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Data Industrialization: Between Datafication Commodification, and Digital Infrastructure

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Abstract

Data is a new oil because in the development of industry and communication technology, digital data can be an important thing that can be produced, distributed, and consumed, or commodified. Every digital data can be obtained from every side of everyday human life so that datafication becomes something commonplace today. On the other hand, the role of digital infrastructure both physical and non-physical as supporting the operation of the internet and the development of industry and communication technology and Data Industrialization cannot be denied. Even the DC/server is used to gain profit for the company itself. This article tries to link datafication, commodification, and the role of digital infrastructure in the process. This article uses a qualitative approach with a systematic review and meta-analysis methods (Crowther, Lim, & Crowther, 2010) which was accompanied by interviews with several relevant informants (Alshenqeeti, 2014) to elaborate related concepts. In this article, I argue that in the digital age, every side of human life can become a digital data which then becomes a digital commodity so that the process of datafication and commodification always appears in every digital data. However, the important role of digital infrastructure both physical non-physical is very important.

Keywords:

big data; datafication; data industrialization; commodification; digital infrastructure; internet

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Introduction

In the digital era, data becomes important to be processed into information. Data is like new oil because every data can be valuable for any parties. Personal information that we put on into our social media sites, email, smartphones and other online platforms will be useful for interested parties to obtain user data, such as personal contacts, e-mails, and even the user's digital habits. Every data can be analyzed and every data can be commodified. As information in digital form, data can be transmitted, processed, and interpreted (Meriam-Webster Dictionary, 2020). Through the internet, the user's data can become a digital commodity that is traded primarily by the owners and developers of web and applications, data brokers, and the owners of capital as the party that has the power. Geotagging and location sharing features, for example, are commodities from digital locations that are targeted by other parties such as advertisers because in the location markers features they can provide access to important user information such as credit card profiles, shopping history, and others (Thatcher, 2017). The convenience of users to share photos, videos and other content on social media is a way for web owners and third-party applications to accommodate user locations. The tendency of people to enjoy sharing experiences

on social media is a performative aspect that is utilized by capital owners (Drakopoulou, 2017). Location and geotagging features are the commodification of memory. Furthermore, the algorithm in the location marker feature can easily obtain the user's personal data and then provide suggestions.

Before the data is commodified, the data analyzed is usually stored in a Big Data, which is physically accommodated outside the server or data center. Conceptually, a Big Data has at least seven characteristics, namely volume, velocity, variety, expertise, resolution, indexicality, relationality, extensionality, and scalability (Kitchin & McArdle, 2016). This information describes a process that writes certain meanings into measurable spatial information. User data collected into Big Data is the result of appropriation as a "data colonialism" (Thatcher, O'Sullivan, & Mahmoudi, 2016). Capital owners have the power to seize any data from application users, to then use the data on commercial purposes. This is a form and practice of digital commodity. Besides, Big Data itself is also a commodity (Thatcher et al., 2016).

With Big Data analysis, each data can be processed, analyzed, and interconnected with other data. Thus, Big Data can be applied and utilized in various things, such as e-commerce (Laney, 2001), smart city (Frith, 2016), political communication (Guo, Vargo, Pan, Ding, & Ishwar, 2016), and manufacturing policy and science (Niebel, Rasel, & Viete, 2019). Also, Big Data can critically create a virtual world that basically cannot be separated from aspects in the real world (Pickren, 2016), namely in aspects where the information provided by Big Data can affect social life, political, historical, and human geographies. For every sector such as business, government, politics, and economics, data is capital for making the right and valuable decisions (Sadowski, 2019).

