Recognition and Evaluation of Data as Intangible Assets

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Abstract

Internet-based companies such as Amazon, Facebook, and Tencent hold an enormous amount of consumer data that are utilized to create business value via big data analytics. Although some companies use big data to provide professional services, such as targeted advertising and product recommendations, according to the current CAS, IFRS, and U.S. GAAP accounting standards, these assets are not recognized as assets since they are generated internally. This paper starts with a discussion of how Amazon, Facebook, Tencent, and Walmart use big data to create value for their businesses and then argues why it makes sense to recognize big data as intangible assets. Possible methods of data asset evaluation and their implications for business managers are also explored.

Keywords
digital economy, data asset evaluation, big data analytics, innovation studies

Recent technological advancements have significantly eased the technical and resource obstacles preventing large-scale data collection and storage, thus enabling companies to take advantage of data assets. The adoption of data analytics by companies may lead to improved decision-making, optimized results, and thus increased business value (Janssen et al., 2017; Mariani & Wamba, 2020). The previous literature has revealed that companies’ data analytics capabilities have both direct and indirect impacts on firm performance, as demonstrated in different countries such as China (Wamba et al., 2017) and Europe (Côrte-Real et al., 2017). In addition, the data possessed by a firm can be the key to driving an acquisition deal. For example, Facebook has improved its targeted marketing capabilities and revenues by acquiring Instagram and obtaining Instagram’s consumer data (VIBE, 2012). Facebook has also significantly enlarged its user base by acquiring Spotify and using Spotify’s user data (Li, 2011). Data, therefore, can comprise assets that are valuable and tradable in the market.

Although data can be important assets for generating firms’ future income, they have not yet been recognized as assets in the statement of financial position according to the current accounting practices. However, the objective of accounting reporting is to “provide financial information about the reporting entity that is useful to present and potential equity investors, lenders, and other creditors in making decisions about providing resources to the entity” (Kieso et al., 2014). To achieve such an objective, researchers and practitioners may need to reexamine the current accounting practices concerning data and reconsider how data should be recognized in financial statements. Academic conversations on this issue have actually emerged (Boehrs, 2021).

In this perspective paper, our first objective is to analyze the nature of data and how they can be used to create value for companies. We use several firm examples to show the business value of data as assets. The second objective of this paper is to investigate when data should be recognized as assets in the statement of financial position based on accounting principles. We examine China Accounting Standards (CAS), International Financial Reporting Standards (IFRS), and U.S. Generally Accepted Accounting Principles (GAAP), regarding how to define and determine intangible assets, and try to identify conditions for including data assets as intangible assets in financial reports. We also explore whether the recognition of data as assets is consistent with the two fundamental objectives of accounting, namely, relevance and faithful representation. The third objective of the paper is to propose potential methods for measuring and recording data

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assets in financial statements. Specifically, we draw on the literature on intangible assets to apply three main approaches to intangible asset evaluation to data assets: the cost, net present value of the predicted benefit, and market value methods (Garanina et al., 2021).

Overall, this paper makes the following three major contributions. First, it provides a comprehensive review of the current business practice of extracting value from data analytics. This can help advance the scholarly understanding of the asset nature of data. Second, this paper contributes to the conversation on whether and when data should be recognized as assets in financial statements (Boehms, 2021). We identify conditions under which data should be recognized as intangible assets in the statement of financial position. Specifically, we argue that if the possibility of economic benefit inflow for the data is higher than 50% and reliable estimation of how much it costs to collect the data can be obtained, then we should consider incorporating the data as an intangible asset item. Third, we contribute to the financial reporting literature by examining how to value data assets using different approaches based on different inherent data characteristics. If data should be recognized as assets, then how to evaluate their value accurately and reliably would be an important topic both theoretically and practically.

The rest of this paper develops as follows. Section 2 reviews the current research on data assets via three perspectives, namely, data analytics and big data, the benefits of data analytics, and the collection and evaluation of data assets. Business examples are utilized to illustrate how data assets contribute to business operations and value in Section 3. Section 4 reviews the current accounting standards to discuss why data assets should be recognized as intangible assets and how to do so. Section 5 discusses different data asset evaluation approaches based on inherent data asset characteristics. Section 6 provides suggestions for business managers regarding how to better use and manage data assets, and Section 7 concludes this paper.

**Literature Review**

Previous literature has identified the substantial value of some examples of intangible items, such as research and development (R&D) expenditure, intellectual property rights, and goodwill (see, e.g., Barth & Clinch, 1998; Lev & Sougiannis, 1996; Wyatt, 2008). Regardless of the difficulties in recognizing the value of intangible assets, there is evidence that the stock market is able to recognize the value of intangible assets (Dedman et al., 2009). Big data asset and its reporting issues appear to be important research areas (Cockcroft & Russell, 2018; Walker, 2009).

