is becoming increasingly vital for policy discussions on "digital economy", "data economy" and "data market" (European Commission, 2017).

Many have taken data for granted as an easily grasped, almost intuitive notion. Increasingly, such simplistic approaches appear unsustainable as data now appears in discussions on financial investments. The current article isolates one crucial aspect: articulation of data as of economic value through metaphors. A distinction will be made regarding the different value of data for research, computing and economy.

In situations where people are forced to deal with abstract notions, they often turn to metaphors (Lakoff and Johnson, 2008). Three influential metaphors are focused in this article: “data as the new oil” (or DINO; Palmer, 2006), “data as infrastructure” (or DIN; OECD, 2015) and “data as asset” (or DAS; Khatri and Brown, 2010). *DINO*, *DIN* and *DAS* are successful but contested, and quite different, attempts at talking about the economic value of data.

There have been several previous reflections on metaphoric use of data in contemporary discussions. Markham (2013) discusses reductionist metaphors of human experiences as data. Nafus (2014) notes a variety of metaphors allowing human attributes for data. Of particular interest has been the use of *big* data as a metaphor, focusing on a wide range of metaphors. Awati and Shum (2015) identify metaphors of big data as articulating issues of surveillance, food, resource, space, industry and liquids. Similarly, Puschman and Burgess (2014) focus on two contrasting metaphors of big data: as a force of nature to be controlled or as nourishment to be consumed.

The next section supplies a background to data as unregulated, i.e as a resource that has neither been targeted by governments nor by standard-setting licensing systems such as have been the case for open content (Creative Commons) and open software (General Public License). After presentation of method, three different ways of talking about data as resource will be presented. Following this, conceptual metaphor theory (Lakoff and Johnson, 2008) is introduced as an analytical approach to the three different metaphors. The main part of the text focuses scrutiny of the three metaphors; what becomes highlighted and hidden. The concluding discussion is explicitly concerned with the issue of ownership of data.

Data as unregulated resource

The current article focuses on metaphors in the area of data as a resource. Implicitly or explicitly metaphors about data as a resource serve to clarify economic value. If data is a resource for business ventures, there are basic legal and commercial issues regarding the economic value of data. The conventional business procedure is that resources required for production of goods are bought. Means of production and raw material are thereafter processed into something of greater value which can be sold with a profit. However, in the data economy the raw resource has been taken for granted to be mostly free for commercial exploitation.

In recent years, there has been a rich critical discussion on data as a taken for granted freely available resource from perspectives such as digital labor (Fuchs, 2014), reinvention of capitalism (Mayer-Schönberger and Ramge, 2018), platform society (van Dijck, Poell and de Waal, 2018) and surveillance capitalism (Zuboff, 2019). The concept of *behavioral surplus* has been suggested by Zuboff, (2019) as a way to understand how companies such as Google and Facebook have extracted value from various traces of online activities with the explicit aim of improving services to users. However, the extracted data have additional value to that of improving on services. Behavioral surplus has therefore been used to create highly profitable applications in a variety of markets.

Data is not the only "free" resource that has developed within the digital economy. Rather, three distinct "open" categories can be identified: data, content and code

(Nolin, 2018). In the late 1990s and early 2000's open content became regulated through the Creative Commons license system and open software through a variety of licensing systems such as the Open Source License and the General Public License. These systems, put in place by strong transparency movements rather than governments, created frameworks for understanding authorship, ownership, procedures for reuse and possible commercial exploitation. However, open data remain unregulated and issues of ownership unsettled. By implication, this means that data as a raw resource has not been seen as having any economic value. Zuboff (2019) points to this lack of acknowledgment of data as value leading to a major economic shift, allowing a new form of capitalism to develop. In addition, representatives of "surveillance capitalism" propagates a kind of cyberlibertarianism (Winner, 1997; Zuboff, 2019) in which online innovations should be unregulated.

It is with this backdrop, that the three metaphors are investigated. In different ways they attempt to communicate the economic value of a data as a raw resource in the data economy. The aim of this article is to clarify tensions between various ways of talking about data as economic value, particularly regarding the economic value of *owning data*:

- What do the metaphors communicate regarding data as economic value?
- What meanings are clarified and which are hidden within the different metaphors?
- What do the metaphors communicate regarding ownership of data?

Data as economic value is currently an unresolved issue of great importance for the digital economy. The European Commission (2017) estimated the EU data economy to

be worth €300 billion in 2016, practically 2% of total GDP. With favorable policy reform, the market was estimated to grow to €739 billion by 2020, which would be 4% of the overall GDP.