On the other hand, before data can be commodified, data must be stored in a data centre or server. Data centres here act as physical infrastructure. While in the aspect of non-physical infrastructure, data is collected and stored in Big Data. From this point, the data will then be sorted, analyzed, and commodified. To be able to run well, the internet must be supported by adequate infrastructure, ranging from physical infrastructure such as fixed line (Sobolewski & Kopczewski, 2017), fiber optics (Deng & Cai, 2007; Warf, 2006; Xiong & Cai, 2012), undersea cable (Howe et al., 2019; Johannessen, Andreassen, & Moe, 2009), to the existence of data centres as data storage (Pickren, 2016). Non-physical infrastructure also play an important role in this regard, such as wireless network (Jaiswal, Kumar, & Kumari, 2014), satellite (Brown et al., 2000), computer software and Big Data (Dhaenens & Jourdan, 2019; Guo et al., 2016; Kitchin & McArdle, 2016; Niebel et al., 2019; Thatcher et al., 2016), Machine Learning, Artificial Intelligence and Internet of Things (Ben-Daya, Hassini, & Bahroun, 2019; Nolin & Olson, 2016; Shin & Park, 2017). With a strong and adequate digital infrastructure, data analysis and utilization (especially for the benefit of commodification) can be more quickly and easily to be done. Globalization, which is still often echoed in this era, requires the internet as one of the main media of affordability of information for all parties wherever and whenever (Sethi & Paramita, 2016).

This article tries to argue why digital infrastructure is very important for communication industry and technology. Besides, this article also tries to argue many common practices of Data Industrialization, which mean that every data like personal or private data (eg telephone number, name, email), internet data plan, digital data (in a form of a byte size), and data on the internet (eg pictures, photographs, multimedia content, news, computer games or applications) can be treated as a capital, a commodity, and can be produced, distributed, and used or re-used. On the other hand, I try to link the discussion with the concept of Big Data and analytical tools such as machine learning or artificial intelligence and datafication to better complement the discussion and its relation to commodification and digital infrastructures.

Literature review

Digital infrastructure

Digital infrastructure is an infrastructural support that is required to create the service, to create or source associated content supplied through the service, and to deliver the service over time (Preist, Schien, & Blevis, 2016). Digital infrastructure can consist of physical aspects such as cable infrastructure (fixed line, fibre optics, undersea cable, satellite), and data centre buildings as physical data storage, as well as non-physical elements such as wireless networks, computer software, Big Data, machine learning and artificial intelligence, and internet of things. All aspects must go well to support the running of industry and communication technology. Fixed broadband networks become an important infrastructure to ensure connections can run well wherever (Choi Sun, Wong Siew, Chang, & Park, 2016). Meanwhile, the growth of the fibre optic industry throughout the world has experienced a rapid increase and caused a large increase in transmission capacity, oversupply, and very cheap prices (Warf, 2006). Then, undersea cable network systems are expected to increase bandwidth capacity and reach a wider area when compared to traditional systems (Johannessen et al., 2009). Satellite communication systems can provide access and interconnection of voice, data and video services to users throughout the world, both on land, sea and air (Brown et al., 2000).

On the other hand, Big Data is an important aspect in technical communication because big data can connect many parties, platforms, and stakeholders, so the role of technical communication practices is needed for the success of big data projects (Frith, 2016). With Big Data analysis, each data can be processed, analyzed, and interconnected with other data. Thus, big data can be applied and utilized in various things, such as e-commerce (Laney, 2001), smart city (Frith, 2016), political communication (Guo et al., 2016), and manufacturing policy and science (Niebel et al., 2019). In addition, big data can critically create a virtual world that basically cannot be separated from aspects in the real world (Pickren, 2016), namely in aspects where the information provided by big data can affect social, political, historical, and social life human geographies. Finally, IoT allows people to connect at any time, anywhere, with anyone, using any network and services (Nolin & Olson, 2016). On the other hand, infrastructure is needed to support computing as normalization, materiality, and balance of power (Pickren, 2016).

The high need for information makes technology giant companies also allocate enormous investments in the development and development of digital infrastructure. With high financial capability, these companies strive to create and develop strong digital infrastructure so that it can be utilized for all needs, including anticipating future use. By mastering the digital infrastructure industry, it can be said indirectly that the companies also master data and information, as well as mastering the industry and communication technology. However, future use of digital infrastructure is not limited to physical aspects. Digital technologies have made possible a "platformization" of infrastructure and an "infrastructuralization" of platforms. And Google exemplifies features in both infrastructure and platform simultaneously (Plantin, Lagoze, Edwards, & Sandvig, 2018).