**Data Analytics and Big Data**

Data analytics is not a new phenomenon; companies have always used available data to understand their consumers. However, recent technological advances in data collection and storage have allowed companies to conduct data analytics on an unprecedented scale, hence the widely used term “big data” (Novikov, 2020). The idea of “big data” was first introduced by Viktor and Kenneth (2013) following an explosive increase in data volume and advanced data analytics techniques. In 2012, The World Economic Forum (2012) published a white paper titled “Big Data, Big Impact,” arguing that data is a new form of an economic asset with long-lasting impact, like petrol and gold (The World Economic Forum, 2012). In China, President Xi emphasized that big data development has become a key economic development strategy and that it is essential to design a system that clarifies the ownership and trading of data (State Council of the People’s Republic of China, 2015).

There are two key components of big data. One component is the ownership and control of large and complicated datasets, namely, “data assets.” Data assets are intangible and nonmonetary resources, and their enormous size requires superior processing power. The second component is the approach or algorithm used to process and analyze such a large dataset, involving actions including capture, storage, analysis, searching, sharing, transferring, visualizing, updating, and protecting. The approach or algorithm chosen allows data users to predict consumer behavior of significant economic value. This paper focuses on how to evaluate these two big data components.

**Practice of Data Analytics and Its Associated Benefits**

As a result of today’s digital data exchange format, it is now possible to construct business databases and information systems that consist of corporate transaction data for business analytics (Novikov, 2020). Most experts agree that over 90% of all data in the world have been created in the past few years (SINTEF, 2013). As a result, data-driven business intelligence and data analytics appear in many key and advanced areas, such as e-commerce, marketing, e-government, public health, and public safety, imposing significant impacts on social goods (H. C. Chen et al., 2012). An increasing number of new enterprises in the private sector base their business models on the use of data (Hartmann et al., 2016), such as the strategic implementation of big data thinking (Xu et al., 2016).

The benefits of data analytics are observable in at least two dimensions, including at the corporate and industry levels. For example, corporate-level analysis uses data analytics to explore the factors that explain different growth rates between companies, such as geography, the level of corporate investment, and skill acquisition channels (Tambe, 2016). Companies further benefit from the application of data analytics to consumer management, supply chain management, pricing strategies, and marketing effects (Feng et al., 2013). Moreover, companies can analyze consumer data such as their purchase feedback and comments to develop new products and innovations. Some companies, such as Amazon and IBM, also analyze employee data and predict employee turnover and employee potential growth.
Table 1. Common Methods to Obtain Data.

| Company type               | Company example       | Ways to obtain data (example)                                                                 |
|----------------------------|-----------------------|-----------------------------------------------------------------------------------------------|
| Internet search company    | Google, Baidu         | Search history and browsing history                                                             |
| Online shopping platform   | Amazon, Taobao        | Search history, browsing history, shopping records, return/refund records, and use of coupons  |
| Social network platform    | Facebook, Tencent, Instagram | Posting information on personal pages (personal characteristics, e.g., company worked for, liked pages, friends, and geographical location service) and data integration across platforms |

Data analytics can also be applied to an entire industry, which contributes to an increased understanding of industrial development trends and promising areas of increased profit. Companies that master such information gain an advantage when facing industrial changes. For example, the banking industry can collect and share various information about customers’ daily lives and develop a credit rating system that can reduce the risks involved in lending. The insurance industry can also develop personalized pricing and calculate personal risk more accurately by analyzing customer data. Furthermore, the healthcare industry can rely on big data and artificial intelligence (AI) to build an operating system that can efficiently allocate resources by matching patients with hospitals.

Collection of Data Assets

The collection of data is a prerequisite for performing data analytics. Depending on the type of business activity, companies have different ways of obtaining data, such as search records, browsing history, purchase history, corporate mergers and acquisitions (M&As), data purchases, and cloud services. Table 1 presents the common methods used by several significant Internet companies to obtain data.

In addition to obtaining data through existing business activities, companies can obtain data through M&As, where companies have access to or trade data directly, which has become increasingly popular in recent years. For example, Facebook purchased the photo-sharing service Instagram that includes an enormous amount of consumer data, which now contributes substantially to Facebook’s advertising income (VIBE, 2012). The purchase of LinkedIn by Microsoft is the largest M&A in the history of Microsoft. In this case, LinkedIn possesses a large amount of social network data that have significant business value (Big Data Observation, 2016).

Governments have begun to take actions to promote data asset trading as a legitimate business activity. For example, the Chinese government set up the first big data trading exchange in the world on 14th April 2015, followed by the establishment of the Shanghai Big Data Exchange Centre (managed by the Shanghai Economy and Information Technology Committee) on 1st April 2016. In addition, the Chinese Ministry of Industry and Information Technology (2017) published a white paper titled “Big Data Industry Development Plan (2016-2010),” with the aim of guiding the further development of the data industry ecosystem.

Data Asset Evaluation

Due to the inherent characteristics of intangibility (difficult to identify), exchangeability (which can benefit both parties), and variability (value changes with time, market conditions, and use conditions), data can be categorized as an intangible asset (X. Y. Li, 2016). It is important to note that since data record historical events, the more recent the data are, the higher their value for the present decision-making. In other words, the prediction accuracy of (historical) data is likely to diminish with time. Of course, the pace of such value decline is influenced by various factors, including data type and the stability of external environments. For example, customer data that can be used to analyze customer personalities tend to be persistently valuable as customer personalities change slowly. Similarly, if the technology in an industry changes slowly, then the value of the data on customer purchases and preferences can last longer.

