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Value Creation in Big Data Analytics

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ABSTRACT

In order to show the value in big data analytics, this paper proposed a flow model to show how to achieve it. The final goal of this value creation model is to make big data analytics to be a sustainable technology.

KEYWORDS: Big data analytics, Value creation model, social equity, economic growth, environmental protection.

INTRODUCTION

Big data analytics is a newly developed research areas. Big data analytics' applications cover a variety of areas, including information systems and IT, healthcare, government, business, nature sciences, social sciences, psychology, industrial technology, geography, etc.

The rise of big data and analytics changed the paradigm this research field. These changes brought in convenience and challenges to researchers. However, many criticism arose since the conflicts of understanding to data sources, data population, sampling, and statistical theories. This study intends to analyze the implication of the changes while adopting big data analytics in their organizations. The research questions of this study is the following: how to create value in Big Data Analytics? Value is an important issue in every research method and discipline. It is a notable contribution to the field of big data analytics if such value model can be identified and become workable later.

The purpose of this study is to develop a mechanism for creating value in big data analytics practice. The value of adopting big data analytics is determined in this study and the process of developing value in Big Data Analytics is defined in this study. The final goal of developing big data analytics technology is to create value to society and then to make it sustainable.
This paper intends to develop a value model in Big Data Analytics area. This paper consists of the following sections: introduction, development of big data and analytics, big data analytics and implication, value model building, big data analytics value creation model, and conclusion.

DEVELOPMENT OF BIG DATA AND ANALYTICS

Big Data

Information technology (IT) has sustained to evolve rapidly, which caused associated enterprise data and social network data to be generated exponentially. Timeline of recent technology developments can be divided into four stages: ERP development in 1980s, CRM development in 1990s, eCommerce development in 2000s, and finally big data analytics in 2010s (Minelli, et

al., 2013). Each technology development stage accompanies individually associated dataset and tools, such as data warehouse, data mining, statistics, and business data analytics. Social network webs such as Facebook and Twitter are able to generate enormous amount of data every day. YouTube uploads massive video and audio data through the Internet transmission. The speedy growth of cloud computing and the Internet of Things (IoT) also stimulates the fast growth of data. Cloud computing providers serve as the major data storage providers in the IT industry. The IoT technology collects sensors data in business transactions globally and then transmitted them through the cloud and the Internet.

The early ideas of Big data appeared in 2001 (Marr, 2015). Laney (2001) defined three commonly recognized characteristics of big data, they are increased data volume, data velocity and data variety. In the following years, several industry leaders such as IBM, Microsoft, and Gartner adopted “3Vs” concept to describe big data (Beyer, 2011). Data volume described the data scale to be enlarged; data velocity described the speed of data utilization must be rapidly implemented; and data variety described the types of data must be increased.

There are many new technologies may be adhered to big data’s development. For this reason, the future of big data is unpredictable. As indicated by Chen, et al. (2014, p. 215), big data “With the emergency of IoT, development of mobile sensing technology, and progress of data acquisition technology, people are not only the users and consumers of big data, but also its producers and participants. Social relation sensing, crowdsourcing, analysis of big data in SNS, and other applications closely related to human activities based on big data will be increasingly concerned and will certainly cause enormous transformations of social activities in the future society.”

Analytics

There are three situations that caused the explosive growth in the use of analytical methods in the business environment, they are technological advancement, numerous methodological developments, and an explosion in computing power and storage capability (Camm, et al., 2014). Three analytical methods and models are adopted in business applications, they are descriptive analytics, predictive analytics, and prescriptive analytics. Descriptive analytics examines the data to describe what has happened in the past using statistical analyses, data visualization, data-mining, and spreadsheet models. Predictive analytics uses modeling techniques to predict the future events or data; more advanced methods such as data mining and simulation are used here. Prescriptive analytics uses optimization models and simulation optimization to perform decision analysis.

BIG DATA ANALYTICS AND IMPLICATION

Big data analytics is the process of probing large and varied data sets to uncover hidden patterns, unknown correlations, and other useful information that can help make sound business decisions. Big Data Analytics is a newly developed research areas. Businesses realize that their traditional data warehouse can be insufficient for their analytics and performance needs. Recent studies indicated that big data is shifting its research methods, based on its large volume of data to be collected and used in the study. Big data analytics utilizes data that contain characteristics of huge in volume, huge in velocity, diverse in variety, exhaustive in scope, fine-grained in resolution, relational in nature, and flexible (Kitchin, 2013). Big data itself utilized technologies such as newly developed could computing technology, Internet of Things (IoT),

Hadoop technology, and data center operations. Data value chain framework was proposed by Miller and Mork (2013).