High demand for web applications, cloud application, IoT, Machine Learning and Big Data Services, and Mobile and IoT Services have helped change the business model of Amazon and Google on the web service platform they provide (Do, 2019; Tan, Fan, Ghoneim, Hossain, & Dustdar, 2016). Such business models provide opportunities for these companies to optimize their resources and large investments in the development of digital infrastructure to provide income on company profits. Another example is the business strategy implemented by broadband providers where they use the liquid pricing model in their data services to consumers (Bandyopadhyay & Cheng, 2006).

Nevertheless, digital infrastructure continues to develop over time. These developments will generally be followed by three things, adoption, innovation, and scaling (Henfridsson & Bygstad, 2013). To remain able to run normally and smoothly, digital infrastructure requires costs in terms of physical care, software maintenance, and capacity and capability enhancements (Timmes, Townsend, & Bildsten, 2020). It is also important to involve collaboration for national and international platforms for the planning, deployment, and management of digital infrastructure (Mahmud Khan, Chowdhury, Morris, & Deka, 2018). In other hand, policymakers must be able to make rules that foster a healthy investment to ensure that the pricing of services sold by providers to participants can also trigger the development of technology and the telecommunications industry, especially based on digital infrastructure (Woroch, 2000). By providing another option in the form of total privatization of digital infrastructure, it can be very beneficial not only for stakeholders but for the community as a whole (Mahmud Khan et al., 2018).

Big Data

Big Data is related to the concept of data management which has a large size (volume), speed (velocity), and diversity (variety) of a particular data (Laney, 2001). A series of data can be regarded as a Big Data if it meets seven criteria, namely volume, velocity, variety, exhaustivity, resolution, indexicality, relationality, extensionality, and scalability (Kitchin & McArdle, 2016). According to Kitchin & MacArdhle (2016), the quality of the velocity and exhaustivity of a dataset can determine a series of data can be called Big Data. Research conducted by Kitchin & McArdle on 26 datasets in the field of mobile communication, websites, social media/crowdsourcing, sensors, cameras/lasers, transaction process generated data, and the administration found the fact that most of the datasets did not meet those Big Data criteria.

One of the benefits of using Big Data is when a company can benefit in the form of increased analytical capabilities and product innovation (Niebel et al., 2019). Big Data Analysis is a relevant determinant for the possibility of a company becoming a product innovator as well as for the market success of an innovative product. However, the important thing to note is the harmony between the use of Big Data with the ability of information technology and computer companies in decision making. According to Frith (2016), to be able to properly analyze Big Data requires adequate technical communication skills. Human actors in this context are important to the success of meaning that can be obtained from the Big Data analysis in the view of Frith.

Commodification

Data commodification is a common practice in discussions about the digital era and the internet. The concept of commodification according to Crain (2016) is a dynamic process and contestation involving the actions of individuals, commer-

cial entities, and state actors. Commodification is always related to the aspects of power (power), capital, and the use of labour. These three things also occur in the context of the commodification of data on the internet. Commodification of users' data on the internet is an economic practice and the practice is discursive (Sevignani, 2013).

Meanwhile, the commodification of data on the internet is also supported by the existence of data brokerage practices (Crain, 2016). According to Crain, data brokers obtain data from two paths, namely by buying users' data from developers and web and application owners, and by exploring public information generated by the web or application. The daily life of the user can be easily marked by the application algorithm, then paving the way for the application to collect user data such as the last location, user name, contact number, friendship network, etc. which are subsequently processed and become bait for other parties such as advertisers to offer a product or service. According to Thatcher (2017), location features are formed at three poles, namely the storage of space and time as digital data objects manipulated by code, spatial and temporal immediacy, and the ability to add value or tell stories to end users and marketers. Thatcher also stated that location is a commodity. When the user is taking pictures at a favorite location, historical place, etc. then upload it on social media, then this is the commodification of memory. Location-based data is a valuable commodity, which can be traded (Drakopoulou, 2017).

Thatcher, O 'Sullivan, & Mahmoudi (2016), namely "data colonialism", which illustrates that in Big Data, information or data can be obtained by being "seized" from the user. This practice returns to the context that the daily life shared by users on the internet is a public commodity that should be private ownership but in practice it becomes "booty" for developers and application owners. Decisions about what data is meaningful (private time and place) have been commodified and privatized as new fields for investment and capital exchange (Thatcher et al., 2016). Asymmetrical power relations between individuals (who produce data) and those who have then benefit from Big Data.

