Chapter

CONSULTING AS A SERVICE - DEMONSTRATED BY CLOUD COMPUTING CONSULTANCY PROJECTS IN THE GREATER CHINA

Victor Chang
School of Computing, Creative Technologies and Engineering, Leeds Metropolitan University, Leeds, UK
Electronics and Computer Science, University of Southampton, Southampton, UK
V.I.Chang@leedsmet.ac.uk

ABSTRACT

The objective of this paper is to highlight Cloud Computing projects with the mutual interests of both mainland China and Taiwan, which present the a strong case of Consulting as a Service (CaaS) as an innovative way for generating profits and delivering services for clients. This paper explains the IT and Cloud development in the Greater China and presents three projects that Taiwanese have been involved in the design, implementation and research. The first project presents a case for Teradata and Shanghai Stock Exchange (SSE), where Taiwanese collaborators have been closely involved. The second project is about two sandstorm simulations in the Inner Mongolia of mainland China and investigates its impacts to the environment and health of the populations. The third project is the Universe Computing which responds to mainland China's call to develop space programme and to explore the unknown territory. Universe Computing includes simulations for satellite orbiting, galaxy formation and galaxy explosion. The author is an investigator for the second and third project and uses Cloud Computing Adoption Framework (CCAF) to design and deploy Software as a Service (SaaS) and Consulting as a Service (CaaS). Taiwanese research and development outputs have been influential to the IT development in the Greater China. This is important to move away any differences and work together to establish more and better research and development results to create a mutual win-win and maintain a high GDP growth.

Keywords:
Cloud Computing; Consulting as a Service; data services for Shanghai Stock Exchange (SSE); sandstorm simulations; Universe Computing; satellite orbiting, galaxy formation and

galaxy explosion; Cloud Computing Adoption Framework (CCAF); Taiwanese high-technology research and development for the Greater China.

1. INTRODUCTION

China became the world's second largest economy in 2010 and in the past ten years, its ranking moved all the way up surpassing a number of wealthy countries. Wang and Wheatley (2010) report that the outcome was due to hard work of the last three decades that turn successfully into economic growth. China, the Dragon in the East, have enjoyed a rapid growth in economic development with an average of 10% growth rate over the past thirty years (International Monetary Fund, 2011). The Economist (2011) predicts that in 2018, China will overtake the US in the GDP as the world's largest economy. In the survey conducted by the Economist (2011), their results show that China has surpassed America over half of twenty-one different indicators, including exports, fixed investment and manufacturing output. The rise of China is due to several factors and the effective development of information technology (IT) help to consolidate the economic growth, which is one of the 2012 national strategies set by the previous Chinese Prime Minister (CPM), Mr, Wen Jiabao (CPM national speech, 2012). Mr Wen Jiabao summarised that China's GDP reached 47.2 trillion yuan, an increase of 9.2% over the previous year; government revenue was 10.37 trillion yuan, an increase of 24.8%; and a total of 12.21 million new urban jobs were created. IT is the fifth national strategy identified by Mr Wen Jiabao and IT has helped China to achieve a brilliant record for economic development. IT provides a solid and well-establish infrastructure, so that organisations can perform their work efficiently, and communications between different companies are improved to ensure business agility and continuity in place. IT also supports the development of transportation systems, electric and power systems, telecommunication systems and information systems (IS) for several countries including China (Lall, 1992; Amin, 2004; Xu et al., 2007, Qiu, 2009), which brings additional benefits such as improvement in the quality of life, the development of new products and services and the stimulant to the economic growth (McIntyre, 2001; Wilson and Corey, 2008; Bernardez, 2009; Qiu, 2009; CPM national speech, 2012).

IT also offers new business models that have added values to the economic growth (McIntyre, 2001; Adekola and Sergi, 2007; Torun and Cicekci; 2007). This includes Business to Business (B2B), Business to Customers (B2C), Consumer to Business (C2B) and Consumer to Consumer Model (C2C). The internet dot-com companies such as Sina and Sohu have hundred of millions of readers and bloggers reading and writing on daily basis (Koepp, 2012). The Sina microblog (or weibo) is the most popular Chinese blogging community with hundreds of millions of users online on regular basis (Baran, 2011). The Alibaba is a successful e-commerce platform to provide B2B, B2C, C2B and C2C services. QQ is another internet service that provides millions of Chinese users in China and abroad to communicate with their family, friends, colleagues, business partners and institutions. Baidu is another giant search engine company and has been among the most popular search engines in China. Renren is another social-networking website for Chinese to stay in touch with their social and family contacts (Baran, 2011). China is also well-known as the world's manufacturer and distributor of different types of electronic products (Lüthje, 2004). This includes Apple products, which the research and development, product design, manufacturing

and product testing are largely made in Taiwan and China. There are also remarkable achievements from IT companies. HTC, a Taiwanese company manufacturing Android-based mobile phones, are one of the best-selling mobile phones in the world. Another example is Lenovo and Acer which always compete between third and fourth largest computer manufacturers in the world. Lenovo purchased the IBM Desktop division to strengthen its position to offer a wide range of quality products and services. Acer is another Taiwanese-based IT company with a variety of products and services on offer, and it has done better in laptops but weaker in desktops than Lenovo.

