



# The role of data in circular economy development

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In the digital age, optimizing the value of data is a key factor to help businesses achieve outstanding success. The right use of data can promote progress and contribute to the sustainable development of society and environment. Within the scope of this article will analyze several aspects of the importance of data in the national economy. Through analytical research and synthetic methods, the article evaluates its role in developing a circular economy (CE). The article provides some basic information about the role of data in Vietnam's continuous efforts to improve data infrastructure and support the development of a CE.

## 1. INTRODUCTION

Data is a form of information, a rich document on the economics of information (Swallow and Haksar, 2019). In terms of hierarchy, data collected directly from the source through observation, survey, interview... which is called primary data. In contrast, available data, publicly disclosed without having to be directly collected, is called secondary data.

In relation to information and knowledge, data is uninterpreted information that plays an important role in many fields. Information is data that has been interpreted, carries meaning and provides the necessary insights for human decisions and activities. Knowledge is formed by giving meaning to information and connecting it with existing knowledge, helping to build new knowledge and deepen understanding of specific issues. Therefore, data can be seen as the precursor of information and knowledge.

The European Union's Convention "The General Data Protection Regulation" (GDPR) provides an indirect definition of data. According to Clause 1, Article 4 of GDPR, data is divided into two main categories: personal data (identifying data) and non-personal data (anonymous data). Personal data is information that can identify a particular person, while non-personal data cannot identify that individual.

In Vietnam, the recently issued Clause 1, Article 2, Decree No. 13/2023/NĐ-CP dated April 17<sup>th</sup>, 2023, of the Government on the protection of personal data provides the definition: Personal data is information in the form of symbols, letters, numbers, images, sounds or analogous form on the electronic medium that is associated with a particular person or helps to identify a particular person. Personal data includes basic personal data and sensitive personal data.

In general, the concept of data is a diverse concept and has many different categories in different fields. Data plays an important role in performing computation, generating information and knowledge, while ensuring the protection of each individual's privacy and intellectual property rights. However, the issue of data definition and classification is still being studied and discussed to ensure understanding and compliance with relevant legal regulations.

## 2. IMPORTANCE OF DATA IN THE NATIONAL ECONOMY

The rapid development of contemporary technologies such as the Internet and cloud computing has released a new resource in the form of data. According to statistics in 2021, every day, we generate 2.5 quintillion bytes of data, 70% of global GDP will be digitized by 2022. Intriguing videos on Instagram make 91% of users engage. Cloud data is expected to surpass 200 zettabytes by 2025. With hundreds of millions of tweets and emails sent daily, the data is constantly being produced and hoarded to a massive extent. Not only increasing in quantity, the value of data is also increasingly concerned. Data is likened to the new oil of the digital economy and is increasingly asserting its position. Businesses that are "rich" in data also become rich in fact. In 2020, Apple, Alphabet, Microsoft, Amazon and Facebook hold up to 26% of the Standard and Poor's 500 Stock Index (a stock index based on the capitalization of the 500 largest public companies in the US).

Today, data is viewed as a valuable commodity in the modern economy. According to the report "Financial Statement Impact of Intellectual Property and Cyber Assets: 2020 Aon - Ponemon Global Report conducted independently", intangible assets of companies (including customer records, employee records, financial statements, analytics data, source code, and other intellectual property) has an average value of US\$ 1,274 million. Meanwhile, physical assets, including all fixed assets and industrial automation systems have an average value of only US\$ 1,223 million.



For the same reason, in 2020, Microsoft spent more than US\$ 26 billion to acquire LinkedIn, an influential company and considered a social network for job seekers. This agreement allows Microsoft to integrate LinkedIn with their enterprise products and services, creating a connected environment for businesses. LinkedIn has 433 million users and collects a lot of valuable data about users' profiles, skills, and relationships. A company's value is largely based on the content and data it accumulates. Microsoft is willing to spend huge sums of money to indirectly buy data in the name of acquiring an app. Currently, the purposes and ways companies use data are very diverse. Every company has its own way of collecting and using data to get the most out of it.

Data research has appeared in many different fields, including Application of product quality monitoring in production; application in the service environment; application in supply chain management; applications in information gathering and analysis activities. For manufacturing, developing an integrated text analytics framework to use social media data to detect product defects (Abrahams et al., 2014). Along with the diversity of data in the market, data research can help to deepen understanding of consumer behavior and improve marketing activities. To ensure security, most of the customer service data collected is personalized.

Data is not only massive but is also produced with many variations in geographical areas, in media and in diverse fields of activity (Gupta et al., 2019). The large and complex data set called big data includes huge volume, diversity and increasingly fast circulation. However, sometimes it is the volume, variety, speed, and authenticity of the data that can become the cause of decision-making difficulties (Almanza et al., 2023).