Method

The impetus of this article came in a recent rereading of the formative text by OECD (2015) on data-driven innovation. In this text, many pages were devoted to undermining the data is the new oil-metaphor (DINO). Why was this? The OECD favored metaphor of data as infrastructure (DIN) appeared to be very similar but less powerful and clarifying. Initially, therefore, it was seen as interesting to contrast these two metaphors. As work progressed, it appeared clear that the two metaphors primarily differed in how ownership of data was understood from an economic perspective.

An extensive review of existing literature was performed to take a full inventory of discussions concerned with data as economic value in general and texts that engage with metaphors in particular. A specific aim with this broad inventory was to identify metaphorical work concerned with the metaphors not only within scholarly texts but also within mainstream discussions.

For the understanding of the DIN-metaphor the OECD (2015) report was the obvious source material together with other texts used to strengthen that approach. Mainly, this was Frischmann (2012) and the United Nations (2008). Selection of the source material for an understanding of the DIN-metaphor was more difficult as it was not built on a strong key document. Rather, there was a history starting with a blog post by

Palmer (2006). Throughout the years the metaphor has been twisted in various ways and source material was used that illustrate these developments. Particularly, in recent years numerous commentators have used the metaphor to make diverse points. A selection of these articles 2017-2019, mostly blog posts and editorial news articles, illustrate the contemporary state of this metaphor in public discussions.

During an extensive review of existing literature regarding ownership of data a third interesting metaphor was identified: data as asset (DAS). This was first noticed through the prolific work of Schmarzo (2016). This was a discourse that was quite separate from both DINO and DIN while more explicitly identifying data as having economic value. This way of talking about data clearly followed from discussions on data governance (Khatri and Brown, 2010). The most prolific and sophisticated use of data as asset/economic value was clearly written by Gartner researcher Laney (2018). This text was therefore also used as a source for understanding the DAS-metaphor.

Various metaphors as well as diverse subtle meanings connected to the main metaphors were found in the texts reviewed. In this way, diverse meanings of the main metaphors could be unpacked. Such metaphors become widely shared if they are found to clarify abstract meanings. This means that they highlight some aspects of that which is to be understood while downplaying other.

To discuss metaphors of data as economic value, there is a need to first explore three different ways of talking about data as a resource.

Three ways of talking about data as a resource

Data is a fluid and complex concept that is used in different ways in various contexts. Inspiration for understanding these quite different takes on the concept can be found in two of the four interpretations of data suggested by Floridi (2008).

First, data is a resource of value for researchers. Floridi (2008) talks about an *epistemic interpretation*, suggesting that data are facts. However, Floridi (2008) argues that the value of data in research appears to be broader than that. Facts can be seen as refined products coming out of researchers working with raw data. Within research data can refer to a broad variety of various materials coming out of empirical investigations.

In the epistemic interpretation, data is something carefully curated and discussed through concepts such as design of study, sampling, method, coding and analytical work. There are further, and quite separate, concepts connected to studies that are either qualitative or quantitative in character. There are also diverse and intense discussions regarding *quality*. Collection of data is seen as an advanced skill performed by professional researchers. Data is understood as being tied to specific contexts, research perspectives as well as to specific theories and methods involved in data collection. Researchers are weary about confounders as well as bias or agendas pushed by diverse sources of data. Critical skills are vital for those dealing with data among researchers.

Second, Floridi (2008) also identifies a *computational interpretation* suggesting that data are collections of binary elements. Floridi (2008) notes that it is a limited mode of talking about data. However, this is an important area in which data can be talked

about as a resource necessary for what computers do and how they relate to humans. Notably, it is a fundamentally different way of talking about data compared to the epistemic interpretation.

Within the computational interpretation of data several slightly separate meanings have emerged about data as a resource. As noted by Floridi (2008), there is a fundamental connection to the digital foundation of computer language: ones and zeroes. To digitize is to make analog information into machine-readable data. The digital essence of computing can be seen as a frame for the other forms of understanding of data. Therefore, the value is also associated with input, the data that the computer needs to do its work. Data also has value as the output, that which the computer delivers after processing. Finally, data is connected to programming, code, and software, i.e. the actual instruments that computers use in order to process input into output. The critical skills so highlighted among researchers, reflecting on the character of data used, are much less apparent within computing. In a sense, the computational interpretation focuses on pragmatic rather than epistemic values.

Notably, discussions about data as economic value fits neither within data as epistemic resource nor with data as computational resource. Data as economic resource should be understood as a separate way of talking about the value of data compared to data as epistemic or computational resource. However, there are overlaps. Many researchers and computing professionals have been drawn into data as economic value. Highlighted in such discussions are notions about data as a resource for innovation. In such discussions, typically, innovation is broadly defined as being of value not only

for businesses in various ways, but also for the public sector. The different values including some overlap are illustrated in figure 1.