There are well-known software companies and services in the Greater China. One example is the security software industry which includes Trend Micro, a global software firm based in Taiwan. It has anti-virus to serve millions of global users around the world. Huawei is a network infrastructure company serving global users and offering consulting services to their client organisations (Inkpen and Ramaswamy, 2006). Gaming is another popular sector reporting to have billions of revenues. The establishment of internet infrastructure and services ensure a large percent of the population have access to the internet and can use internet for gaming and e-business. Popular games can attract millions of turnover per year and create generate revenues including start-up companies (Bhattacharya and Michael, 2008). Gaming has also extended to the mobile devices such as mobile phones and pads, so users can play games on their mobile devices. All these explain the role of IT is significant to China and is contributing to its GDP development (Qiu, 2009).

The objective of this paper is to highlight Cloud Computing projects with the mutual interests of both mainland China and Taiwan, and present all the projects as the case for Consulting as a Service (CaaS). Consulting services for Cloud Computing is not new. For example, consulting firms such as Accenture, PricewaterhouseCoopers, Deloitte and KPMG already have their Cloud consulting services for their clients. IT companies such as Google, Microsoft, IBM and Oracle offer different types of consulting services for a variety of sectors. Each consulting service has a different strength, and is suitable for different types of services and customers. For example, if a client requires a database-driven Cloud service, he is more likely to consult Oracle, or Google due to their reputation in software engineering. On the other hand, there are some local-based consulting firms such as in the Greater China, which are less well-known globally, but they are very competent, experienced and quick to respond to the market needs. Those locally-based firms can establish a good reputation in the local and regional market in the Greater China. This paper then describes consulting projects that those local-based firms have been involved. If any particular firm involved has concerns in revealing their identity, their names will not be mentioned, as the focus is on presenting Consulting as a Service as a useful strategy and implementation for delivering goods and services in the Greater China.

The structure of this paper is as follows. Section 2 explains Consulting as a Service (CaaS) and its elements. Three projects in regards to CaaS are presented in Section 3, 4 and 5 respectively. Section 3 presents a case for Teradata and Shanghai Stock Exchange (SSE), where Taiwanese collaborators have been closely involved. Section 4 describes a sandstorm simulation project that investigates the impacts to the Chinese citizen and the environment, which the author is lead investigator in his initiative. Section 5 demonstrates a Universe

Computing project to respond to China's space mission program that the author is an investigator in his initiative. Section 6 presents discussion topics in support with CaaS. Section 7 then sums up Conclusion and Future Work.

2. CONSULTING AS A SERVICE

This section presents Consulting as a Service (CaaS), and the three elements in association with the consulting model. The first element is the introduction of the framework to present the best practices. The second element is the summary of Taiwanese high-technology expertise.

2.1 Cloud Computing Adoption Framework Overview

There is an increased number of organisations which adopt Cloud Computing to consolidate resources, improves efficiency and reduce costs (Vouk, 2008; Chang et al. 2011 d). Organisational Cloud adoption has been confirmed to offer such benefits that Chang et al (2011 b; 2011 c; 2011 d) report to have different types of return on investment (ROI) for SAP, Vodafone/Apple, National Health Service (NHS) UK and University of Southampton under the recommendation of Cloud Computing Adoption Framework (CCAF). The use of CCAF is reported to provide added values for organisations that adopt Cloud, and resolve existing problems that those Cloud-adopting organisation needs to deal with in the process of using the Cloud. There are deliveries of services and projects presented as in Table 1.

Table 1: Deliveries of services and projects

Sectors or subjects	Summary of CCAF contributions	References
Finance	Demonstrate a platform to calculate more accurate computational and visualisations results for price and risk.	Chang et al (2010 ; 2011 a; 2013 a; 2014 b)
Healthcare	Develop a platform to manage and archive Big Data, and allow scientists to exchange and sue data swiftly and effectively. Use the platform to simulate proteins, tumours, brain imaging and genes.	Chang et al (2011 b; 2012 c; 2013 b); Chang (2013 e)
Education	Demonstrate Education as a Service (EaaS). Develop Cloud to save costs. Develop applications for learning.	Chang et al (2012 a; 2013 b)
Natural Science	Develop a platform to simulate tsunami and sandstorm	Chang (2011 a; 2011 b)
Interdisciplinary	Provide a platform for service integration to calculate prices and risks	Chang et al (2011 d; 2012 b); Chang (2013 a)

	in regard to taking each service. Provide a framework to disseminate good practices and recommendations	 Chang et al (2013 a; 2014 a)

All these successful deliveries of services support the case of CaaS, since each service has different requirements, designs and implementations. All lessons learned and recommendations are useful for stakeholders, organisations and individuals that plan to adopt and use Cloud Computing.

2.2 Contributions from Taiwanese research and development in the development of high-technology sector in China

Taiwanese research and development have been internationally well-known in some key areas such as Chemistry, Microelectronics, high-technology and so on. Dr Yuan Tseh Lee is the Nobel Laureate in Chemistry in 1986 for his contributions concerning the dynamics of the dynamics of chemical elementary processes. He is currently the Director of Academia Sinica, the highest level of research and development institute in Taiwan. In addition, computer and microelectronics manufacturing by Taiwanese is well-established in the world market. A vast number of good-quality computer components (such as mother boards, graphics cards and monitors) and computer equipment are manufactured by Taiwanese firms based in China which reflect their high number of outputs from the research and development. Foxconn is a Taiwanese firm setting up factories in China and is the main manufacturer for global computer brands such as Dell and Apple. Apple iPhones and iPads are the most well-known products and they have been successful helping Apple to maintain offering the most popular products and to generate billions of revenues. There are current Cloud services in Taiwan across different sectors and Cloud Computing plays a more important role in the strategic IT development for both Taiwan and China (Chandrasekaran and Kapoor, 2011). The Council for Economic Planning and Development (2011) in Taiwan set three major objectives which can be summed up as follows:

Autonomous Supply:
•Develop a full fledged Cloud ecosystem of service providers
• Improvement of Internet infrastructure
•Encourage R&D to introduce value-added services

Demand Creation:
•Adoption in the public sector – Government-to-Consumer (G2C), Government-to-Business (G2B) and Government-to-Government (G2G) services
•Promotion of adoption of Cloud services by the private sector by increasing local awareness levels.
•Promoting export of Cloud services.