VALUE CHAIN IMPLICATIONS

Value Chain Theories

Value creation is a purpose of organizational operation. Value is also a goal of decision-making in organizations. Based on Cronk and Fitzgerald (1999), value is the worth or desirability of a thing. The thought of information technology (IT) delivering value is a commonly acceptable impression in organizations. The data value chain concept was proposed by Miller and Mork, in which a framework is used to illustrate how to "bring disparate data together in an organized fashion and create valuable information that can inform decision making at the enterprise level" (Miller and Mork, 2013, p. 58). Another data value related framework is the value chain of big data, based on Chen et al. (2014), this value chain contained four phases: data generation, data acquisition, data storage, and data analysis. These value chain phases described the process of conducting big data analytics.

Big data analytics generates information that can enhance the value of decision making at every levels. Based on McKinsey's report, "But there is strong evidence that big data can play a significant economic role to the benefit not only of private commerce but also of national economies and their citizens. Our research finds that data can create significant value for the world economy, enhancing the productivity and competitiveness of companies and the public sector and creating substantial economic surplus for consumers." (Manyika, et al, 2011, p. 1). Chou and Chou (2012) proposed a green IT value model, in which the four stages of green IT valuation process has been suggested. They are awareness, transition, comprehension and green IT value.

Decision Quality Chain

Big data analytics practices conduct tremendous amount of decision-making activities. We must understand how to perform a sound decision process to generate value from the practice. In fact, a good decision should follow the decision quality chain suggested by Matheson & Matheson (1998), it consists of the following six elements: frame, alternatives, information, values, logical reasoning, and commitment to action.

SUSTAINABILITY OF BIG DATA

Sustainability is a remarkable concept and goal in business, industry, and society. The implication of sustainability is the endurance of systems and processes in human (Wikipedia, https://en.wikipedia.org/wiki/Sustainability), it is not just focusing on current needs, but also dealing with the opportunities in the future. Sustainability is an important aim in the studies of economics and ecology/ecosystem.

Big data technology should seek sustainability so it can be sustained and it can contribute to human beings. This study intends to formulate a process that allow big data to be endured in the field and society. We now discuss the three components of sustainability that to be exhibited through big data technology.

Economic Growth Value through Big Data

Applying big data technology in global economy may benefit the world economy. Based on McKinsey's research, big data technology may contribute to a full play to the economic function in the world economy, improve the productivity and competitiveness of private and public sectors, and generate enormous amount of benefits for consumers in the global economy (Manyika, et al., 2011).

McKinsey's report found strong evidence regarding the value creation through big data applications, for example, big data can generate $300 billion potential annual value to US health care, €250 billion (Euro) potential annual value to Europe's public sector administration, $600 billion potential annual consumer surplus form using personal location data globally, and so on (Manyika, et al., 2011). The overall benefit of using big data not only can create substantial value for the global economy, but also can boost the productivity and competitiveness of both private and public sectors.

Social Equity Value through Big Data

Can big data technology makes society better or more impartial than before? The answer may not be easy to be answered. It depends on the behavior patterns of the data users. If data sources to be accessed legally or ethically, big data analytics could benefit the social equity and strengthen the social value. On the other hand, if big data sources to be breached or illegally accessed, it may generate potential risk and damage to social equity. Social website such as WikiLeaks is an example of data hacking.

Social media is one of the major data sources of big data. Social media such as Facebook and Twitter generate tremendous amount of data that can be collected and analyzed for gaining needed information. A good use of big data from social media sources can help government to work on social problems such as removing the wall that obstructing citizen's well-being and equity. Therefore, a healthily designed Internet technology and strongly protected social media data sources could generate huge societal benefits for future generations in global society.

Environmental Protection Value through Big Data

Environmental protection is one of the three components in sustainability framework. Environment or ecology is closely linked to human being's life and health. Maintaining a clean and renewable environment is a common goal of scientists and socialists. Moreover, other environmental issues such as climate change, food supplies, clean air and clean water are also on the list of global environmental protection.

In order to meet the need of keeping a safe ecology in the world, it demands sufficient information to be offered by environmentalists and ecologists. Big data analytics can be applied to global environmental datasets for advanced information findings through descriptive, predictive, and prescriptive analyses. These big data analytics technologies create value to global environmental protection task.

