

Four Changes of Modern Universities From the Perspective of “4V” of Big Data

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Abstract

With the advent of the era of big data, the “4V” characteristics of big data, volume, variety, velocity and value, have brought the impact to the independence, reformation, guidance, balance and system of modern universities. This article analyzes both the pros and cons and proposes the four changes of modern universities from the “4V” perspective of big data, which is “to win by relying on data volume rather than overall strength, on data variety rather than disciplinary advantages, on data velocity rather than design in advance, and on data value rather than social responsibility”.

Key words: Big data; “4V” perspective; Modern university; Four changes

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INTRODUCTION

While we are looking around in the Internet age, the era of big data, like a “ghost”, has quietly come. *The Wall Street Journal* calls the big data, intelligent production and Wi-Fi revolution as three major technological changes to lead the future prosperity. Many developed countries have raised large data to the national strategy. As early as March 29, 2012, the United States releases *Big Data Research and Development Plan*, while at the same time founded the “Big Data Senior Steering Group” and invested more than 200 million US dollars in the field

of big data to carry out research. Big Data is advanced science and technology, and it can be considered as not advanced science and technology. It is relevant to all walks of life in society and our daily lives. An important participant in China’s Internet development, Xie Wen, in the preface of the book *The Era of Big Data* says that, “big data will become part of modern social infrastructure, and it is as indispensable as roads, railways, ports, utilities and communications networks.” (Mayer-Schönberger & Cukier, 2013, p.4)

In the era of big data, modern universities, as an important part in social network, are definitely of no exception. We try to link the modern university with big data to examine and think about the changes of modern universities from the “4V” characteristics of big data.

1. BIG DATA AND ITS “4V” CHARACTERISTICS

Back in 1980, the famous futurist Alvin Toffler, in his book *The Third Wave*, gives a warm tribute to the big data and describes it as “the cadenza of the third wave”. Since about 2009, “big data” has become into a buzzword in Internet IT industry. To 2013, “big data” has penetrated into all areas of various industries and produced a tremendous force for change; therefore, 2013 is also known as “the first year of big data”.

1.1 How Big Is Big Data?

In Wikipedia, “data” is interpreted as “data, also known as information, refers to the recorded symbols that describe things. Data is measured, collected and reported, and analyzed, whereupon it can be visualized using graphs or images. Data as a general concept refers to the fact that some existing information or knowledge is represented or coded in some form suitable for better use or processing. Data can be divided into two categories: analog data and digital data. Data also refers to the “raw” materials for computer processing, such as graphics, audios, text,

numbers, characters and symbols and so on.” Therefore, physicists often say that, “the essence of the world is data.” From the words and deeds and smiles and frowns of people, to the dissemination of knowledge and social progress; from Oracle, Latin, to the digital code of “0 and 1” of the computer; from pigeon messengers, the communication of smoke, to mobile phones, tablet computers; from the mobile Internet, Internet of things to cloud computing, Internet of vehicles, and all kinds of sensors throughout every corner of the earth, they all are sources of data or carrying ways of data.

How big is big data? It is really indescribable and we can only see a piece of a jigsaw. For example, the quantitative data produced by a student who has finished the nine-year compulsory education for analysis basically does not exceed 10KB, including basic information about the individual and the family, the school and the teacher-related information, the examination results of all subjects, height and weight and other physiological data, library and stadium using records and medical information and insurance information, etc. The analysis of big data is a completely different level of technology. According to the research of the famous Dutch behavioral observation software vendor NOLDUS, in a 40-minute period of the general high school lesson, the holographic data a student generates is about 5-6GB, among which there are about 50- 60MB quantitative data that can be categorized, labeled, and analyzed. This is equivalent to the total amount of data he has accumulated in the field of traditional data in five years (Zhang, 2013). Coincidentally, every day, Google deals with more than 24 petabytes¹ of data, equivalent to a thousand times of the amount of data contained in the paper of all publications in the US National Library; Facebook updates over 10 million photos every day; in 2011, there were more than 40 million hits in Taobao a day. Experts have estimated that by 2013, the data stored in the world are expected to reach about 1.2 ZettaBytes². What does so much data mean? If these data are stored on discs, these discs can be stacked five piles, and each pile can expand out into the moon (Mayer-Schönberger & Cukier, 2013, p.13).