Integrated Governance:

•Steering Committee for Development of the Cloud Computing Industry to handle coordination and implementation of policy.
•Cloud Computing Industry Promotion Office to help domestic companies.

Another example for Taiwan-led services includes the Supply Chain Cloud to manage the process of manufacturing, transportation and business sales between different provinces in China and then between China and Taiwan to reduce costs and improve business agility (Chu, 2008; IBM 2011). Three projects described between Section 3 and 5 demonstrate Consulting as a Service (CaaS) as a result of Taiwanese contributions and development.

3. CLOUD COMPUTING DEVELOPMENT IN CHINA – SHANGHAI STOCK EXCHANGE (SSE)

Shanghai Stock Exchange (SSE) is a vital part of mainland Chinese economic development, since it serves millions of clients and has a combined market capitalisation of RMB 18 trillion (an estimate of £1.8 trillion) (City of London Economic Development, 2010). Shanghai is equally important as Hong Kong and Tokyo as the centre for finance, economic and business development in Asia. Technology adopted by SSE is highly relevant to help SSE fulfil its ambition as one of the most popular and established financial centers in the world. Millions of data are used for information and also produced by real-time transactions. Values for high-quality information and reliable transactions are essential for all types of investors. In addition, SSE needs to develop new services to cope with increasing demands over agility, reliability, confidentiality and efficiency. Thus, the challenge is to build terabytes of data which can be accessed and used in real-time. This ensures SSE to play as a strategic role and finance and maintains its leading position in Asia.

3.1 The involvement with Teradata

Teradata is the contractor company for the SSE to develop terabytes of data, and started to build increasing amounts of data storage and real-time computing since 1990s. Teradata specialises in data warehousing, business intelligence, customer relationship management (CRM) and data integration. The author has an important Taiwanese collaborator, who is an ex-Vice President leading the software development and client support in the past twelve years. This section describes the contribution from Taiwanese-led team for SSE development since late 1990s. Their development has three key stages. The first stage began from 1990s to 2000 where the emphasis was to meet increasing demands of data usage and information processing. They built infrastructure, platform and software services to ensure data is accurate and up-to-date, and information can be retrieved and processed in real-time. This allows SSE to emerge as a prominent financial centre in Asia and the increasing stock market investment in China. The second key stage was between 2000 and 2007, where the emphasis was to improve existing infrastructures and ICT services and the overall quality of services. They also extended their data services into terabytes to allow the massive amount of information to be processed and displayed efficiently. They developed in-house data services to allow integrations of different requests and display of results.

Their third key stage began from 2007 to current period. Their emphasis is to ensure the better integrations of different services to allow their clients to perform a different type of tasks simultaneously. The use of Cloud computing resources can ensure clients can query their data while making another service requests, and can also review their real-time stock market index and advice to make a better judgement of their investments. The multi-tasking service ability can provide business added values such as agility, since the processing time for each service can be reduced. It also offers improvement of efficiency, since multiple services can be handled simultaneously and to allow their clients with additional business advantages. This is crucial for financial services since the capability to offer accurate and up-to-date real-time is essential (ObjectStore, 2008; Chang et al. 2011 a).

3.2 Technology behind SSE and Teradata

SSE began to adopt Teradata technology, which offers the following advantages:

- The database has no limit to the number of users.
- It has a great scalability and supports up to 100TB per database
- It can optimise performance and allows up to a maximum of 64 nodes per database server.
- It has an excellent visualisation capability and provides integrations with different services.

Teradata Relationship Database Management System (RDBMS) has two major components: Parsing Engine (PE) and Access Module Processor (AMP). AMP can read data from the magnetic stripes of the disks and make data into readable formats and put the data back to PE. PE optimises the tasks for AMP, instructs AMP to perform tasks, and processes the data to send back to the database tables. The teradata architecture is influential to the database optimisation. The functional architecture for teradata has three layers, which include infrastructure as a service (IaaS), platform as a service (PaaS) and Software as a Service (SaaS). Their IaaS layer includes a large number of services, which include disk array, operating systems, teradata RDBMS, Data mining and Online Transaction Processing (OLTP). All these features provide the fundamental requirements and functions for users. Their PaaS layer includes the following services: customer analysis, revenue analysis, product analysis, quality analysis, market analysis and marketing analysis. These PaaS services allow their clients to query the core functionalities and understand their business status based on feedback and results from their customers, revenues and market research. Their SaaS has two types of services. The first type of services is the advanced application services, which include loss of customer modelling, customer value modelling, customer confidence modelling, pricing modelling and product modelling. These functions are useful for the managers understand their strengths, weaknesses, opportunities and threats related to their businesses. The second type of services is the value-added SaaS services, which include fraud detection (Fraud 5.0), pre-product sales modelling (RPS 2.0), Customer Relationship Management (CRM 4.0), Performance Monitoring and Management (PM & M 3.0) and Collection 4.0. These additional services can ensure SSE clients to understand their business performances for different divisions. The use of Teradata ensures SSE can provide all types of information and data that clients demand in real-time (Teradata, 2006).