Datafication

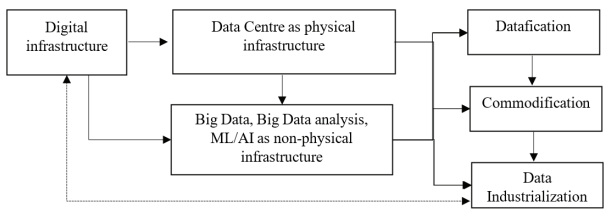
Datafication is a term where all aspects of human life can be presented in the form of digital data (Mejias & Couldry, 2019). Its also mean that data is the new transformation of human life. Data can be analyzed as capital or a political economics aspect to every party, especially to the business model, government, dan any social, political, and economical parties around the world (Sadowski, 2019). Data can be treated as commodities, and in the Internet era, every data is a digital commodity (Johanssen, 2019). Datafication process consists of at least two steps: data quantification and data generating process (Mejias & Couldry, 2019).

Datafication also means that we present our everyday life into data every time we spend, from the past to present (Mascheroni, 2018; Mejias & Couldry, 2019). To be meaningful, data must have a logical aspect, especially when the data is presented or interpreted. At this stage, we can consider that datafication is an information technology driven by sense-making process (Lycett, 2013). Data makes sense only insofar as we have a framework for understanding it, which means that data have narrative stories and we also tell a narration through data (Dourish & Gómez Cruz, 2018).

The data itself is the information infrastructure that exists in political, economic and social structures (Diab, 2017). After the analysis phase, the data can be traded as a commodity between the data broker and the information empire (Mai, 2016). This also means that in the context of developing technology and the political, economic, and social structures that exist, the data also contain asymmetrical power which will clearly lead to discrimination (Leurs & Shepherd, 2017).

Research Methodology

To elaborate on the link between datafication, commodification, and the role of digital infrastructure to those process, the authors used the method used systematic review and meta-analysis (Crowther et al., 2010). The data completed in this discussion are scientific articles collected which are supplemented by interviews with informants who feel they can elaborate or confirm concepts supported by the author. The stages invited by Crowther, Lim, & Crowther (2010) consist of approval of *clinical questions*, consultation of appropriate *search strategies* (via electronic databases, conference abstracts, handsearching, contacting investigators, or internet sources), *study selection* (with research design, language, date publication, and duplicate data), *assessing the quality of studies*, *data extraction*, *combining the data* (meta-analysis), and *making conclusions*.



Appendix 1: Conceptual Frameworks
Source: Author's data

Meanwhile, at the other stage, the authors conducted interviews with some resource persons, a programmer who worked in government agencies in one of the ministries in Indonesia, an official of digital infrastructure unit in one of the telecommunications SOEs in Indonesia, an editor in chief of one digital television in Indone-

sia, chief editor in a digital newspaper in Indonesia, and two internet data plan entrepreneurs. In the process of selecting interviewees and the interview process, the author uses an interview guide (Alshenqeeti, 2014), namely with steps in the form of *conducting interviews, analyzing interview data, and reporting interviews*.

Result and discussion

In the digital age and the internet, all data can basically have value depending on how the data is collected, processed, quantified, generated, and interpreted or presented. All data both personal data and public data on the internet can be analyzed, both manually and with the help of software (machine learning or artificial intelligence – ML/AI). Long before data can be processed, data in the form of a byte-sized digital is a measurement that usually involves many facets of everyday human life (Mascheroni, 2018), from past to the present times (Mejias & Couldry, 2019). In this perspective, we can say that human beings are as if they have nothing when humans surrender the sides of their lives to technology (McLuhan, 1964).

Data Industrialization

In this section, I argued that there are four types of data that can be produced, distributed, and consumed through digital technology and internet as appendix 3 as follow. Basically, every type of data can be produced, distributed, and consumed by everyone and every party that need those types of data.

Personal data

Along with the popularity of social media, the need for people to interact with family, friends, colleagues and other people is getting higher. Various social media platforms such as Facebook, Instagram, Twitter, Whatsapp, and YouTube are familiar with everyday life. The need and desire of people to always be connected to social media makes them voluntarily provide their data (including privacy data - full names, telephone numbers, addresses, etc.) to be accessed by their social media applications.