In addition, unlike, for example, weather data, access to corporate data is not free of charge; it usually involves transfer, exchange, and trading (Abbasi et al., 2016). At this stage, we acknowledge that many potential and/or essential intangible assets are difficult to identify and measure, especially those with uncertain future economic benefit inflows. Therefore, when we develop an evaluation approach for corporate intangible assets, we also need to consider how intangible assets affect corporate value by breaking down the information barrier between data scientists and investors (X. Y. Li, 2016).

The previous literature has investigated data asset evaluation, including building a three-layer value model for measuring how user evaluation data can contribute to useful business analytics (Loukis et al., 2012), conceptual models (Shi et al., 2017), and algorithms (Wang, 2016), as well as evaluating data based on the data obtainment methods used (Zou, 2017). In recognition of the continuous adoption of IT technology and the gradual development of web analytics service (WAS) providers, Loukis et al. (2012) developed a value model to measure resources and capabilities that can be provided by WAS providers. With a case study of
Creating Business Value From Data Assets

Data collection without further analysis produces only many meaningless numbers. Therefore, the construction of a valid data model and an analytical system is essential prior to data processing and analysis. The capability to discover the inherent business value in big data has become an essential component of the big data industry (Janssen et al., 2017). This paper reviews internet materials and uses Amazon, Facebook, Tencent, and Walmart as examples to illustrate how business value can be created from data assets. These companies identify and extract business value from data assets in a variety of ways. Some choose to collect and analyze their own consumer data, while others partner with (or acquire) firms with significant data assets. Data assets are primarily used to create value via targeted advertising and marketing, the improvement of product and service design, and client management; however, novel applications are beginning to emerge.

Targeted Advertising and Marketing

A key method for extracting value is to leverage data assets to sell more products (Birch et al., 2021). Amazon, as America’s largest e-commerce company, collects its own user data using a personalized system that tracks users’ browsing history and purchase records (CTOCIO, 2012). These data assets are used to build clustered consumer models (Contemporary Logistic, 2018) and produce “item-to-item” collaborative filtering technology to construct a personalized recommendation system. Targeted advertising and marketing in this manner are estimated to increase Amazon’s profit margins by 10% to 30% (MacKenzie et al., 2013). Moreover, Walmart primarily relies on self-collected data assets derived from consumer purchase history and preferences (both offline and online). After the creation of Walmart’s Data Lab in 2011, increases of 2.8 and 2.3 billion in online income were reported in 2012 and 2013, which were 3.5 and 2.875 times greater, respectively, than the reported online income (8 billion) in 2010 (Leber, 2012).

Distinct from Amazon and Walmart, social media platforms such as Facebook and Tencent have access to diverse, self-collected, multidimensional user datasets, including photos, videos, and status updates. Facebook’s acquisition of the photosharing service provider Instagram has vastly increased its available data assets. In the 1.5 years after the acquisition, the user base of Instagram reached five times (150 million) more than that before the acquisition (30 million; Lieyun, 2013). The popularity of Facebook and Tencent on mobile platforms also means that geographical user data can be further leveraged (Miller, 2017), which enables social media platforms such as Facebook and Tencent to analyze users’ personalities, including their sexual preference, life satisfaction, intellectual quality, emotional stability, religion, intake of alcohol and medications, marital status, age, gender, race, and political viewpoint (H. F. Li, 2016; Miller, 2017). Marketers can target users based on a variety of variables, including their location, age, gender, language, interests, behaviors (purchase behavior and intention), and connections (followers or not connected). Advertising revenue accounted for 98%, 97%, and 95% of Facebook’s total revenue in 2017 (Peterson, 2018), 2016, and 2015, respectively (Facebook Inc., 2018). Moreover, the company’s total revenue in 2017 increased by $13.02 billion, or 47%, compared to 2016, primarily due to an increase in advertising revenue (Facebook Inc., 2018).
Facebook’s use of user data to create value in the wake of the Cambridge Analytica scandal has triggered privacy concerns about data assets around the world. In March 2018, it was revealed that over 50 million Facebook users’ profile data were leaked to Cambridge Analytica, a data analytics firm. This data leakage was used to send 2016 U.S. presidential election campaign materials to targeted audiences, which affected the election results to some (as yet unascertained) degree (Whittaker, 2018). Following this scandal, the Facebook stock price dropped more than 7%, for a loss of 42 billion U.S. dollars (Kozlowska, 2018). As pointed out by Zuckerberg (2018), in his written testimony at the hearing before the U.S. House of Representatives Committee on Energy and Commerce on 11th April 2018, protecting data and making sure data are used for good are essential tasks. While Facebook guarantees that it will share and sell only anonymous data to marketing clients when users allow it to do so, many users have complained about confusing privacy settings on Facebook (H. F. Li, 2016). To balance the needs of marketing practitioners and users’ privacy concerns, the company introduced the use of “topical data,” wherein it primarily utilizes and on-sells data relating to users’ consumption patterns, including their brand perception, response to events, and activities, as well as various other topics.