Consultancy and enterprise research contributions from Taiwanese-led team in the past twelve years are important to the database development to Teradata and SSE, since SSE requires a high-performing and accurate data for information exchange, processing and transactions. Their contributions also help their clients to have up-to-date data so that they can make a better decision about their investment.

4. SANDSTORM SIMULATION

China has experienced sandstorm over the decades and some provinces have suffered its destructive effects. The extent of such destructions has been increasingly severe due to climate change and the frequent human activities such as industrialisation and deforestation (Ci, 2001). The PRC Government has put in additional effort to reduce the level of destruction but the outcome does not have a significant difference (Wang and Chokkalingam, 2006). Sandstorm often occurs in spring, late summer and autumn in dessert, Inner Mongolia and neighboring provinces in the northeast and northwest of China (Ci, 2001; Liang, Eckstein and Liu, 2008). Sandstorm brings dryness, massive dust and poor visibility, which have related implications to health hazards including nausea, lung inflammation and so on (Health Effects Institute, 2004). In addition, sandstorm reduces the crop yielding and is a serious threat to the food sources to supply an approximate 1.3 billion population in China (Oxfam, 2009). Sandstorm simulations have great interests to PRC Government and scholars. Liu et al. (2007) have demonstrated their method of modelling and animating sandstorm based on their multiple-fluid model to simulate the motion of air, sand and dust particles. They explain how their 3D texture can work on Graphical Processing Unit (GPU) and also show screen-shots of several simulation results. They demonstrate how comparisons of different modelling outcomes between real and their simulation, and also between different levels of visibility. Zhang and Wang (2000) focus on their sandstorm simulations near Beijing area, and investigate its impacts based on their numerical model. They conclude their numerical model is useful to predict the movement and timing of the sandstorm formation near Beijing area. Sandstorm is not only an interest to Chinese scholars but also scholars from neighbouring countries such as Japan. Ministry of the Environment of Japan (2008) investigated the cause of sandstorms from Mongolia and China and its impacts to Japan. They showed their research methods and various numerical results of their investigations and summed up its impacts to Japan and proposed their monitoring system to track the sandstorm movement.

Sandstorm simulations and modelling are within interests of research communities in China and Japan, and different advanced techniques have been used. All these require years of training in order to investigate the impacts and understand the consequences caused by sandstorm. Advanced models are used to simulate sandstorm, including their formation, movement and levels of destructions. The use of Cloud applications and resources can open a new paradigm to the existing practices (Pandey, Karunamoorthy and Buyya, 2011). Chang (2011) explains how tsunami simulations can be achieved by using his Cloud applications to demonstrate all resources can be computed in the Cloud platform. Similarly, Cloud offers a platform to write, store, reuse and test code. Some software development done in the Japan tsunami project can be used for sandstorm investigation, although part of the code needs to be rewritten to convert them into easy-to-use commands. In the Cloud, there are unified

languages and tools to program software code for simulation. The easy-to-use commands can be used to demonstrate the sandstorm simulation which reduces the level of complexity to start with experiments and simulations. The CaaS project has developed his own private Cloud platform to run sandstorm simulations. The project lead and his team use Mathematica and MATLAB based platform for programming and simulations. The development team develops the commands to ensure one line of code can execute the software, which is equivalent to a few hundred lines of code. The development team runs their own Cloud resource to demonstrate sandstorm simulations and its impacts to the environments and health for residents.

Inner Mongolia and desserts in Mongolia are among places of origins in sandstorm formation and investigation on how and what leads to sandstorm can help scientists to find potential remedies. Figure 1 shows the sandstorm simulations in Inner Mongolia of China, where the sandstorm can be presented as waves of sand. The three dimensions of x, y and z-axis can demonstrate the scale of destruction, which is defined by the code. Technical details are not presented here due to the flavours of this journal.