At the user stage of providing personal data, the privacy data production process has taken place. Then access the data by other parties (applications, developers, analysts, content providers and aggregators) is the process of data privacy distribution. Furthermore, the use of these data for commercial purposes, for example by advertisers, can indicate the process of consuming privacy data.

Internet data plan

Every data and information access on the internet require an internet data plan. Every time a user accesses social media reads news online or plays online games, each time the internet data quota is also used. Basically, the need for people to be always connected to the internet and social media is what makes the internet data quota industry grow. In Indonesia, various internet service providers and cellular operators compete with each other to sell internet services at competitive, cheapest, most complete data plan, networks quality, and so on as a way to attract consumers in all circles.

With the increasing dependency of people on internet access, it becomes a business opportunity for telecommunications entrepreneurs to provide large, fast, and quality infrastructure for their customers. However, the practice of providing internet data quotas also shows that the distribution of power is actually uneven (Pickren, 2016) because it is only controlled by investors. While on the other hand, consumers can only surrender to the choices available. In this perspective, internet data plan is also a commodity.

Data on the internet

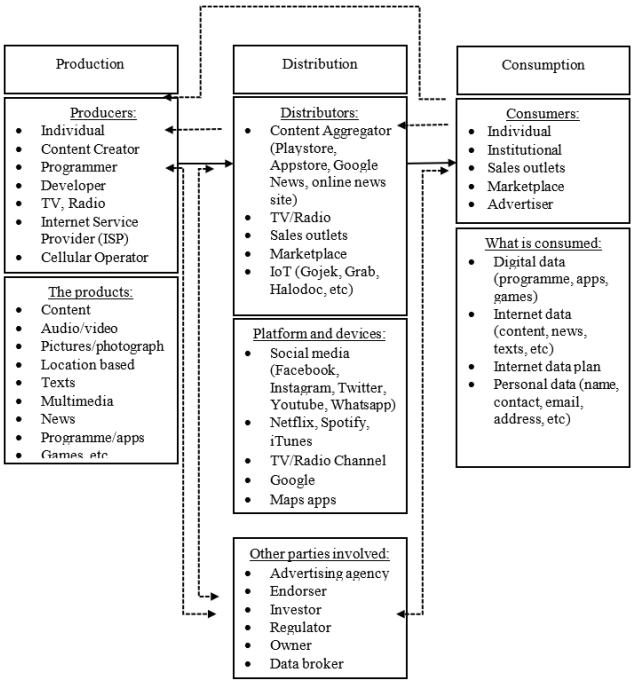
Digital technology is also closely related to the internet. For digital technology, the internet provides a relatively broad, fast, and easy way for digital data to be spread across many devices. The process of uploading, downloading, and installing applications on computers and mobile devices is a simple example of that proposition. Users can easily find various kinds of data and digital content in the form of music, videos, games, and so on through the internet. In the internet network, there are also data industry processes. For example, if the Youtube video link is shared by people and more and more fans are watching and liking the video, it means that producing, distributing, and consuming process occurs.

Digital data

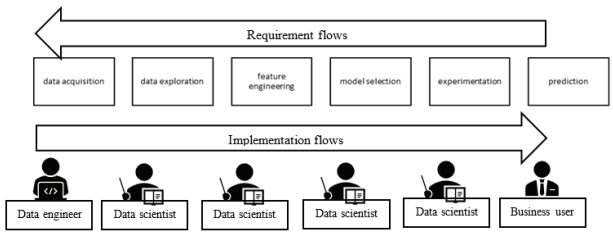
Digital data is a fundamental aspect of the development of industry and communication technology. Digital technology also provides a smaller but relatively more complete storage medium and without relatively large physical space. Data and information can be stored in virtual form, with smaller file sizes, and do not require relatively large physical storage space. The existence of the internet also allows the process of transmitting messages in a way and time that is much faster, effective and efficient. Digital technology has changed various technology platforms in various fields, such as manufacturing, engineering and telecommunications. In other words, digital technology has become the foundation for other technologies (McMullan, 2017).

Every data available on digital devices and the internet is the result of production. For example, when a programmer builds a program/computer application, there is an indirect production of digital data in the process. The results of programs/applications that are stored

in internal or external storage devices are also digital data. This data can then be reproduced, redistributed, and consumed continuously.