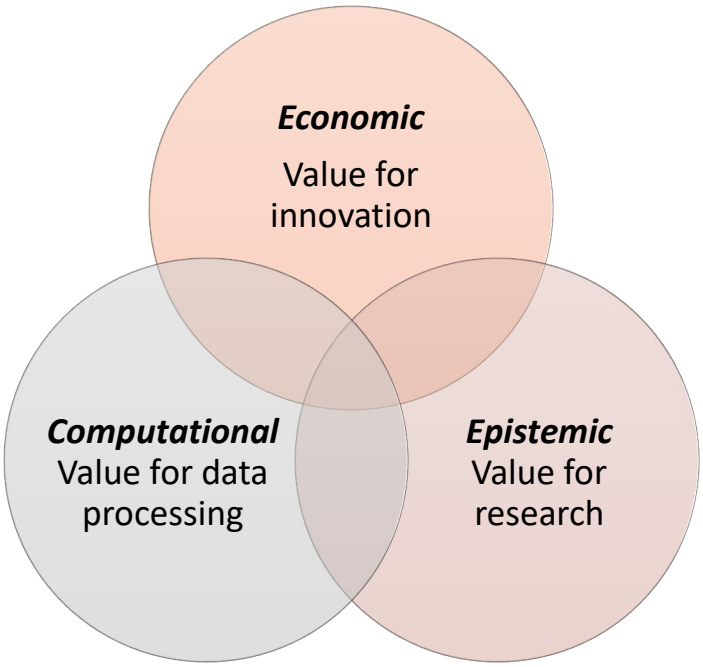

Figure 1: Stacked Venn diagram illustrating the value of data within three different ways of talking about data as a resource.

When people encounter complex and abstract concepts in their everyday practices, they often turn to metaphors. These become resources for discussions and a meeting of minds. The current text investigates variations of three different metaphors (DINO, DIN and DAS). However, before scrutinizing these, a brief introduction to conceptual metaphor theory is in order.

Conceptual metaphor theory

There are two competing approaches for understanding the dynamics of how people make sense of abstract notions encountered in everyday life: *technological frames* (Davidson, 2002) and *Conceptual metaphor theory* (Lakoff and Johnson, 2008). Both approaches have their strengths and weaknesses. Simply put, technological frames allows for many conceptual tools, particularly in the context of when new technology is introduced into organizations. Conceptual metaphor theory is concerned with how concrete concepts are used to make sense out of abstract notions. In what follows, Conceptual metaphor theory will be used to discuss three separate metaphors that in many discussions have been used to make the connection between data and economics more concrete.

According to conceptual metaphor theory people understand abstract concepts in terms of more concrete and familiar language (Lakoff and Johnson, 2008). Human experiences are usually so rich that there is a need to reference known entities when encountering new ones. Therefore, any metaphor involves a combination of a target domain and a source domain. Within any target domain there are abstract notions difficult to communicate purely with the help of other concepts within the same domain. Obviously, some concepts within the same domain are useful. However, there are limits to the resources available in these domains when attempting to clarify something as abstract as data having economic value.

Lakoff and Johnson (2008) understand metaphors as dynamic and pragmatic. People tend to use several metaphors to comprehend and communicate the meanings of a single activity, concept or artefact. Each metaphor can highlight one distinct aspect

while minimizing others. Different metaphors relating to the same experience can therefore frequently be in conflict with each other. Consequently, people operate with a system of metaphors whose parts often fail to be consistent. Metaphors are not only used to make sense. They can also be constitutive of perspectives, allowing people to view the world in a certain way. Furthermore, metaphors serve as rhetorical instruments, convincing others of a certain viewpoint. With this in mind, the next sections involves scrutiny of the three main metaphors (DINO, DIN and DAS).

Metaphor 1: data is the new oil (DINO)

DINO has received scant scholarly attention beyond Hirsch (2014) who argued that the analog between oil and big data also should include an understanding of the similar environmental harm connected to both production of data and oil. Some reflections on DINO have also figured briefly in discussions of big data metaphors (Puschman and Burgess 2014; Awati and Shum, 2015). The academic discussion aside, DINO has figured in a wealth of articles within mainstream media and influential blogs, particularly since 2017. Such articles are brief and varied in their interpretation of the metaphor. Nonetheless, a review of such reflections are informative about the various ways in which the metaphor can be used.