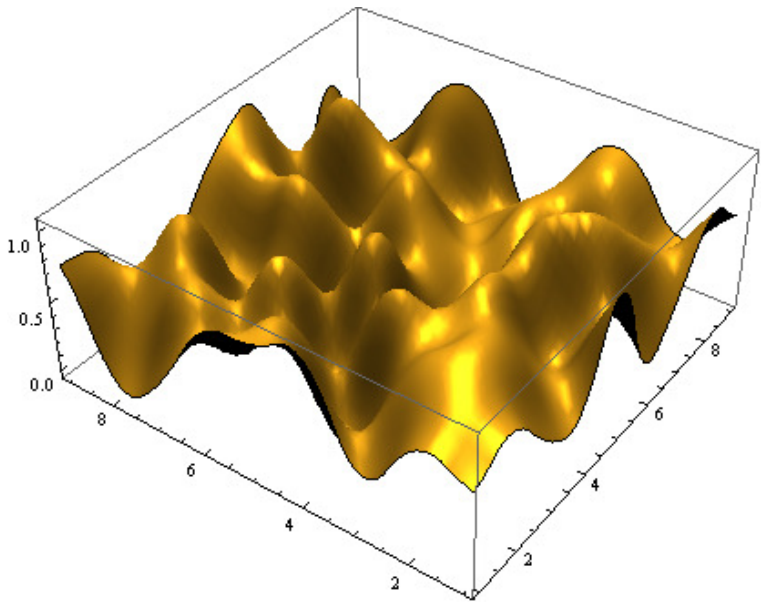

Figure 1: Sandstorm simulations in the Inner Mongolia

The next scenario is to simulate the extreme scale of sandstorm after twenty years due to severe deforestation and human activities against environment sustainability. Figure 2 shows the sandstorm when its scale of destruction has increased several times. The reason for doing so is to exploit the potential maximum level of destruction to the environment and the surrounding provinces. Results show that enforced protection on the environment and laws and investment in new technology are necessary to reduce the possibility of reaching this disaster scenario. Different scales of sandstorm simulations may help the scientists to understand the level of destruction when a sandstorm is formed and then investigates any methods to reduce its scale of destructions.

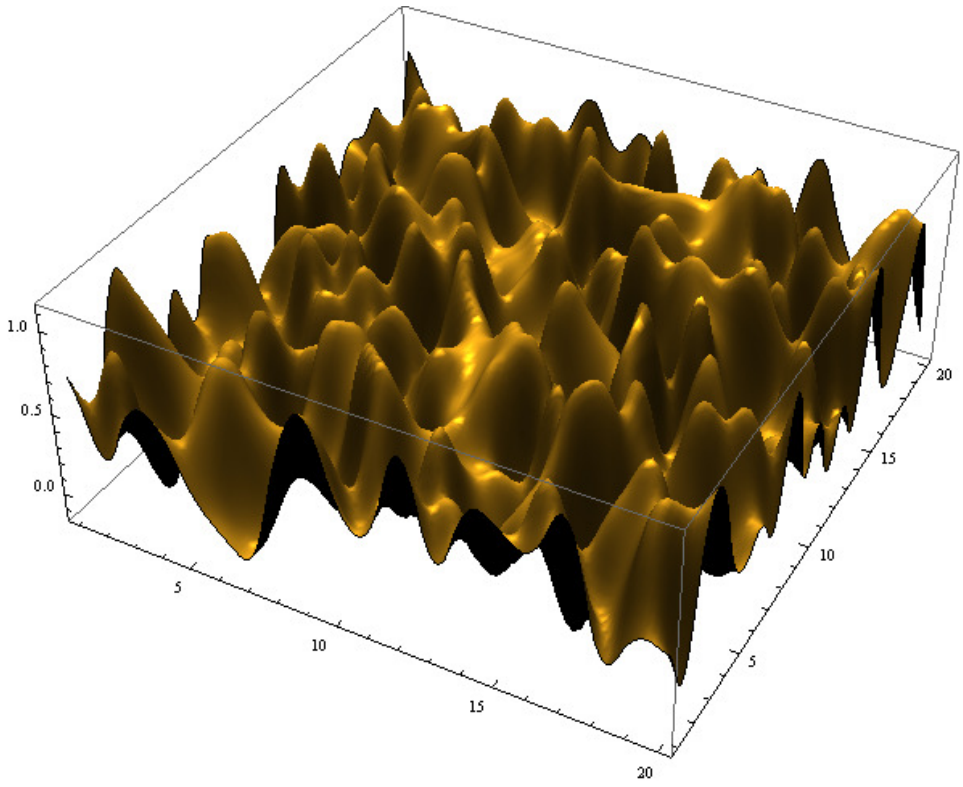

Figure 2: Sandstorm simulations in the Inner Mongolia 20 years later

5. UNIVERSE COMPUTING

China has the interest and ambition to become one of the most developed countries in the space technology and exploration. China successfully launched their space programmes in 2003, 2005 and 2008 respectively and China became the third country in the world to send astronauts into the space. Space technology is one of the national Chinese strategies and they have successfully launched satellites, rockets, and space station (Fisher, 2011). In 2011, China launched "Tiangong 1", a space laboratory module and a testbed demonstrate the capabilities of running a space station centre. This largely exceeded expectations from international communities including NASA, which refused to help China to launch a space programme and building of a space station at the beginning. China has plans to explore the unknown territories, which include understanding the universe and making simulations related to the universe (Dicken and Ormrod, 2007; Chen 2011; Fisher 2011). Space exploration can widen our knowledge, which includes speed of light by Einstein, Newton's theory of gravitation and black hole theory by Stephen Hawkins. Space exploration helps mankind to investigate any possibilities for human habitation, as NASA has identified potential planets, or Super Earth such as Kepler-10b.

Cloud Computing offers a unique role in space technology, as it can reduce the level of complexity and presents different types of modelling and simulations to assist space mission.

There are areas of interests such as satellite orbiting and galaxy formation and explosion. The use of GPU and Cloud computing resources can model 3D and 4D of the galaxy to make analysis easier for scientists. The satellite orbiting simulation can help to offer accurate calculations and precisions related to speed, angle and direction of satellite movement in the space. The author is the lead investigator in this Cloud initiative and has numerous good research outputs to disseminate. These include modelling and simulations for satellite orbiting, and galaxy formation and explosion in the use of advanced Cloud Computing techniques. Some examples are demonstrated as follows.