Big data is mainly driven by the development of new technologies and methods. On the other hand, big data in supply chain management helps to improve supply chain visibility and product quality, improve operational efficiency, personalize services and enhance service quality. At the same time, operate new and better predictive business models (Wang and Alexander, 2015). Data enables managers to act on structured and unstructured data to aggregate and analyze business information systems such as financial position and personnel structure. Overall, data is an integral part of creating innovative value through product and service innovation in the national economy. Data contributes to business profitability through behavioral assessment and big data analytics (Del et al., 2021). By using data in descriptive statistics, individuals and businesses can actively analyze, make predictions and make appropriate business plans.

Besides, big data brings benefits in extracting useful production information, supporting decision making process, improving productivity as well as competitiveness of manufacturing enterprises. The popularity of big data and the development of machine learning algorithms have enabled data analytics to solve increasingly complex problems (Swallow and Haksar, 2019). In the report of the International Monetary Fund 2019, data plays an important role in the development of the digital economy with two main roles: (1) Data is an input to the production of goods and services, contributing to innovation and efficiency; (2) Data generates and shifts information between economic actors, influencing strategic interactions and information conflicts.

**Table1: Analysing the role of data in CE development**

Data action	Role in CE
Data analysis	Data analysis facilitates the adoption of the CE model. The data derived from analytics will enable individuals and organizations to simplify complex processes in manufacturing and services, thereby improving the sustainability of their business in the long term.
Data management and mining	Effective data management and mining brings many benefits to individuals and businesses, driving demand and supporting the development of a better CE.
Data forecast	Forecasting the possibility of daily production and maintenance changes; human performance; health, safety and environment; especially the status of raw materials for recycling or reuse.
Data report	Secondary data provides statistics, impact indicators and effectiveness assessment tools, help make decisions about the cycle plan of products and services that apply to different sectors and sizes of companies.
Data technology	Data technology supports the digitization of business processes to achieve the CE. In addition, data technology plays a role in regulating the relationship between human resource management and business performance in the supply chain of the CE.



### 3. THE ROLE OF DATA IN CE DEVELOPMENT

The CE is an important form of economy, based on the reuse and recycling of goods and materials. A company that manufactures and ships traditional products directly to the customer or to the customer's distribution location, everything ends at the time of delivery and payment. However, in a CE, the company will have to create a closed loop system to regenerate natural materials after use and ensure a new feed to the supply chain.

Because data itself is an intangible asset with inherent recycling property (the output of one processing can be the input of another) and it has no impact on the creation of waste. So, the goal of data in a CE is to manipulate the data so it gets to where it needs to be, focus on the ability to effectively exploit data to ensure optimal benefits that data brings.

Development must go hand in hand with sustainability. National data policies also require a balanced integration between individual competitive objectives and socioeconomic interests. According to the World Bank, data development is fundamental for national policy making, efficient resource allocation and optimal public service delivery to: (1) Driving growth and competition through access to data; (2) Ensure incentives for data collection and processing; (3) Promote stability by investing adequately in cybersecurity; Ensure that individual privacy preferences are respected. For that reason, many countries around the world have established legal frameworks for data protection. In May 2018, the GDPR issued by the European Union established standards for a data policy framework by defining and clarifying the rights and obligations of residents residing, living and working in the European Union with respect to personal data.

However, in the perspective of transitioning to a CE, in addition to ensuring the privacy of individuals with respect to data, an important aspect that needs attention is ensuring access to data to promote faster economic development. Currently, data collection and access are still facing many difficulties. Businesses and individuals are afraid to share data because of concerns about security and competition. This creates limitations for governments, development organizations and private businesses when implementing data solutions in the CE.

To solve this problem, anonymous methods can be used or just shared non-specific information. It is important to create a supportive environment to promote secure data sharing and collaboration between businesses and organizations. Another approach is to use blockchain technology to create an anonymous and trusted marketplace for the trading of recycled and reused resources. This technology can help build trust and transparency in transactions, thereby encouraging cooperation between business partners.

### 4. CONCLUSIONS

Data is an important component in building and operating a CE model. Assessing the role of data, many countries have issued policies related to rights and obligations in data collection and exploitation associated with the circular production process.

Big data technology is seen as a possible solution to accelerate the implementation of the new CE initiative, which involves reducing the intensity of raw materials, reusing products and increasing efficiency. Analysis, management, mining, forecasting and decision-making from data-related activity will become essential tools, which brings many benefits in developing data for the CE. At the same time, there is a need for extensive cooperation and transparency across businesses and sectors throughout the circular supply chain ■

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