Some commentators experience the metaphor as clarifying and useful, elaborating on why it is appropriate to see data as the new oil (Skerrett, 2018; Nygard Mar, 2018). Others take DINO as a guide to riches within a new financial paradigm (Rotella, 2018; Swinfen-Green, 2018).

There are commentators who take the metaphor as a source for concern about the changing corporate landscape of financially leading multinational corporations from, so to speak, Standard Oil to Facebook (Aslund, 2018). Some are concerned with privacy, i.e. reflecting on the extended metaphor *personal data* is the new oil (Pringle, 2017; Rajan, 2017 Bloor, 2018). Zax (2011) mixes metaphors, querying if "personal data is the new currency?" The specific add-on of "personal" to these metaphorical discussions is usually credited European Consumer Commissioner Kuneva (2009). This important revision of DINO introduces ethical aspects to becoming rich through data. Other ethical aspects have also been associated with DINO. Elliott (2018) notes a parallel between the Cambridge Analytics scandal and oil spills: "As several companies including Facebook have found recently, data really is that 'new oil' - when badly handled and spilled, it can require a toxic cleanup".

However, some commentators specifically engage with the metaphor as misleading. Intentionally or not these comments echo more substantial arguments put forth by OECD (2015) through the DIN metaphor. This is the case with several critics (Marr, 2018; Schlosser, 2018; Martinez, 2019 and Zadeh, 2019).

DINO was first formulated in 2006, preceded by another powerful and more straightforward metaphor: "data is the new currency" (Schwartz, 2000). This metaphor constitutes a basic way of expressing the connection between data and economics, utilizing economics as the source domain. As with many striking metaphors, it clarifies and hides meaning at the same time. It is rarely possible to take a raw piece of data in some medium or another and trade it for other types of goods. Nonetheless, the syntax of "data is the new currency", with emphasis on "the new", is so similar to DINO that

it might have served as inspiration. Nonetheless, DINO appears to communicate something different; that data is *not* as money, having an economic value in another sense.

DINO is an indirect metaphor. "Oil" appears to have *natural resources* as source domain. However, some natural resources, such as gold and oil, are universally associated with great wealth. The word oil therefore resides in an overlap between the source domains of natural resources and economics. This indirect character of the metaphor is so striking that it has been satirized through the popular T-shirt meme "data is the new bacon" (Nafus, 2016). In that case, the source domain is taken from *food*. However, this is actually another indirect use of economics as source domain. There is an implicit cultural reference to "bringing home the bacon", i.e. being someone who makes money to provide for one's family. This indirect communication of economic value creates a humoristic effect.

Bacon and oil communicate radically different forms of economic value. The bacon-metaphor supplies associations to wage earning, getting by day by day. DINO implies great wealth much along the lines of the way Zuboff (2019) discusses how behavioral data generates behavioral surplus, the raw material for some of the richest corporations in the world such as Google and Facebook. However, DINO could also lead to an interpretation that data has an economic value in itself without being processed. This was not the original meaning of British mathematician Humby, usually credited as originator. The much quoted statement is actually from a blog post by Palmer (2006), summarizing a talk by Humby. Notably, it is in this blog post unclear which of the two

coined the metaphor. “Data is the new oil” serves as a heading for the post, but the metaphor is not explicitly part of what Humby is quoted as saying:

> Data is just like crude. It’s valuable, but if unrefined it cannot really be used. It has to be changed into gas, plastic, chemicals, etc to create a valuable entity that drives profitable activity; so must data be broken down, analyzed for it to have value.

Stated in this way, the metaphor allows for a more complex understanding of data as having economic value. The statement of the metaphor in this context utilizes several concepts from the source domain of *work.* With this subtext the metaphor communicates that data can be of great economic value, but only after much specialized data work (refined, changed, broken down, analyzed).

It should be stressed that DINO is not “data is like oil”, but rather “the new oil”. This difference in nuances is highly significant as an economic paradigm shift appears to be implied. “The new oil” seems, again, to be taken from the overlap between the source domains of natural resources and economics, as a way to talk about *highly profitable investments*. The implication of the metaphor is that those wanting to become really wealthy in the 20th century invested in oil. Those aspiring to similar riches in the 21st century, should invest in data. Once again, this is similar to how Zuboff (2019) articulates the arrival of a new form of capitalism. Usage of “new” within the “data is the new bacon”-metaphor communicates something completely different in economic terms: working with data is the new form of paid labor.

DINO is a strong and powerful metaphor which taken in the context of the full quote supplies clarity regarding the character and amount of processing needed in order to generate economic value. The metaphor has also served as an important instrument for communicating ideas during these early days of data as economic resource. It has also inspired other metaphors with slightly different meanings.