**Improvement of Product and Service Design**

Data assets can be leveraged to improve product pricing and logistics management (Birch et al., 2021). Amazon maintains ideal inventory levels and goods delivery systems using consumers’ data (Big Data Analytic, 2015: Contemporary Logistic, 2018). Amazon and Walmart also collect information from social media to understand development trends, thus enabling rapid inventory adjustment to accommodate consumers’ needs and boost sales revenue (iDoNews, 2014). Moreover, Walmart utilizes AI to select products on sale and design promotion techniques based on store location (Yang, 2018). Recently, Walmart has incorporated blockchain technology to improve food safety, recording transaction details in its system (such as meat quarantine certificates), to track the entire production and retail cycle of the foods it offers (Pan, 2018).

Social media platforms such as Facebook and Tencent are able to grow and evolve based on data analyses of their vast data assets, facilitating the rapid improvement in the quality and reach of their services. For example, from 2011, Facebook encouraged users to share their music preferences via a “Spotify” add-on, facilitating the creation of targeted, popular music playlists, which allowed Facebook users to stay on Facebook longer and contribute multidimensional user information, which would eventually be converted into more advertising income for Facebook (Ding, 2011). Facebook’s acquisition of Instagram has amplified the reach of the company in terms of user network connections and new types of data, such as real-time geographical location services. Tencent’s instant messaging applications, WeChat and QQ, serve as base platforms for a wide range of services, including music, email, video surfing, and online shopping (Eddie, 2017; Sohu, 2016), facilitating rapid design and service improvement based on users’ experience.

**Client Management**

Based on their self-collected data assets, Amazon provides additional services to third-party websites to improve its advertising efficiency (Zhen, 2013). Moreover, Amazon utilizes a Demand Side Platform (DSP), where advertising agents can bid on Amazon’s online advertising space. This service helps advertising clients target consumers more efficiently and means that consumers are more likely to view advertisements related to their preferred products. In China, Walmart has established a strong collaboration with Tencent, leveraging its geographical location services and data assets to send WeChat messages to consumers as they arrive at Walmart stores (Yang, 2018).

Facebook not only records users’ historical behavior on Facebook (links and liked pages published by users in addition to mouse click patterns and cursor time in particular areas of the webpage), but also applies cookie technology to track users’ browsing history if they open other webpages while keeping their Facebook page open (Rangaiah, 2021), thus generating significant user data regarding third-party websites. As revealed by the Cambridge Analytica scandal, Facebook may have shared a range of its data assets with third-party companies for data consulting, mining, and brokerage purposes, thus benefiting client companies around the world.

**Novel Applications**

Key novel applications of data assets are observable primarily in China, where online payment platforms and social media have achieved a synergy that has yet to be surpassed in the West. For example, Alipay is a popular mobile payment platform in China that was developed specifically to facilitate transactions on Taobao, an online retailer in Ant Group. Now Alipay covers many different types of transactions in consumers’ daily lives, including when, what, and how they spend their money. These data are essential for credit providers to assess borrowers’ (consumers’) payment ability. Alipay also provides diversified financial services such as insurance, lending, and fund investment. More recently, Tiktok in China started its delivery promotion service, pushing delivery service associated video to viewers according to their viewing preference. This is on top of the existing algorithm that pushes shopping items to viewers.

In addition, Tencent has been able to create significant revenue and detailed data assets via its gaming service. According to a survey conducted by Sensor Tower, the multiplayer online battle arena (MOBA) game “King of Glory,”
developed by Tencent, is the most downloaded application both in China and around the world, exceeding WeChat and Taobao. According to Tencent’s Q1 report in 2017 (Tencent, 2018), Internet gaming, including the success of “King of Glory,” contributed 22.811 billion Yuan, representing a 24% growth (TMTPost, 2017). In addition to revenue, this gaming service is a means of obtaining a vast amount of user data; for instance, personality characteristics can be inferred by character selection and payment for enhanced in-game abilities (Wang, 2018).

Tencent also maintains other big data and machine learning applications in the field of corporate/individual financial fraud discovery (Yin, 2018), as well as the identification of job candidates’ stability based on a collection and analysis of existing and historical employee characteristics (M. Y. Li, 2016). Following a collaboration with the local government to create a “smart city,” Tencent has further expanded its analytical scope into urban and rural planning. For example, Tencent now undertakes city population structure analysis to assist with improved city planning and the utilization of resources (Xinjiang Net, 2018).