Appendix 3: Data Industrialization process
Source: author's data



Appendix 4: Data flow
Source: author's data

Linking Datafication, Commodification, and Digital Infrastructure

Big Data is an important aspect in technical communication, because Big Data can connect many parties, platforms and stakeholders, so the role of technical communication practices is needed for the success of the Big Data project (Frith, 2016). With Big Data analysis, each data can be processed, analyzed, and interconnected with other data. Thus, Big Data can be applied and utilized in various things, such as e-commerce (Laney, 2001), smart city (Frith, 2016), political communication (Guo et al., 2016), policy making and science (Niebel et al., 2019), and others. In addition, Big Data can critically create a virtual world that is basically inseparable from aspects in the real world (Pickren, 2016), namely in aspects where the information provided by Big Data can affect social, political, historical, social life, and human geographies.

On the other hand, Big Data also provides opportunities for Datafication. Datafication is a process in which something from human life is processed and presented in the form of "digital data" (Mejias & Couldry, 2019). This datafication process takes place on all sides of human life where "data" becomes capital, both from the political, economic, and social aspects (Sadowski, 2019), that happens in our everyday lifes (Mascheroni, 2018), from past to present time (Mejias & Couldry, 2019). Today's social world is shaped more by datafication, where every data of human life is transformed into metadata by digital communication technology devices (Breiter & Hepp, 2018). When personal data such as names, addresses, e-mails, contact numbers that we submit and agree to be accessed by our social media for example, then the data will enter into a Data Center/server as a large data set of all users, called Big Data. Big Data will not have any meaning as long as the vast amounts of data are only left as raw data.

Nevertheless, if the raw data available in Big Data can be accessed by the public, there tends to be information disclosure that can open the empowerment of public democracy (Baack, 2015). However, on the other hand there can be abuse on it for example by hackers who use it for personal gain or cyber crime. In addition, unequal access to Big Data also allows the emergence of a new digital divide (Boyd & Crawford, 2012). This digital divide can be in the form of an imbalance that is physical (does not have access to computers and other IT devices) or that is a skill necessary to be able to participate as a digital citizen (Ariyanti, 2016).

The data will only be valuable when it is processed, analyzed and interpreted, which can then become a digital commodity (Johanssen, 2019) – it means commodification. Businesses and government agencies have the power to explore and exploit the rapidly growing pile of metadata collected through social media and communication platforms, such as Facebook, Twitter, LinkedIn, Tumblr, iTunes, Skype, WhatsApp, YouTube, and free email services such as Gmail and Hotmail, to track information about human behavior (Van Dijck, 2014).

Datafication are occurs in many fields of study such as democracy, participation, and journalism (Baack, 2015), education, health, and agriculture (Kuch, Kearnes, & Gulson, 2020), learning and media technology (Knox, Williamson, & Bayne, 2020), and so on. In the journalism and digital media, Ardhi S., a Deputy Chief Editor of Detik.com said that:

> "In digital news media, data that can become datafication are UV traffic (unique visitors), PV (page views) and playtime (especially video). From the business side, people usually use impressions. This impression is usually used by advertisers. Another thing that can become datafication is the headline that is

> "played" so that it affects on the click bite and finally it can be monetized" (personal communication, May 21, 2020)

Meanwhile, in the digital TV station, data such as the number of viewers and showtimes which are then analyzed their performance every day. Niki CL., a Deputy Chief Editor of CNN Indonesia says:

> "About CNN Indonesia, we have IPTV data and FTA data, because there are our programs that air on Trans TV and Trans7. Talk about FTA data is relatively the same as the others because the data source is from Nielsen. The ones listed are of course share, rating, SES, and others. While data on IPTV is relatively general, about the number of viewers." (personal communication, May 23, 2020)

> Niki also says that analysis of program performance fluctuation (FTA) is the basis for determining the rundown. For example, which interesting content will be followed up the next day, while the less interesting ones are seen again, whether it is a theme that is less attractive or packaging (personal communication, May 23, 2020).