In the context of the current text it is important to emphasize that DINO implicitly suggest that ownership of data has substantial economic value, as those owning oil historically have been well reimbursed. This is an important backdrop for the other two main metaphors investigated in this text.

Metaphor 2a: data as infrastructure (DIN)

OECD (2015) introduces three interconnected metaphors for talking about data as economic value:

- data as infrastructure (DIN)
- data as non-rivalrous
- data as capital good

The last two of these can be seen as attempts at clarifying specific meanings connected to the main metaphor of DIN. Together, they constitute a *metaphorical chain* (Koller, 2003) as different metaphors within one text collectively build an aggregated viewpoint. All of the metaphors therefore need some substantial unpacking and discussion.

OECD (2015, p. 179) notes that infrastructure is a kind of “large-scale physical facility”. This clearly spells out the source domain. A few examples are provided: publication systems, telephone and broadband networks, sewage and water systems. Typically, infrastructures require investment to be constructed and additional funds for maintenance and upkeep. Crucially, large-scale physical facilities seen as a source domain has no explicit overlap with economics. Instead, such artifacts can be seen as platforms upon which key economic activities play out, e.g. economic activity on a broadband network.

Through reference to a text by the US National Research Council (1987) there is also a broadening of infrastructure to include non-physical facilities: systems of education, governance and courts. Building further on Frischmann (2012) it is argued that infrastructures should be seen as having a function rather than being understood as a physical or organizational entity.

DIN may at first sound like a concrete metaphor with great explanatory potential. However, as the metaphor actually builds upon the soft and complex definition suggested by Frischmann (2012), it becomes translated to “data are a specific kind of nonphysical large-scale physical facility”.[1] Discussed in this way, DIN becomes vague

[1] Overall, this text utilizes the modernized way of talking about data in singular, i.e. "data is". However, OECD (2015) follows the older tradition of plural, i.e. "data are". This is in principle correct as the semantic origin is as plural of datum (“data are”).

and indirect, muddying the waters rather than clarifying. Nonetheless, the use of Frischmann (2012) allows for another metaphor with substantial power to clarify data as economic value: data as non-rivalrous.

Metaphor 2b: data as non-rivalrous

Frischmann (2012) states that one aspect of infrastructures is that they can be consumed in non-rivalrous ways. The argument builds upon the distinction by Romer (1990) between rival and non-rivalrous goods: if one corporation uses a rival good, then the competitor is excluded from it. In contrast, competitors can use non-rivalrous goods symmetrically. Romer (1990) argues that, in general, technology should be seen as non-rival input. For instance, using the freeway when driving to work does not deplete the road. Others will still be able to drive on it. Similarly, if someone uses a PC it is still possible for others to use their own computers.

OECD (2015) uses this metaphor to deconstruct DINO. It is argued that data is nothing like oil. Natural resources, such as oil, will be spent with usage. Infrastructures, such as data, on the other hand, will not be depleted by being used. As with many other metaphors, problems emerge with closer scrutiny. If data is non-rivalrous in this sense, so is just about anything involving intellectual property rights. People can watch

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However, terms derived from other languages frequently change through popular usage and increasingly data is talked about in the singular (Rogers, 2012).

movies, but these are not spent in the process. Similarly, corporations can use patents without depleting them in any way.

OECD (2015) also discusses rival goods in the context of abundance or scarcity. As there is an abundance of data, there is no competition. Nonetheless, it could be argued that some data can be characterized as scarce and that, for instance, data brokers are in competition about harvesting behavioral data as resource for marketing. However, data as non-rivalrous is in the metaphorical chain of OECD complemented with "data as capital good".

Metaphor 2c: data as (capital) goods

Data as goods is an economic metaphor, implying that data can be understood as an entity on a market as milk, shoes, books and other types of items bought and sold. It should be noted that data is a complex concept that can, but need not, be understood as goods. Zuboff (2019) argues that behavioral data is the foundation for a new form of capitalism relatively unconcerned with traditional economic notions of selling goods to customers. For instance, Google do not sell but freely give away applications such as Google maps and Google apps. Focus is not on selling goods to customers but instead collecting data on how customers use the goods.

In order to understand the OECD metaphor of data as capital goods, it is necessary to be cognizant of the distinction between consumption goods, intermediate goods and capital goods. For definition of these concepts, OECD make reference to a text by the United Nations (2008) in which consumption goods are defined as directly satisfying

individual needs and wants, alternatively the collective needs of members of a community. Intermediate are those goods and services which are inputs (and consumed as such) when producing consumption goods.