Comparison Between U.S. and Chinese Companies

As discussed above, data analytics can be valuable for firms by improving their competitive advantage in many areas. We observe that many U.S. companies have used data analytic, particularly for improving marketing capabilities in their primary businesses (e.g., targeted advertising and client management). They may also sell data to third-party firms for direct income or acquire other companies to obtain data that can be leveraged in their primary businesses (e.g., Facebook acquiring Instagram). Sufficient and comprehensive personal data covering multiple dimensions allows more accurate targeted advertising, which can be dangerous if it is used in the wrong setting, such as democratic voting. Considering the financial service is China still has large rooms of improvement, Chinese private technology firms are able to significantly improve the financial service based on highly efficient data analytic, such as Alipay and WeChat Pay. In contrast, Considering the strong benefits and interest protection of credit providers, technology firms in the U.S. are comparatively less interested (or active) in providing financial service, due to strong benefits and interest protection of credit providers.

Data as Intangible Assets

Definition and Recognition of Intangible Assets

To determine if data constitutes intangible assets, it is necessary to review the various accounting standards (Barker et al., 2021). This paper argues that CAS, IFRS, and U.S. GAAP constitute the three major accounting standards in the world since China and the U.S. are the top two economic entities globally, and IFRS has been widely adopted in many European and other countries. More importantly, these standards have only minor differences in terms of the definitions and recognition of intangible assets (Garanina et al., 2021).

According to International Accounting Standard (IAS) 38.8, published by IFRS, intangible assets are identifiable nonmonetary assets without physical substance, which require three critical attributes: indefinability, control (the power to obtain benefits from these assets), and future economic benefits (such as revenue or reduced future costs). The U.S. GAAP requirement is similar to IFRS, wherein intangible assets are assets without physical substance (except financial assets).

In CAS, intangible assets are nonmonetary long-term assets without physical substance and are used for product production and service provision (among other uses). Intangible assets can be differentiated into identifiable and unidentifiable assets. Identifiable intangible assets include (non)patent technology, trademarks, copyrights, land use, and franchises, while unidentifiable intangible assets comprise goodwill.

Data are usually stored in servers, USB drives, discs, etc., which can be accessed only through hardware equipment such as a computer. Therefore, data adhere to the requirement of intangibility, as they are without physical substance. Although data cannot be separated from their storage device, because it is easy to evaluate a storage device, data can be counted as separable and identifiable. Therefore, data are “intangible” and “identifiable.”

Recent developments in big data and data analytics have also introduced heated debates about data privacy. We argue that there are at least three different types of user-generated information collected by internet companies: personal private information (name, user alias, mobile phone number, password, gender, IP address, etc.), user-generated information by using such an internet service (chat history, purchase history, search history, etc.), and anonymous information (all information following the data desensitization procedure; that is, users’ credentials cannot be identified). Taking WeChat, the most popular social media (instant communication platform) in China, as an example, according to the document titled “WeChat Privacy Protection Summary” released by WeChat (2019),

In the event of an internal restructuring of our or our affiliates businesses, or the sale of WeChat or any of its assets to a third party, the entity that consequently operates WeChat may be a different entity to us and we will transfer your information accordingly so that your service can continue.

Regarding the sharing of users’ information with other third-party service providers, WeChat also stated that it would share users’ information with “service providers supplying services to support, improve, or advertise through our
services.” In the public document titled “About Our Advertising” prepared by Tencent Privacy (2019), the company that develops and operates WeChat, Tencent states, “To serve you with more relevant and useful ads, we will personalize ads that you may receive based on your previous use of our services.” These statements from WeChat and Tencent reveal that internet companies maintain control of user information to some degree and are able to share such information with other third-party service providers for future economic benefit inflows, such as targeted advertising.

Another criterion is related to recognition, namely, the probability of economic benefit inflows and the reliable measures of these estimates. All three accounting standards (CAS, IFRS, and U.S. GAAP) set out probability criteria for determining whether or not economic benefit inflows following the occurrence of contingency items should be recorded, and they list similar criteria under the “contingency” section. This paper uses “CAS 13 – Contingency” as an example, which states the criteria (the probability, \( X \)) of recording economic benefit inflows following the occurrence of a contingency item as follows:

1. “almost certainly”: \( 95\% < X < 100\% \);
2. “more likely than not”: \( 50\% < X < 95\% \);
3. “possibly”: \( 5\% < X < 50\% \); and
4. “unlikely”: \( 0\% < X < 5\% \).

For an intangible asset to be recognized as a “contingent asset,” the probability needs to exceed 50%. In reality, the probability of economic benefit inflows into a company depends on professional judgement, including the types, size, information volume, and methods of big data collection. Therefore, this paper argues that with sufficient supporting evidence, the probability of economic benefit inflows into companies must exceed 50% to adhere to the requirements to be a “contingent asset.”

A further requirement for recognizing intangible assets is that their cost can be reliably estimated (Barker et al., 2021). Considering data as intangible assets, the associated costs involve data collection, cleaning, analysis, etc. This paper further argues that this criterion should also be met (as discussed in Section 5).