1.2 Big Data and Its “4V” Characteristics

Definition of big data is explained mainly from three different angles: One is that big data means the “data is big”. A typical representative of this opinion is the McKinsey Global Institute, but it does not define how big is considered as big data. In this definition, “big” is a dynamic concept. Their hypothesis is that as technology advances and as time goes by, data sets in line with the definition of big data will also increase (Manyika et al.

2011)³; the second one is that big data is “complex” data, represented by technical director in Deloitte Consulting, Robert Foley. His definition of big data is that: use data sources arrange in a huge amount, making use queries very difficult and the complex relevant relationships make it difficult to exclude. The first property of big data is the complexity. “Big” does not refer to the quantity, but the complexity. The third one is that big data is date of “great value”, represented by Viktor Mayer-Schönberger. He believes that big data is a unique new ability in today’s society: “In an unprecedented way, through the analysis of vast amounts of data, to get products and services of great value, or profound insights.” (Mayer-Schönberger & Cukier, 2013, p.4)

These three definitions are different, and it is difficult to give big data an accurate and comprehensive definition. It becomes clearer to interpret big data with “4V” characteristics. The “4V” characteristics of big data are Volume, Variety, Velocity and Value.

Volume refers to the huge amount of data and data integrity of big data, which has leaped from terabytes (TB) level to petabytes (PB) level⁴;

Variety means we need to find the intrinsic correlation between the mass and a large variety of data which are all-inclusive and full of wonders, including the above-mentioned words and deeds as well as blogs, images, locations and so on;

Velocity can be understood as to meet real-time requirements faster. This is a typical “one second rule” or second-class rule, that is to say on the processing speed it is required to generally obtain the results in a given time frame of seconds, and it takes too long to lose value. This speed requirement is one of the biggest differences between big data processing technology and traditional data mining technology.

Value is the ultimate meaning of big data, and that is to gain insights and value through the data. Take the video as an example. In the uninterrupted monitoring process, the potentially useful data is only a second or two. In these four characteristics, the most important one is the meaning and value behind big data. Questioning the meaning and value of big data is what present people concern and discuss the most. If there is no meaning and value of big data, it will be worthless. Computing and communications expert at the University of California Riverside Campus, Dr. Yang Ming, stresses that “recent media often talk about big data. In fact, they refer specifically to the fourth dimensional nature of big data, and that is the value of data, mainly in intelligent analysis of data.” He points out that intelligence analysis is an investment in the future intelligence, and the ultimate

¹ 1 petabyte=2⁵⁰ bytes.

² 1 ZettaByte=2⁷⁰ bytes.

³ Looks at innovation and competitive advantages for industries using big data, including health care, retail and use of personal location, p.1.

⁴ 1 Trillionbyte (TB)=2¹⁰ bytes; 1petabyte (PB)=2⁵⁰ bytes.

goal of the analysis is to make more informed decisions (Chen, 2012). The Secretary Chinese Academy of Social Sciences Information Technology Research Center, Jiang Qiping, believes that “data is only the object. Once it leaves the subject, it will backfire. Whether big data is good or bad depends on whether it is of significance or not: meaningful data is intelligent and data without any meaning is garbage.” (Jiang, 2013)

2. MODERN UNIVERSITIES WITH “FIVE FEATURES”

Modern university has philosophical basis. For a long time in the academic field, there are three points of view. One is Brubacher’s binary theory, namely epistemological philosophy and political philosophy; another is Clark’s four-element theory, namely justice, ability, freedom and loyalty; the third is the value basis that some scholars believe. For example, the famous scholar, Yang Dongping, believes that in the 19th century, Humboldt founded the University of Berlin, lay the principles of “academic freedom, freedom of teaching, learning freedom”, and it has become the basic values and basic principles of the modern university. From this point of view, the author prefers political philosophy and theory of value, after all, “universities are only the knowledge wing of the ruling class,” (Brubacher & Wang, 2001, p.23) and to provide appropriate services for the state and society is the responsibility for modern universities. Specifically, we can further interpret this from the “five features” of modern universities.