OECD (2015) argues that data can be seen as neither of these two categories, rather being *capital goods* which are used as input for production, but are not material in character and not consumed in the process. The basic underpinning for this metaphor is the previously described "data as non-rivalrous". However, it is difficult to make this kind of distinction without clearly defining data. The metaphor of data as capital goods hides that data can have a variety of meanings. For instance, social media feeds can be characterized as data, consumed by people while eating breakfast. Is the breakfast egg a consumable good, while the Facebook feed is not?

Another argument against the metaphor is that data frequently is spent, used up, on a one-time basis. This is primarily because data can be used as a driver for changing material circumstances. For instance, Highway traffic data can be used to push decisions on the construction of a new bridge. However, once this has been built the old data is obsolete and of no further use, as the material circumstances has changed. Similarly, if one party uses data to gain a certain competitive advantage, such as winning a contract to build a bridge, competitors will afterwards have no use of the same contract-specific data.

At a glance, it is difficult to see what data as capital good contributes beyond the data as non-rivalrous-metaphor. However, the series of metaphors suggested by OECD (2015, 181) leads to the argument that: "Data have no intrinsic value as the value

depends on the context of its use". In other words, data can be economically valuable but only when processed in particular ways in certain settings.

DIN articulates a distinct movement away from the links between data and wealth, so central in DINO, claiming that data are as infrastructure, not something that has any value in itself. Through this chain of metaphors (2a-2c), OECD (2015, 198) can then, finally, conclude that ownership "is a questionable appellation when it comes to data. In contrast to other intangibles, data typically involve complex assignments of different rights across different data stakeholders". Therefore, open data is hailed "as a solution to promote better access to data" (p. 187).

The bottom line of this argument, as it relates to ownership, is as follows:

- If data is as infrastructure, involving no rivalry and not being depleted when consumed, then it should be seen as part of the Commons, there is, then, no one who can claim ownership.
- Data has no intrinsic value, therefore there is no value in owning data and those gaining profits from data as economic resource should not financially reimburse those owning data.
- All the subsequent value generated by the data should therefore fall in the hands of those processing data.

Largely, the two main metaphors discussed so far (new oil/infrastructure) communicate quite similar messages. There appear to be an agreement that actual economic value is developed through sophisticated processing. However, OECD

(2015) clearly attacks DINO and goes to great length in developing an alternate perspective. Why is this?

Arguably, the main difference concerns the history of oil as economic value. Those who have owned land containing non-processed oil have been hugely compensated economically. Why should those owning resources of non-processed data gain nothing? In order for OECD (2015) to credibly argue that ownership of data has no economic value, there is a need to carefully undermine DINO and the parallels between oil and data. Fundamentally, a distinction is attempted between the economic value of owning a natural resource (such as oil) and a human made resource (such as infrastructure).

Metaphor 3a: data as asset (DAS)

The specific interpretation of ownership implied by DIN is challenged by another influential metaphor in recent years: data as asset (DAS). The source domain is here clearly economics. Asset is a broadly useful economic concept referring to resources that have some kind of value. That value may not be explicit, but use of this metaphor implies, at the least, an indirect economic value.

The metaphor can be traced back to a discussion on data governance (Kharti and Brown, 2010) introducing a distinction between IT as asset and data as asset. Discussions on data governance tend to be explicitly data centric and little concerned with economics. However, others have used the metaphor to explicitly argue economic value.

Metaphor 3b: data as prudent value

Schmarzo, a CTO at Dell, has been prolific in promoting the old turn-of-the-century metaphor "data is the new currency" as well as innovating the concept of Economic Value of Data (EvD). The common thread in such metaphorical work appears to be to explicitly attach economic value to data in order to push organizations into investing into data and the competences involved in management of data. Schmarzo has made numerous attempts at constructing a powerful EvD-perspective, explicitly talking about DAS.

Schmarzo (2016) suggested that data should be categorized as an intangible but quantifiable *prudent value*. This concept is taken from a specialized part of the economics source domain. It is a banking term used when attempting to estimate the value of various intangible assets when customers are applying for loans. Schmarzo (2016) sees a parallel in the way *goodwill* has already been recognized as of (prudent) economic value.

Data as prudent value could therefore be useful in communication with economic professionals, particularly when negotiating large loans. However, it may be less valuable when engaging other stakeholders. This metaphor illustrates how the economic value of data need to be clarified in separate ways to different professionals. Stating that data is as prudent value or goodwill may generate a sudden insight within a community of economic specialists that otherwise struggle with the issue.