Objectives and Elements of Financial Reporting

The objective of accounting is to “provide financial information about the reporting entity that is useful to present and potential equity investors, lenders, and other creditors in making decisions about providing resources to the entity” (Kieso et al., 2014). Relevance and faithful representation are two fundamental qualities of accounting objectives (Kieso et al., 2014). Relevance requires that accounting information be relevant to the economic decisions made by financial report users. For internal corporate management, data contribute to corporate decision-making and increased operational efficiency. External investors use big data to understand the corporate value and future corporate development. As previously discussed, big data present an opportunity for a company to create business value, such as personalized business product recommendations, targeted advertising, and reductions in operating costs. If a company chooses not to report its data assets, then the effectiveness of financial report users’ decisions may be reduced. Therefore, the recognition of data as an intangible asset is both relevant and necessary.

Faithful representation means that the numbers and descriptions in the financial report match what truly existed or happened and requires a company to be cautious and consider potential risk and loss. Therefore, a company needs to fully consider the true value of the data and whether they adhere to the criteria of intangible assets before recording the values in its financial report.

Timeliness is also essential for data assets, as outdated information is quickly rendered useless in this fast-paced technological era. In the accounting arena, timeliness requires a company to make suitable disclosures of transactions or items without undue delay. Untimely disclosure severely damages the potential utility of data for users. Therefore, incorporating data assets into financial reports is likely to improve the timeliness of the reported accounting information. At the same time, corporate managers need to ensure that information regarding data assets is rapidly updated to satisfy the “faithful representation” requirement.

The above discussions show that the recognition of data as an intangible asset does indeed adhere to the definition of intangible assets as well as the fundamental qualities of accounting objectives.

Differences Between Patent Technology and Data Assets

There is extensive literature regarding the value of patent technology (Y. S. Chen & Chang, 2010; Suh, 2015). IAS 38.2 notes that patent technology and databases are both classes of intangible assets. However, they differ, and we cannot simply apply the patent technology literature to data asset evaluation. Patent technology is “the right to exclude others from making, using, offering for sale, or selling” (United States Patent and Trademark Office, 2018). An investigation of patents related to big data indicates that the methods of data collection (such as capturing data from social media), data analysis (random forests and support vector machines), and data storage (cloud services) can be recognized as patent technologies. However, collected raw data and data assets after cleaning and analysis cannot be recognized as patent technologies. Patent technology and data assets differ in several aspects. First, by examining the corporate contribution from patent technology and data assets, it is found that patent technology is a “method” of doing something (Baglieri & Cesaroni, 2013), while data assets are more comparable to a production line or inventory that contributes
to better production, service, or business decision-making. Second, focusing on the characteristics of patent technology and datasets, while patents are unique and static, data assets can be consistently enriched and improved as more characteristics are added to the dataset, making it a key production element. Third, a review of the ownership and evaluation of these two classes of intangible assets presents further differences. Regarding ownership, patent technology can be traded, but the trading of private information is forbidden due to privacy concerns. In terms of value, patent technology usually has discrete value because it is an invention capable of creating business value; however, data assets have zero value before a data user creates a business application that can benefit from their use. Thus, the value of data assets changes with various usage approaches.

**Data Asset Evaluation Approaches**

There are three basic approaches to intangible asset evaluation: the cost, net present value of the future benefit, and market value. Here, the focus of the discussion is on how we may apply these approaches to evaluate data assets, and therefore, we leverage the related accounting standards to provide detailed technical methods for doing so. We adopt a real financial service provider, Hithink RoyalFlush Information Network Co., Ltd. (“Hithink RoyalFlush”), as an example in the end of this section.

**Cost Approach**

This approach is dependent on the method of obtaining data, namely, either self-collection or external purchase. Self-collected data assets should be initially evaluated based on cost, including the construction costs incurred at the beginning stages of data collection and the ongoing operational costs. The construction cost includes the cost of collecting and storing raw data, as well as information system construction costs like labor and storage equipment fees. Ongoing operational costs include the technical expenses incurred during the data preprocessing phase of cleaning, masking, correlation, and integration, as well as expenses related to data mining to create business value. This cost approach is suitable for Amazon, Facebook, and Tencent, as these companies own an enormous amount of user profiles and transaction data that require continuous investment in construction and maintenance.

It is important to point out that IAS 38 specifies the requirement of cost capitalization. Research and Development (R&D) expenses are capitalized only after the technical and commercial feasibility of the asset for sale or use have been established. This means that the entity must intend and be able to complete the production of the intangible asset and either use or sell it and be able to demonstrate how the asset will generate future economic benefits [IAS38.57]. Accordingly, a company needs to make informed decisions regarding whether such data assets can be used in the future. Intangible assets are categorized into having limited and unlimited lifespans. If data assets are deemed as having an indefinite lifespan, then they should be subject to periodic amortization. Specifically, following the accounting treatment for goodwill, the value of data assets should be amortized over an estimated lifespan, not over 40 years (Linsmeier & Wheeler, 2021). If there is an incidence that indicates that the carrying amount of data assets is not recoverable, however, then firms need to record the impairment loss (Financial Accounting Standards Board [FASB], 1995).

For data assets with a limited lifespan, which is a more common case, depreciation applies, and the data asset value is equal to the cost minus accumulated depreciation and loss in value. Considering that data asset value changes within its useful lifespan and as a result of market and use conditions, it seems inappropriate to apply the “straight-line” depreciation method. According to IAS 38.98A, it is possible to apply a revenue-based amortization method for intangible assets. For data assets with an undetermined useful lifespan, a fair value test should be conducted at the end of each year to determine the accumulated loss in value.