5.1 Satellite orbiting Saturn

Figure 3 shows the satellite orbiting the Saturn. This is to simulate the scenario where the PRC launches a successful space mission and the satellite is exploring other planets in the Solar system. It would be a remarkable achievement for the PRC Government if their satellite can travel beyond the Mars. Travelling to Saturn can symbolise their space mission success. The simulation is to model the way the satellite can perceive while orbiting the Saturn. The technology is based on Cloud Computing techniques which transform complex mathematical formulas into executing commands. This includes the orbiting movements and the vision that satellite can perceive. 3D visualisation offered by MATLAB and Mathematica can enhance the availability of satellite vision, which can be performed in real-time. Cloud Computing has reduced the level of complexity and there is less need to model intensive simulations based on orbiting movements.

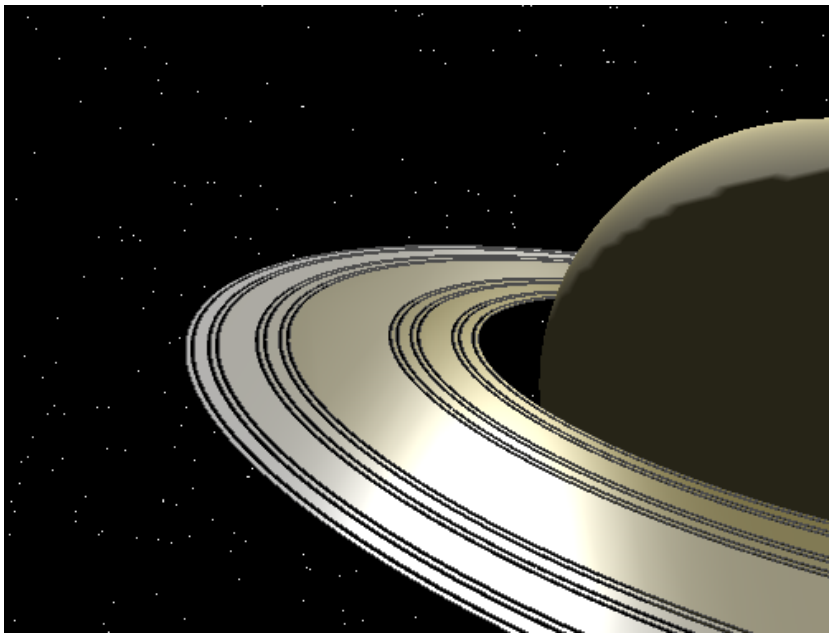

Figure 3: Simulations of Chinese satellite orbits the Saturn.

5.2 Simulations of the galaxy formation

The ultimate ambition of space mission is to explore our own and other galaxies. The travel between the Earth and any galaxies may take thousands of light years. Current human technology has the limitation of achieving so because current technology is unable to produce anything that can travel as fast as the speed of light. Hence, it becomes apparent if an established platform can model and simulate the formation of the galaxy without investing further in satellite exploration outside our Solar system. Investigating the formation of the galaxy is useful to understand the life span of the universe and how the origin of life began. This can help establish any links with existing literature and space programs. Figure 4 shows the formation of a galaxy. Cloud Computing offers a platform to compute galaxy and the use of GPU technology can ensure a high quality of galaxy modelling can be computed. There are commands developed for the Cloud Computing platform which translate complex algorithms into commands. These commands can use GPU for advanced graphical modelling and then compute 3D simulation of the galaxy.

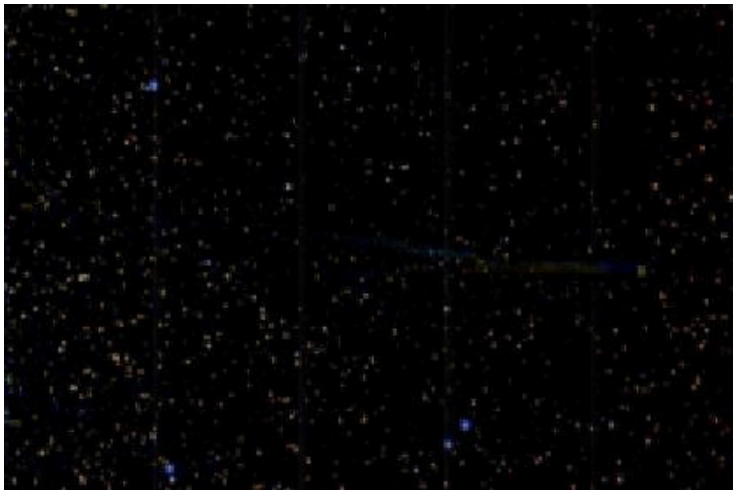

Figure 4: Simulations of galaxy formation

5.3 Simulations of the galaxy explosion

There are always different debates about the origin of life and the scientists led by Stephen Hawkings believe the Big Bang theory. However, how the universe was formed and how life began are still controversial, and there are scientists who believe in God to defend their faith and explain how science and creation can co-exist (Lehrman, 2008, Lennox, 2010). The intellectual challenge for this project is to model the explosion of the universe and the galaxy, so that simulations can be computed to understand how this happens and any useful observations when it happens. Cloud Computing offers a unique platform to compute complex models and can use the GPU to optimise the graphical processing capabilities. Special commands are developed to make the simulations as accurate and interactive as possible. When any key elements are changed, the graphical outputs will be dynamically

changed. See Figure 5 for the demonstration. This mini-project helps researchers to understand how, why and what makes the galaxy explosion. The explosion of the universe and galaxies can be presented at any stage and results can be extremely helpful to demonstrate the added value for astronomical research. Results of the research outcomes can be relevant to space science and high performance computing communities in the Greater China and the United Kingdom.