Metaphor 3c: data as supply chain

In his 2018 book *Infonomics* Gartner researcher Laney introduces a rich array of perspectives regarding the monetization of data. Infonomics is defined as "the theory, study, and discipline of asserting economic significance to information" (Laney, 2018, 9). At the outset, Laney (2018, 9) explicitly positions his account within the "data as asset" tradition:

> As a business, information, or information technology (IT) leader, chances are you regularly talk about information as one of your most valuable assets. Do you value or manage our (sic) organizations information like an actual asset? Consider your company's well-boned supply chain and asset management practices for physical assets, or your financial management and reporting discipline. Do you have similar accounting and asset management practices in place for your "information assets?" Most organizations do not.

Laney makes two interesting strategic moves here. *First*, he uses information rather than data, collapsing the two concepts. Although he is clearly situated in the "data as asset"-tradition, use of the "data as information as asset" notion allows for a broader range of resources available for monetization.

Second, Laney (2018) introduces a new economic metaphor: "information supply chain". The source domain is logistics and the argument is that the regular supply chain has a parallel information supply chain. At every level, there is an opportunity for added value; increased efficiency, better quality products/services, improved sales and business relationships through monetization of information.

Laney (2018) considerably expands on the notion of information/data as asset and introduces numerous ways of monetization. His intended readership are those that already own data in their respective organizations as well as data professionals who are in need of arguments for more resources. However, with this focus on monetizing owned data there is an increased distance against the OECD position that ownership of data has no economic value. While OECD (2015) fixates data as infrastructure, Laney (2018) puts forth a view of information as much more heterogeneous, dynamic and liquid: having different value in separate situations. While OECD (2015) argues that data has no intrinsic value, Laney (2018, p. 11) argues that there are "endless economic alternatives for information".

The main ambition for pushing the various metaphors connected to DAS appears to bee to illustrate various ways in which ownership of data can be seen to have an economic value. Again, this is in contrast to what is communicated through the metaphorical work of OECD (2015) as regards to ownership.

Discussion: what is clarified and hidden within the metaphors?

It has been argued in this article that a new way of talking about the value of data has emerged between earlier notions of data as resource, having value either for research or for computing. Within discussions of economy, the meaning of data is unresolved, making articulation of data as economic value both necessary and extremely difficult. There is therefore a need for various metaphors to facilitate advanced understanding

and communication of a central idea of our times: *in which ways do data have economic value?*

A central notion in metaphors discussed in this article is that of valuable reuse of data across different contexts. Different meanings are communicated. DINO suggests that data has to be refined in order to attain value. However, once refined there is an implication that data can be reused again and again in various contexts. This interpretation is reiterated by the OECD (2015) criticism of DINO in which data is characterized as non-rivalrous. From that metaphorical standpoint data can be used again and again to produce value in different contexts without becoming depleted. Nonetheless, the alternate metaphor of DIN seems to suggest something different: data only becomes useful/valuable in specific contexts. With that interpretation, the user of data for production of value need to take into account the context within which data is to be reused. Similarly, with DAS data is talked about as owned by organizations and valuable within that same organization. Reuse of data therefore appears in a very similar context to that of the original use. The specific metaphor of talking about data/information as a supply chain illustrates a notion of mobile data transported between different contexts within the same organization, producing various types of value along the way.

The metaphors discussed in this text are neither true nor false, but rather of varying use for elucidating separate issues of value in different contexts and relating to various aims. However, it is problematic if a powerful metaphor is seen as communicating the only possible interpretation. In an ideal world good metaphors should be seen as instruments for opening and facilitating discussions. Table 1, below, illustrates the

various attributes clarified by DINO and these are listed together with attributes that, consequently, become deemphasized or hidden.

Clarification of DINO	Hidden by clarification of DINO
Data is as natural resource	Data is a resource created by humans for humans
Data is extremely valuable, as oil	As with oil, negative value is connected through pollution
Data work is needed to create value	Some data is used for behavioral surplus
Data is a prime investment	Ownership of data is difficult to establish
Data must be broken down to have value	Data can be toxic if mishandled

Table 1: Breakdown of some attributes clarified with DINO as well as attributes equally relevant but hidden with this metaphor.

The DIN metaphor involves a critical engagement with DINO in its simple form. Both Palmer (2006) and OECD (2015) appear to agree that economic value is generated through data work. However, use of "oil" in the metaphor implies that those owning "the new oil" should expect to become very rich. In addition, DIN allows for other types of attributes being associated with data as economic value, see Table 2.