Data assets purchased from external suppliers should be recognized by their historical purchase cost, including purchase price, related taxes and fees, and other expenses incurred to make these data assets ready for their predetermined purpose of use. Following this initial recognition of data asset value, the evaluation method for the following periods can take the same form as that for self-collected data.

**Net Present Value of Future Benefits**

The net present value approach estimates the future benefits that data assets may create for a company and then discounts them using the market rate. Distinct from the cost approach, the net present value approach recognizes the outstanding profitability of intangible assets that may occur in the future. Because data assets can be used multiple times, there is a potential spectrum of future benefits depending on how a company chooses to use a data asset (Birch et al., 2021). To adopt the net present value approach, a company needs to consider the historical usage of the likely intangible assets in addition to how they plan to use these data in the future to determine the remaining economic life of the data assets and estimated future cash inflows. For example, Facebook acquired Instagram in 2012, which has allowed the former to better understand its client preferences to improve its profitability (e.g., by providing targeted advertising services; Xiao, 2017). In this case, a discounted estimation of increased profits in the future due to this M&A can be recognized as the data value. According to the Bloomberg Estimate, the value of Instagram could reach 100 billion, which is 100 times more than the initial acquisition in 2012, and more than one-sixth of Facebook’s current market capitalization (approximately $575 billion; Lee, 2018).
**Market Value**

Following the establishment of the big data market, data transactions between corporations have become increasingly frequent. The increasing number of data users and data collectors allows us to approximate the fair value of data assets, as both buyers and sellers want to maximize their benefits and minimize their costs. Therefore, the determination of data asset value can reference existing data assets in the market with similar characteristics, including (but not limited to) data type, expiration date, data application scope, and data complexity.

This approach is suitable for data assets similar to other items in the active market or if the value of a data asset is difficult to approximate using the net present value approach or cost approach. Following the establishment of big data trading centers in Chinese cities like Guiyang and Shanghai, we expect that data assets will become more liquid and frequently traded like an ordinary product, making the market value approach more practical and realistic.

The same data asset, when used in different business models, may produce distinct business value and cash generation capabilities. Therefore, the efficiency of data asset usage depends on how they are used by a company, that is, a company’s ability to conduct data mining with the data asset to create business value, and how well the data asset can contribute to effective business decision-making. The new business environment of today’s Internet era requires companies to update their asset evaluation approaches. A comprehensive review of corporate business models, how data assets create business value, and the probability of economic benefits is required before a company decides which data asset evaluation approach to use (Sivarajah et al., 2017).

**A Practical Example of Hitink RoyalFlush**

Hitink RoyalFlush is the first online finance information service provider in China. It mainly integrates raw data from the stock exchange, collects customer information, and then develops tailored-made financial news products that assist investors in making investment decisions. It recorded over 28 billion RMB in sales revenue, and 18 billion RMB in profit in 2020, mainly from their finance-data related services. According to the recent annual reports from Hitink RoyalFlush, among its major operating incomes, added-valued telecom service, advertising and internet promotion, and software subscription and maintenance are associated with investors’ data/information needs. While these services are data-driven, data have not been recognized by Hitink RoyalFlush as intangible assets in the financial statements, which may underestimate the profitability and value of Hitink RoyalFlush.

As the data used by Hitink RoyalFlush for providing those services (added-valued telecom service, advertising and internet promotion, and software subscription and maintenance) or similar data assets are not available in the market (because they are uniquely produced by Hitink RoyalFlush), the market value approach may not be applicable for measuring the value of data assets of Hitink RoyalFlush. The cost approach can be theoretically used by accounting for the construction costs incurred at the beginning stages of data collection and the ongoing operational costs. However, the limitation of this approach is that it cannot reflect the future value of the data assets, given that Hitink RoyalFlush is likely to use the data multiple times. As a result, we suggest that a net present value approach based on the service charge of these services in the future can be used to estimate the value of data assets of Hitink RoyalFlush. On the other hand, other operating incomes such as managed fund sales and transaction charges are common financial services that do not require particular data support. Therefore, the fees of such services do not contribute to the calculation of data value.

**Insights for Business Managers**

For business managers, the emergence of big data can be viewed as a key resource for optimizing resource allocation and conducting effective business decision-making. For internal corporate management, cost control, budget management, and performance review can all benefit from the data-driven analysis of corporate production processes that lead to increased transparency and internal collaboration. For external corporate management, data analysis contributes to the better management of supply chains (inventory management), leading to lower information asymmetry between supply and demand, and better consumer service experience.

At the same time, we should also acknowledge the challenges of big data, especially for data assets. As illustrated in this study, companies collect user information to conduct business activities. Thus, how to regulate ethics and privacy issues during the collection, analysis, and usage stages is an important topic. Despite the fact that a user agreement is usually set up between the corporate entity and user regarding the usage of user data as anonymous data, it is still important for corporate management to set up protocols to ensure that the collection and use of data are legal. This is a necessary step to avoid repeating past incidents such as the Cambridge Analytica scandal involving Facebook.