In summary, big data technology can create value in economic growth, social equity, and environmental protection as discussed above. However, we must illustrate the path of how big data analytics can create value and reach to sustainability. The following section discusses such framework.

Sustainability and Value Creation Models

Chou and Chou (2012) utilized a value model to illustrate the process of realizing green IT. Their green IT value model consists of four components/stages, including awareness, translation, comprehension, and green IT value realization.

Similar to the previous research, Chou (2015) applied value creation framework into cloud computing technology. The final goal of this value creation model is to seek a sustainable cloud computing technology.

This paper intends to apply the value model that proposed by Chou and Chou (2012) and Chou (2015) to solve the problem in Big Data Analytics.

BIG DATA ANALYTICS VALUE CREATION MODEL

As indicated in the last section, the final goal of implementing big data analytics is to seek a sustainable technology. In order to meet the sustainability of the technology, it must meet the goals of economic growth, social equity, and environmental protection. These three goals have been clearly discussed earlier. We now need to identify a big data analytics value creation framework to achieve its final sustainability.

Big Data Analytics value creation model consists of four components: awareness, translation, comprehension, and big data analytics value creation. Each stage of the framework consists of a few tasks that need to be completed. Each stage follows the sequence to perform the tasks until reaching the end of model.

Awareness

The following activities need to be implemented in this stage:

- Understanding of Big Data Analytics (BDA).
- Need and strategy identification
- Cost analysis

Translation

After completing the awareness stage, it should move to the translation stage. The following activities must be performed:

- Risk identification
- Security issue and control
- Tool selection
- Talent selection

Comprehension

After translation stage, the comprehension stage should perform the following tasks:

- Audit standards
- Risk measurement
- Value metrics

Big data analytics value creation

After comprehension stage, we reach to the final stage of the framework. In order to achieve the goal of value creation, the following tasks must be completed:

- User satisfaction
- Corporate value
- Social value

After that, a sustainable Big Data Analytics technology can be matured.

CONCLUSION

As indicated in this paper, big data analytics technology is still in its development stage. Many researchers in the field are working so hard to link this technology with related IT, data types, and storage devices and methods for fully utilize BDA for achieving human being's advantage.

In order to contribute to the field, this paper proposes a BDA value creation model for helping BDA technology to reach to its maturity. The value creation model is an incremental process that contains four stages: awareness, translation, comprehension, big data analytics value creation. Each component in the model needs to achieve its goal through completing individual tasks. The final objective of this process is to reach a sustainable big data analytics technology.

References

Beyer, M. (2011). Gartner says solving big data challenge involves more than just managing volumes of data. Gartner. Retrieved from http://www.gartner.com/it/page.jsp.

Camm, J.D., Cochran J.J., Fry M.J., Ohlmann J.W., Anderson D.R., Sweeney D.J., and Williams T.A. (2015). *Essentials of Business Analytics*. Stamford, CT: Cengage Learning.

Chen, M., Mao, S., and Liu Y. (2014). Big Data: A survey. *Mobile Networks and Applications*, 19 (2), 171-209.

Chou, D.C. (2015). Cloud computing: A value creation model. *Computer Standards and Interfaces*, 38, 72-77.

Chou, D.C. and Chou, A.Y. (2012). Awareness of Green IT and its value model. *Computer Standards and Interfaces*, 34, 447-451.

Cronk, M., Fitzgerald, E. (1999). Understanding 'IS business value': derivation of dimensions. *Logist. Inf. Manag*. 12(1-2), 40-49.

Kitchin, R. (2013). Big data and human geography: Opportunities, challenges and risks. *Dialogues in Human Geography*. 3(3), 262-267.

Laney, D. (2001). 3D Data Management: Controlling Data Volume, Velocity and Variety. *Meta Group Research Note*, February 6.

Manyika, J., Chui M., Brown B., Bughin J., Dobbs R., Roxburgh C., and Byers A.H. (2011). Big data: The next frontier for innovation, competition, and productivity. *McKinsey Global Institute report*.

Marr, B. (2015). A brief history of big data every should read, Retrieved from https://www.linkedin.com/pulse/brief-history-big-data-everyone-should-read-bernard-marr.

Matheson, D. and Matheson, J. (1998). *The Smart Organization*. Boston: Harvard Business School Press.

Miller, H.J. and Mork P. (2013). From data to decisions: A value chain for big data. *IT Pro*, 15(1), 57-59.

Minelli, M., Chambers M., and Dhiraj A. (2013). *Big Data, Big Analytics*. Hoboken, New Jersey: John Wiley & Sons.