Again, the data itself is very important for every business, including digital TV station. In the digital TV industry, datafication and commodification practices are also used to hook potential customers such as public policymakers, both individuals and institutions, and other middle-class targeted clients. Niki says:

> "The basic capital of our sales is data. It seems the awareness of this data is evenly distributed both in us as producers and in agencies or brands or institutions as clients. The data that we have will be explained according to the market needs of the client. For example, our IPTV data shows that CNN Indonesia is monitored by a decision-maker. Thus, our potential clients are clients with an interest in decision-makers, for example, public policy makers, both individuals and institutions. While our FTA data shows that our audience mostly comes from middle-up, then the targeted clients who have middle-up products such as electronic goods, namely mobile phones, laptops or tourist trips." (Niki C.L., Deputy Chief Editor of CNN Indonesia, personal communication, May 23, 2020)

Meanwhile, for state-owned telecommunications companies such as PT TELKOM, data such as user behaviour (which can be used to provide a better user experience), the performance of production equipment (which can be used as an improvement in the quality of production equipment), and the needs and desires and preferences of users (which can be used as new product development) are some of the things that become datafication. Furthermore, commodification that occurs for example when a user is accustomed to using TV channel, then the user's habits will be studied and analyzed by a machine which will then appear on the user's device as a channel recommendation or suggestion (Brian P., digital infrastructure official in PT TELKOM, personal communication, May 21, 2020).

From some of the responses above it can be concluded that the data about everyday human life can be very useful for the communication industry players to analyze and then generate the needs of consumers or potential target consumers. It means that every side of human daily life is always can be digital data or metadata. When digital data appear through the process of datafication, the commodification can also appear too.

Next, I consider that digital infrastructure as a backbone to communication industry and technology (even physical eg DC or non-physical eg Big Data, ML/AI). Without network support, DC, Big Data, ML/AI that are qualified, the process of datafication, commodification, and industrialization can be hampered, because the infrastructure support for the running of ICT and the internet is very high. All can be connected via the internet if there is an adequate network, be it wired or wireless. DC is also important as a data storage medium that must also exist physically. Even cloud computing still needs DC/server to run well. Every IoT require DC too. The processing and analysis of Big Data are actually on the DC/server. Data Center and Big Data, in this case, is a unity of physical and non-physical digital infrastructure. As stated by a programmer as follows:

> "Data Centre (DC) or a server has a role as physical infrastructure, otherwise the Big Data and the tools like softwares, ML/AI, modules, programmes, is a non-physical infrastructure that exist in this digital and internet era" (Fridey A.A., a ministry programmer, personal communication, May 21, 2020)

The same thing was stated by Brian P., a digital infrastructure unit official in PT TELKOM as follows:

> "DC and its internal components (power, network, server, security, equipment, etc.) as physical enablers, while data related supporting components (stack technology, human resources/digital talent, platforms, etc.) as digital enablers" (personal communication, May 21, 2020)

On the other hand, datafication is also closely related to commodification. For example, raw data is transmitted using the flow here (with

- Social me
- Netflix, S

all the processes and roles needed to do that) so there is the potential economic value that can be generated. As Brian says:

> "Because in the end, only Big Data is not enough (need ML, AI, etc.) so that it can automatically add value to the company." (personal communication, May 21, 2020)

In addition, the DC/server itself is can be enabled to gain profit for the company itself. Brian also says that:

> "Initially Amazon needed a lot of servers to deliver e-commerce services. That's why they invest heavily in infrastructure (data centers and servers). Uh, obviously they are excess capacity, aka many servers who are unemployed because they use Amazon e-commerce only in part. The rest, they sell as cloud services, under the name AWS (Amazon web service). (personal communication, May 6, 2020)

Nevertheless, Brian (personal communication, May 6, 2020) also says that AWS was also responsible for 13 percent of Amazon's overall revenue of $ 70 billion in the quarter, and it is still growing faster than the company as a whole. Some cloud services players provide services such as IaaS (infrastructure as a service), for example, rent a Virtual Machine. If an outside player, has only PaaS (platform as a service) service until SaaS (Software as a service) even XaaS. The X here means anything as a service. He also says:

> "However, owning DC itself will not make us a customer, because it also depends on the service we provide whether it responds to customer needs. FYI, AWS has almost 300 services. even has a Ground Station service as an alias service for managing satellites. So, satellites don't have to build earth stations, because AWS can already provide applications for it." (personal communication, May 21, 2020)

That means that in the industry and communications technology, digital infrastructure plays a very important role in many things, including in the acquisition of corporate profits from the commodification of DC as physical infrastructure leased to other parties.