Cloud Computing offers a platform and resource to open up possibilities to compute advanced modelling, which was expensive and difficult to achieve in the past. There is no need to buy, organise and manage thousands of computers for high-demand processing of client-server requests and applications. The use of Cloud Computing can ensure similar type of experiments and modelling can be achieved in a smaller scale.

Figure 5: Simulations of galaxy explosion

The next scenario is to simulate the extreme scale of sandstorm after twenty years due to severe deforestation and human activities against environment sustainability. Figure 2 shows the sandstorm when its scale of destruction has increased several times. The reason for doing so is to exploit the potential maximum level of destruction to the environment and the surrounding provinces. Results show that enforced protection on the environment and laws and investment in new technology are necessary to reduce the possibility of reaching this disaster scenario. Different scales of sandstorm simulations may help the scientists to understand the level of destruction when a sandstorm is formed and then investigates any methods to reduce its scale of destructions.

6. DISCUSSIONS

There are two topics for discussions. The first topic is about the use of a recommended framework to design and deploy these services, and the second topic is the added values from these three projects from Taiwanese contributions.

6.1 The role of Cloud Computing Adoption Framework (CCAF)

There is an increased number of organisations adopts Cloud Computing to consolidate resources, improves efficiency and reduce costs (Vouk, 2008; Chang et al. 2011 d). Organisational Cloud adoption has been confirmed to offer such benefits that Chang et al (2011 b; 2011 c; 2011 d) report to have different types of return on investment (ROI) for SAP, Vodafone/Apple, National Health Service (NHS) UK and University of Southampton under the recommendation of Cloud Computing Adoption Framework (CCAF). CCAF is a dynamic framework to help organisations to achieve good design, deployment and services for organisational Cloud adoption. It has several case studies to demonstrate the benefits and added values for organizational Cloud adoption. CCAF has three key areas and the one relates to this paper is Portability, which defines the migration of services from desktops to Clouds and between Clouds. There are two types of Portability – the first type is the migration of the existing services and the second type is the design and deployment of a completely new service. The last two projects in this paper have been designed and completed in the recommendation of CCAF. The SSE data services belong to the first type of portability and their services have been migrated a while ago. Both sandstorm simulations and Universe Computing belong to the second type of the portability that are completely designed and deployed from the very beginning of the software life cycle by the author. Comparing with two types of portability, new Cloud development has the advantages over migration of existing services as follows:

1. There is no need to design new functions and update existing functions for Cloud portability: Applications are designed and built from the beginning of the software life cycle and functions are consistent throughout the software life cycle. There is no need to introduce new functions or update existing functions as a result of change in software requirements due to portability.

2. There is a greater consistency in the software as a service: The new services are designed, built and tested on the Cloud throughout the software engineering and IT management life cycle. There is a greater consistency and synchronisation, and there is no need to perform tasks at different locations of the system and then move the results over like some Cloud software do. This is helpful in the case when the user requirements evolve from time to time, since there is no need to write additional software to meet new user demands.

.

CCAF is instrumental in designing and building different types of software for different sectors. Chang et al (2011 a) have demonstrated financial portability with IBM US and Commonwealth Bank of Australia (CBA), and they have used Least Square Method (LSM) of the Monte Carlo Simulation and Black Scholes Model (BSM) to calculate the best pricing and risk values from the results of up to 100,000 simulations. Results have been helpful to

financial services and a few such as CBA have considered adoption. Academia Sinica has also adopted financial portability similar to approach recommended by CCAF and they have disseminated their publication to Taiwanese research and banking community (Peng et al., 2012). Chang (2011) also presents his Cloud portability in tsunami and seismic simulations to investigate the tsunami impacts to Japan in 2011 in the United Nations (UN) Information Society Forum. Results have been helpful to the UN authority and Japan delegates. This research is relevant to Taiwan due to the similarity in geographical and ecological factors that both Taiwan and Japan are located at the earthquake and typhoon zones.

6.2 The added values from these three projects as a result of Taiwanese contributions

Taiwanese research and development outputs have been influential to the IT development in the Greater China. The phenomenon contributions include microelectronics and computer manufacturing industry that contributes to the GDP growth and job creation in China. Advanced technology products and services described in this paper have highlighted its strategic importance to long-term IT development. Data services for SSE are significant to the economy in China. The sandstorm simulation is highly relevant to investigate its impacts to our weather, environments and the health of the populations. The implications and outcomes from sandstorm simulations are not only useful for scientific research but also are relevant to the national strategy of the People's Republic of China (PRC) government to reduce impacts caused by natural disasters. The Universe Computing is a testbed for simulations in regard to the PRC's plan of its space programme and the exploration of the Universe. Cloud Computing offers a platform to simulate satellite orbiting other planets such as Saturn. Formation and explosion of galaxies help scientists to understand the origins of the life and how the galaxies can interact. These simulations and modelling with advanced technology and techniques are useful for our IT development and creation of new knowledge.