Considering the ethics and privacy of data, corporate managers should respect intellectual property guidance, adhere to the legal requirements of data sharing, provide necessary data masking, and protect data assets related to national and corporate confidentiality and personal privacy. On 1st June 2017, the Chinese government released “The PRC Cybersecurity Law” to regulate the illegal trading of personal data (DLA Piper, 2018). As of May 2018, all companies operating in the European Union (EU) had to follow the General Data Protection Regulation (GDPR; European Commission, 2018), which illustrates that as a result of the
rapid improvements in data analytics, updated intellectual property and data protection legislation is required. Corporate managers should actively participate in the creation and improvement of related legislation, protect users’ rights, and explore how to better conduct corporate governance under these new regimes.

To improve the efficient use of data resources, corporate managers are also advised to monitor the timeliness and accuracy of data resource use. As consumer demand is frequently changing, corporate managers should learn how to observe market changes through data analytics. The broad collection and integration of multiple data sources, such as numerical, text, photo, audio, and video sources, allow companies to identify the potential need for personalized services for individual consumers, which enables companies to use big data analytics to design differentiated products to satisfy the needs of a diverse market.

As big data analytics imposes requirements related to data collection, storage, and management, corporate managers may consider increased investment in new computation platforms, decentralized computing architecture, data processes, analytics, and presentation (visualization), as well as open-source techniques and ecosystem influences. While the adoption of cloud techniques reduces the burden of corporate technology investment, it requires an understanding of new technology by IT professionals.

In the initial stage of big data, professionals are required in hardware-related areas, such as system architecture development and data storage design. With the increasing popularity of big data analytics, professionals in this field are likely to have a background in statistics and mathematics, data analytics, data mining, and AI, as well as fields that are more software related. Therefore, managers need to consider the human resources management aspect when recruiting big data talent, as well as appropriate training courses for existing employees. More importantly, for the purpose of data asset evaluation, companies need in-house professionals that can understand both big data technology and accounting concepts to accurately reflect data asset value in financial reports.

Conclusions

An evaluation of data assets illustrates that data resources affect companies’ future profitability and improve the quality of financial reports by facilitating a more accurate reflection of data asset value (Wamba et al., 2017). The objective of this paper is to argue that data should be recognized as intangible assets in financial statements. We achieve this objective by reviewing the relevant accounting principles and showing that they are consistent with our argument. In addition, we propose three alternative methods for evaluating data assets for financial reporting, each of which may be applied to different business scenarios.

We believe there are benefits to recognizing data assets as intangible assets in accounting information systems. For example, the stock market can produce a more accurate evaluation of many new types of Internet corporations that profit from data analytics, which also encourages companies to invest more heavily in data infrastructure in addition to recognizable fixed assets, benefitting the establishment, and operation of data-trading platforms.

Therefore, the main message of this paper is that it is time for researchers and regulators to reexamine the reporting practices for data assets. There are several areas that can be addressed by future research. First, future research can identify when data assets can or cannot be recognized as intangible assets. As we previously mentioned, the criteria for being recognized as intangible assets are that the possibility of economic benefit inflows is higher than 50% and that a reliable estimation of how much it costs to collect these data can be obtained. However, it is sometimes difficult to determine whether the possibility of economic benefit inflows is higher than 50%, as it is subject to data type, data size, data quality, the computing ability of firms, the market demand for data analysis, etc. Future research can examine when these criteria are likely to be met. A possible condition is when the focal firm can successfully start to generate revenues from data analysis. Second, we propose three alternative methods for evaluating data assets in financial statements that may be applicable to different scenarios. The cost approach appears to be the most prudent, as the costs of developing data assets can be reliably observed. However, this approach may not truly and fairly reflect the business value of data assets. Moreover, the net present value approach can reflect the true value of data assets only if the estimation of future revenues is reliable, which is also difficult. The market value approach can reflect the true value of data assets only if transactions of similar data assets exist in the market. Future research can further examine the conditions under which these three methods should be used and eventually identify which method should be the best in general.

Our paper also has implications for internal auditors. The major responsibilities of internal auditors are to improve a firm’s risk management, internal control, corporate governance, and the quality of financial reporting (Ajao & Oluwadamilola, 2020). As argued by our paper, data assets can be recognized as intangible assets rather than expenses if certain criteria are met. However, managers may have motives to record data expenses as data assets, even if those criteria are not met, because doing so can make the profitability of such assets look good in financial statements. It is the responsibility of internal auditors to monitor and avoid this type of managerial misconduct. Moreover, despite the value of analyzing data, there are risks involved in collecting and sharing sensitive data that may violate the laws of personal privacy and national security. For example, Didi has recently been removed by app stores in China, as it has been accused of collecting and publishing sensitive data in the U.S. Internal auditors should be familiar with the relevant laws and regulations so that they can effectively monitor the collection and use of data by their firms.
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