2.1 Independence

Independence is significantly reflected in “university autonomy and academic freedom”.

Whether its fund comes from private donations or state subsidies, or whether it is formally approved by Pope Orders, Royal Charter, or national or provincial legislative provisions, academics associations have to manage their own things. It was once thought without the autonomy, higher education will lose its essence. (Ibid., p.31)

Destruction of the rights of academic freedom is to destroy its power, and it is not alarmist. Probably no other hit is more directly pointing to the vital point of higher education than the suppression of academic freedom. We must prevent this threat at all costs. Academic freedom is the fortress in the academic sector, and we should never give up. (Ibid., pp.59-60)

2.2 Reformation

Modern universities, whether in the United States and Germany, whether in developed or developing countries, were not born as “modern” universities, and they have still experienced a lot of changes and development, just as the university function “to serve the community” was initially “rejected” by Cambridge and Oxford University. Reformation has become the “engine” of

universities to change them from traditional universities to modern universities. At present, Chinese universities have entered the deep water area of reform, and it has been in the degree that we have to change and there is no way other than reform, and we must come up with tough determination and strong momentum to crack problems impeding reform.

2.3 Guidance

Universities have always been the place to research “higher and deeper knowledge” and “to start a new atmosphere”. Technology revolutions and social thoughts in society are more or less influenced by universities, and to a large extent are subject to universities. Information Age first “sounded” the horn in the laboratory at the university. “May Fourth Movement” also issued the first shout at the university. Modern universities do not serve a certain social class, nor serve a special group. They do not serve for a stakeholder body. They should fully reflect “positive energy” of modern universities in science and technology and social responsibilities.

2.4 Balance

After all, modern universities are not “isolated” “monk temples or nunneries”. They need to coordinate the relationships with the society, government, enterprises, and teachers and students, and maintain a commendable balance in these relationships.

2.5 System

Whether a university is a modern university depends on whether it has comprehensive and effective system. System contains two aspects: First, whether there is “Constitution” in the university—University Statutes. This aspect is mainly to see whether the modern university is institutionalized and whether it clarifies the legal status of the Constitution; the second is to see whether the university has established the system of board of directors for university’s development and effective operation in order to achieve the orderly operation of the government, society and the university.

3. FORTUNE OR MISFORTUNE: MODERN UNIVERSITIES UNDER THE 4V PERSPECTIVE OF BIG DATA

A professor of sociology at Harvard University, Gary King, once says: “This is a revolution. Huge data resources allow each field to start the quantization process and whether academic sector, business or government—all areas will begin this process.” (Ling, Ni, & Anya, 2013). Can you imagine such a scenario would occur: “A Taobao seller, due to long-term poor business, is on the verge of collapse?” One day he suddenly received an email from Peking University,

“though your entrepreneurship does not go well, yet according to the analysis of vast amounts of data since your birth, if you go through targeted training in the literature department of our university, you have 80% chance to become a Nobel Prize winner.”

The seller logs into Peking University virtual classroom, pays tuition through Alipay, and then it immediately has a personalized menu and a variety of training course plans. He then begins a school career of Peking University in Chongqing. He does not need to go to Beijing, nor need to go to the classroom. He completes a variety of learning and exam anytime and anywhere through the network, and even Physical exercise is also at home and then he just submits data to the sports department of Peking University.” Some may say that this is nonsense and whimsical. However, doubters look at the simple applications of large data now and they can find it is amazing: Google can predict the spread of influenza from the search of users; Farecast (an American company engaged in big data analysis) system predicts the US domestic flight fares with nearly ten trillion price record and the accuracy rate is up to 75%; even when you bought a toothbrush in the morning on Tmall, Amazon or Dangdang online and in the afternoon the website would certainly recommend a tube of toothpaste or a bottle shampoo in the web page you are browsing; you randomly searched a message on Baidu; when you switch to other websites, there will be advertising information related to your search on Baidu. The Above many cases simply uses a very small part of the predictive capabilities of big data.