Meanwhile, other opportunities that have emerged in the Big Data era include statisticians, data engineers, data scientists, data modellers, etc. The role of work in the digital world is increasingly diverse because of the need for increasingly stringent data processing. Again, the economic value of data is not just the data itself, but from the industry that is growing around data processing (Brian P., personal communication, May 21, 2020). Thus, there are opportunities to establish data analytic companies, new digital competencies, the types of work related to data analysis, etc. For example, in Indonesia until 2019, there are at least 11 start-up companies based on artificial intelligence, such as Snapcart, Kata.ai, Nodeflux, Databot, Delligence.ai, etc. which also provide services to other business agencies (convergencevc.com, 2019).

The vital role of digital infrastructure also occurs in smart cities consepts. Smart cities are increasingly connecting the ICT infrastructure, the physical infrastructure, the social infrastructure, and the economic infrastructure to leverage their collective intelligence, thereby striving to render themselves more sustainable, efficient, functional, resilient, livable, and equitable (Bibri, 2019). By designing smart and playful and interactive art city, then actually a city has been hacked. It can be likened that in this surveillance era, there is no freedom for people to move because basically all data has been stored in DC or Big Data (de Lange, Synnes, & Leindecker, 2019). Before becoming "smart", a city must have a digital infrastructure that is not just based on sophisticated technology but also has reliable analytical tools. The results of the analysis and prediction must be precise so that the policies taken can provide significant results in many ways (Kuch et al., 2020), and this can be helped by the presence of a reliable digital infrastructure both in physical (ie DC/server) and non-physical aspects (ie Big Data, ML/AI, etc.).

Conclusions

McLuhan (1964) states that when we surrender our senses to technology we seem to have nothing more to have, because everything becomes so dependent on technology that it reduces the human sense itself. To make a data have value and meaning, a process such as datafication is needed, wherein a matter about human daily life can be quantified and presented in the form of "digital data" which can then be commodified or have added value. Datafication is a major social phenomenon that has many effects, including how people experience and assume that data in their daily lives is very important (Kennedy, 2018). Datafication is also related to commodification, in terms that our everyday life has been stored in DC and Big Data, then analyzed, that later used by any party or agencies so they can suggest something to our social media for example.

On the other hand, to make an analysis of data valid and reliable it also requires adequate digital infrastructure. Then the role of DC/server as physical infrastructure and Big Data, ML / AI, etc. as non-physical infrastructure is very important for that. In addition, when digital infrastructure has a central role in the development of communication technology and other human technologies in the digital era and the internet, it cannot be denied that digital infrastructure also plays a role in shaping the economic, political, and social structure of society, especially in

the internet era. The massive use of social media by users can be an example of how the virtual world is developing rapidly in shaping the new public sphere. Much research has discussed privacy and security violations on the internet and states that datafication is also related to these violations, discrimination, and power imbalances in the economic, political, and social structure of society, however, the important role of digital infrastructure seems to be neglected.

This article tries to argues that we cannot deny the important role of the digital infrastructure, both in its physical and non-physical elements. The speed of internet access and the development of technology supported by cable and wireless infrastructure, for example, do not necessarily make a "data" have value and meaning so that raw data can be processed, sorted, analyzed, and interpreted to further become a digital commodity. So, the role of digital infrastructure is very important to form one of the terminologies of Data Industrialization. A digital data which then becomes digital commodity is certainly through the process of Data Industrialization, where data is produced, transmitted/distributed, and consumed/used by many parties. In fact, DC itself can be used as capital to look for corporate profits by hiring cloud-based services for example. This means that DC can undergo a process / is used for commodification.

However, the relationship between digital infrastructure, datafication, and commodification in this article are not yet comprehensive. Further research can be done on examples, contexts and various concepts that have not been discussed in this article such as the sovereignty and freedom of the internet and the problem of violations of security and privacy on the internet. Further research can also be carried out, for example, on the role of physical and/or non-physical aspects of digital infrastructure in more detail and details.

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