Clarification of DIN	Hidden by clarification of DIN

Data are as infrastructure	Data is not a uniform resource such as water on tap, or a road
Data are non-rivalrous	Data brokers such as Facebook and Google are rivals, frequently competing for access to the same data to produce behavioral surplus
Value is given to data through data work, not ownership	Data brokers such as Facebook and Google have become among the wealthiest companies in the world through appropriation of data
Data are capital goods, not material in character	Data is intertwined with material entities and commercial activities in numerous ways
Data are capital goods, not consumed when used	-Some data can be seen as consumption goods as use of data frequently changes material circumstances, in practice depleting value of original data -Data yielding behavioral surplus can be seen as competitive goods
Data have no intrinsic value	Some data appear to have easily exploited value

Table 2: Breakdown of attributes clarified with DIN as well as attributes equally relevant but hidden with this metaphor.

While DIN signals that data have no intrinsic value, DAS explores numerous ways in which data can be seen as an asset of economic value. Thus, there is a fundamental

divide between these two metaphorical approaches regarding the value of owning data. Nonetheless, DAS involves metaphorical work that also hides attributes, see Table 3.

Clarification of DAS	Hidden by clarification of DAS
Data is as other economic assets	Data is difficult to compare with other economic assets
Data is extremely valuable	Different data has various value and some data have no value at all
Data work is needed to create value	Some data yields behavioral surplus
Data can be seen as prudent value	As data is so varying in character, generic standards for valuation are difficult
Data is as supply chain	Data is not organized in the longitudinal way that supply chains are.

Table 3: Breakdown of attributes clarified with the metaphors of DAS as well as attributes equally relevant but hidden with this metaphor.

While DIN develops a philosophical and legal argument, the metaphors of DAS is more concerned with the nuts and bolts of working with data. OECD (2015), on their part, has found a way of articulating the value of data as economic resource to an audience of policymakers. In doing so, they are downplaying the value of owning data. For those working with DAS, the audience is CEOs and board members that need to understand that data is an asset of great economic value.

Concluding discussion

As data as economic value is further developed in the years to come, it becomes crucial to scrutinize the metaphors used. It should be noted that the three different main metaphors discussed in this article are situated within different contexts. DINO was developed at an early stage of the digital transformation and useful for a specific way of discussing data removed from the way it is talked about within research and computing. It remains to this day the most broadly used metaphor for understanding the economic value of data.

OECD (2015) is particularly concerned with so-called public sector information (PSI), a category which also includes open government data (OGD), richly described in chapters 7-10 of the report. Those who strive to have free access to this resource sometimes talk about "Government as a platform" (O'Reilly, 2013), which of course involves another contentious metaphor (Gillespie, 2010). It would seem that the metaphors pursued by OECD serves to allow digital entrepreneurs free access to governmental data in order to produce substantial economic value. If this is the agenda, it makes sense to attack DINO as the metaphor implies that giving away data for free would be like handing over oil without economic compensation. DIN appears to express a cyberlibertarianism ideology (Winner, 1997; Zuboff, 2019) in which the resources for the production of behavioral surplus need to be free and unregulated.

The concept of *open data*, promoted by OECD, becomes a rhetorical device for asserting that profits connected to a certain resource belong not to a local community of resource owners, but to those who can process such resources. If this kind of argument would have prevailed in the context of exploitation of natural resources, then

those owning land rich in gold, oil, diamonds etc. should not have expected economical reimbursement.

Crucially, open data is connected to other commercial activities beyond that of behavioral surplus. For instance, opening up of government owned geological survey data can allow multinational corporations an opportunity to combine such information with vast databases on geological patterns connected with deposits of valuable minerals worldwide. Thereafter, with such asymmetrical information advantage at hand, various local landowners can be approached and valuable areas acquired at a low-cost. Such real-life developments were identified by Raman (2012) in her study of open spatial information provided by the Indian government.

Typical for the cyberlibertarianism ideology is a conflation of the rights of individuals with that of corporations (Zuboff, 2019). Open government is promoted as a service for the citizens while the resources made available through such ideological arguments may fall in the hands of corporations. G8 (2013, 3) stated that they "recognize that governments and the public sector hold vast amounts of information that may be of interest to citizens". This argument confuses the democratically driven rights of citizens to have open access to data with the needs of multinational corporations. The data intensive organizations (not citizens) have the *accessibility literacy* to know that a certain resource is available, where it is situated, what value it has and, furthermore, has the knowledge and technology to extract value. With this development in mind, governments being enticed with the promise of open data may be less forthcoming if they conceive of "data as the new oil", i.e. a fundamental national asset of great value.

Obviously, the metaphor of DAS is also pursued with a specific agenda. In this case, it is a matter of persuading organizations to realize that their data resources in many ways can be monetized. This metaphor can even be pushed further. Laney (2018), quite parallel to Zuboff (2019), position data/information as economically superior to other assets. With that argument, data is more like oil than bacon.

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