Therefore, in the era of big data, perhaps modern universities will be developed like this: There is no physical campus, no real building, no real teachers and students, and no everything in reality, and there is only a website and a huge network space as well as servers which keep roaring all day long. All of the teachers and students are linked up through the data. Let’s think about it: if Harvard, Yale, Oxford, Cambridge, Peking University, Tsinghua University and other universities around the world have become so because of big data, is this “a fortune or misfortune” for modern universities? Few people can accurately answer this question, because the development of times is often unpredictable. However, we can learn from the “4V” characteristics of big data and boldly speculate some changes in modern universities:

(a) Universities will win by relying on data volume rather than overall strength, which makes universities more targeted, but also makes educational resources more injustice. This aspect highlights the reformation of universities, while the balance of universities is broken.

The current modern universities stand out by their educational philosophy, fund investment, management system, teaching mode, research strength, faculty, student quality and many other factors. For universities in big

data era, these factors do not seem so important. The key of big data is who owns that data first and who has more data. If you grasp the “huge amount of data and the integrity of data”, then you have the “magic” to defeat the competitors. As for the later processing and analysis of data, you can just hand it over to professional companies. Can you imagine that Ma Huateng, Li Yanhong and Ma Yun operate world-class universities to train world-class talents? Not impossible, because they have a large amount of data. There is a very simple example. The chance for a kid who often adds to a technology QQ group, buy physical books and Baidu physical knowledge, to a certain extent, to become a physicist is higher than a kid who does not have the above mentioned hobbies, right? At present, the Big Data Project developed by Purdue University – “Course Signals”, is designed to track students’ academic progress and real-time remind students, one on one to help students to successfully complete courses. The school claims that students who used “course signals” system in the course have gained more B and C and fewer D and F in the assessment; in some courses, the number of students who get A and B has increased by 28%.

This poses a paradox. Is this going to make the distribution of educational resources more inequitable? If we know ahead of time through prediction that the child has potential to become famous, then whether would the educational resources be delivered with targets, and how can we talk about educational equity? In addition, since the top universities occupy more data sources, does it mean that their advantages will become increasingly obvious, and then they will naturally occupy other educational resources, coupled with the comprehensive promotion of digitalized teaching, geographical boundaries are completely broken. Yale, Oxford might occupy the student sources of Peking University and Tsinghua University, and Peking University and Tsinghua may occupy the resources of Chongqing University and Wuhan University.

(b) Universities will stand out by relying on data for variety rather than disciplinary advantages, which will make it easier for universities to establish superior disciplines, but also make some subjects disappear. This improves the adaptability of universities, but will have them to lose the charm of independence.

Big data technology can be applied to all walks of life. In macroeconomic aspect, Indiana University uses mood analysis tools provided by Google to sum up six types of mood from thousands of Internet messages and then to predict the change in the Dow Jones industrial index. The accuracy rate reaches 87%. In agriculture, there is a climate company in Silicon Valley which gets decades of weather data from the US Bureau of Meteorology and other database, makes precise charts of the relevant degree of the rainfall, temperature, soil conditions and crop yields over the years to predict the yields of a farm in the coming

year so as to sell personalized insurance to farmers. In business, based on Taobao trading conditions, Ali selects SMEs which are financially healthy and stress integrity of the enterprise, to grant them loans without guarantee. So far it has been lending more than 30 billion Yuan, and the bad debt is only 0.3%. In the field of education, all freshmen of Southwest University are required to fill in integration and lengthy psychological test scales online at the time of enrollment. If we superimpose the data with all other data about students obtained before and after they come to university, by mass and a wide variety of data to discover its inherent association, it is not impossible to build Psychology in Southwest University into a world-class advantageous discipline and it will no longer be a problem to predict the next college student who will jump from the building to commit suicide.

However, very unfortunately, after a lot of quantitative research and accurate quantitative analysis,

economics, political science, sociology, and many scientific fields in big data era are undergoing tremendous changes and development and even in essence, thereby affecting human's value system, knowledge system and lifestyles. The never ending debate of world Gnosticism and agnosticism in the history of philosophy will be transferred into specific issues in empirical science. Gnosticism is absolute, and there is nothing unknowable; agnosticism is relative, and it means we have not known yet.” (Mayer-Schönberger & Cukier, 2013, p.4)

Does this mean that some disciplines which take pursue and exploration as their purposes will lose their own significance and this will also mark the end of these disciplines?

(c) Universities will stand out by relying on data velocity rather than design in advance, which makes students more excellent while make students lose individuality. This highlights the guidance of modern universities, but makes reformation meaningless.

Modern universities are of reformation. Their innovations are reflected in many aspects. For example, for university training programs, every college, every major and even every class has a corresponding program. All these programs have been rigorously reviewed by teachers, experts, the college, the university and even the industry, and they also combine with the international and domestic situation. It should be said that they all have passed a thorough research and careful design in advance and will be modified in a year or six months. Even though they are so strict design, still there will appear more or less “individual differences”, and the development of students is uneven. In the era of big data, this situation might be broken. The school will be based on a lot of data collected on each student to develop a personalized training program and will adjust the program after and during school, and even after a lesson or from the new data reflected from students from time to time. A Canadian education technology company has launched a big data service project which based on a university

student's achievement data in the past predicts and improves their future academic performance. Eric Mazur, a physics professor at Harvard, uses the help of data in the classroom discussions to select the most suitable partner for student discussion. “Ask the system to analyze students' practice tests and other relevant data, and then combined with each student's seat, and send a similar note: ‘You and Smith (in front of you) and Johnson (on your left) discuss your problem’”.

Through such “fix of what lacks” and fast adjustment, will all the students become excellent and perfect? Is this going to make all students lose personality and they are all stereotyped without features? Perfect plus perfect often brings a very bad result, which perhaps is a disaster for the state, society, universities, and their families and themselves.

(d) Universities stand out by relying on the value of data rather than social responsibility, which reflects social service function and makes universities lose ethics. This will make the independence and balance of universities lose their value.

In big data era, modern universities can make every use of “value”: The use of interdisciplinary research, academic ability and scientific and technological advantages makes universities participate in more big data projects and receive more funds from government and enterprises, which fully reflects the social service function, but also virtually destroys the bottom line of “independence” and “balance” of modern universities.

If so, it would be the real “disaster” for universities to stand out by relying on data value rather than academics. Regardless of Plato's *Utopia*, Rousseau's *Emile* or Dewey's *Democracy and Education*, whether from the University of Bologna in medieval, University of Berlin in Germany, or the University of Oxford in England, whether from the Modern University Academic committee, the board system, or modern university charters, they all highlight the “supreme” status of “social responsibility” in modern universities. However, in the era of big data, government, society, enterprises and even universities are more concerned about the ultimately meaning and value of their own big data, that is to gain insights and value through the data, which will make universities become pure “value machine” and “utilitarian companies”. This is not much different from a business or a stakeholder entity. By this time, universities have been completely enslaved by interests. Are those academic fields which do not have data support or value going to fall down forever like a meteorite? “University autonomy” could be in better control of the government and enterprises; “academic freedom” has become an accessory of market economy; walking too much out of the “ivory tower” will may be a step away from ruining the “ivory tower”. If the time comes, it really is “the death of universities”!

With the advent of the era of big data, there is no one who can stop it, and it is impossible to stop it. It is

difficult to avoid the impact of it to modern universities. As educators, we can only be sensible to face it, objectively analyze it, have the courage to challenge, and use its advantages while avoiding its disadvantages and then we can ensure the healthy and scientific development of modern universities in the era of big data.

CONCLUSION

Whether the above discussion is a fantasy or not, whether the above discussion is alarmist or not, now big data has quietly come to the university, and it is slowly taking root, flowering and fruiting. More and more universities have begun to accept and use big data technology. We basically can draw the following conclusions:

a) The “4V” characteristics of big data, Volume, Variety, Velocity and Value, have a great impact on the modern university and some of the impact is even revolutionary, especially on traditional classrooms, traditional teaching models, traditional university systems, and traditional internal management of the university.

b) Under the impact of big data, modern universities pay more attention on “data”. In particular, the occupation and utilization of “data” in universities will be important merits to judge whether the university is good or bad. Multiversity has inherent advantages in this aspect, but it is undeniable that some special schools with characteristics will spring up and even produce far-reaching impact.

c) No matter what impact big data brings, modern universities should still maintain the balance between the role of “ivory tower” and “service station”. “Academic freedom” and “social responsibility” of universities should be better integrated and become a destiny community.

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