6.3 Consulting as a Service (CaaS) – successful lessons to be reproduced in European projects

Reproducibility is an important aspect in Science to ensure that the steps and processes involved in the design and deployment of Cloud services can be reproduced at another environment to get similar results. Reproducibility can ensure the lessons learned and recommendations can be available to Cloud-adopting organisations, including the European projects. There are similarities between European projects and these consulting firms described as follows. Firstly, these projects are research and development focused, with the similar objectives to explore the unknown, provide recommendations and solutions and improve the conditions of current practices. Secondly, these consulting projects can generate incomes in the long-term. The first project in regard to SSE can have a direct impact to the economy in China. The second project helps the Chinese population calculate the extent of damage caused by the sandstorm, and can provide a higher accuracy to do sufficient preventive measures in order to save costs as a result of over destructions. The third project can provide a testbed to simulate an unknown territory. Exploring the unknown with a higher accuracy rate can save the space authority costs of running its operational activities. The use of CaaS can provide strong cases for funded European projects.

7. CONCLUSION AND FUTURE WORK

The objective of this paper is to present Consulting as a Service (CaaS) and use Cloud Computing consulting projects with the mutual interests of both mainland China and Taiwan as an example. This paper supports contributions offered by Cloud Computing to the IT development in the Greater China and presents three projects that Taiwanese have been involved in the design, implementation and research. The first project presents a case for Teradata and Shanghai Stock Exchange (SSE), where Taiwanese collaborators have been closely involved. SSE requires a high-performing and accurate data for information exchange, processing and transactions. CaaS contributions help their clients have up-to-date data to improve business agility, so that client companies can make better decisions about their investment. The second project to support CaaS is the sandstorm simulations in mainland China, which investigates its impacts to the environment and health of the populations. Sandstorm brings dryness, massive dust and poor visibility, which have related implications to health hazards. Cloud Computing offers a platform to understand the extent of destruction and to find any remedies for improvements. Two scenarios of sandstorm simulations in Inner Mongolia of China are presented. The first simulation symbolises the current status of sandstorm formation and the scale of destruction. The second simulation shows the extreme scale of sandstorm after twenty years due to severe deforestation and human activities against environment sustainability. Results show that enforced protection on the environment and laws and investment in new technology are necessary to reduce the possibility of reaching this disaster scenario. Space simulations by Cloud Computing offer opportunities to understand more about the unknown in space, and the one of the PRC Chinese strategies and they have successfully launched satellites, rockets, and space station.

The third project is the Universe Computing which responds to mainland China's call to develop simulation testbeds in space programme and to explore the unknown territory. Cloud Computing offers a unique platform for space simulations, as it can reduce the level of complexity and presents different types of modelling and simulations to assist space mission. The use of GPU and Cloud computing resources can model 3D and 4D of the galaxy to make analysis easier for scientists. There are three mini projects under Universe Computing. The first mini-project is to simulate the way the satellite can perceive while orbiting the Saturn. The objective is to calculate the orbiting movement while surrounding other planets such as Saturn and the view that satellite can perceive. The second mini-project is a simulation of galaxy formation modelled by Cloud Computing. Investigating the formation of the galaxy is useful to understand the life span of the universe and how the origin of life began. The third mini-project is the explosion of the universe and the galaxy. Simulations make full use of GPU for dynamic graphical processing. The explosion of the universe and galaxies can be presented at any stage and can be extremely helpful to demonstrate the added value to astronomical research. Results of the research outcomes can be relevant to the space science community in the Greater China and the European Union including Britain. The use of CCAF is instrumental for the sandstorm simulation and Universe Computing projects. CCAF is useful for Cloud computing development and portability, and ensures there is a greater consistency in software functionality and a better match to user requirements.

Taiwanese research and development outputs have been influential to the IT development in the Greater China. This is important to move away any differences and work together to establish more and better research and development results. Taiwanese firms such as HTC, Acer, Foxconn, Eva Air, Want-want and so on have gained economic revenues through 1992-consensus. This strategy is not only on politics and economic development but should also be extended to research and development, as there are not many Taiwanese-led high-technology research projects focusing on Greater China's interests. These include Cloud Computing, which offers a platform to improve efficiency, reduce costs, consolidate resources, provide added values and contribute to research with national interests and commercial values. More advanced research in sandstorm simulation and Universe Computing will continue, and collaboration with elite scientists and well-known institutions are welcome to further establish research records and quality of results. The win-win outcome will be a phenomenon similar to mainland China's rapid GDP growth when more collaboration, funding, research investment and support are available to ensure the world-class research outputs can be produced and disseminated in the Greater China.

ACKNOWLEDGEMENT

We thank that Mr Simon Yang, the ex-Vice President of the Teradata, for his information, assistance and collaboration. Some information is not available to the public, so that there is no any diagram to show the architecture and deployment scenario related to Teradata and Shanghai Stock Exchange.

REFERENCES**

Adekola, A. and Sergi, B. S. (2007), Global Business Management: A Cross-Cultural Perspective, Ashgate Publishing, ISBN: 978-0-7546-7112 1, Copyright.

Amin, M. (2004), Balancing Market Priorities with Security, IEEE power and energy magazine, July/August edition.

Bhattacharya, A. K., Michael, D. M. (2008), How Local Companies Keep Multinationals at Bay, Harvard Business Review, March.

Baran, R. (2011), Social Networking in China and the United States: Opportunities for New Marketing Strategy and Customer Relationship Management, AFBE Journal, Volume 4, No. 3, December.

Bernardez, M. (2009), The power of entrepreneurial ecosystems: extracting booms from busts, Working paper, Expert2Business, 2009.

Chandrasekaran, A., Kapoor, M. (2011), State of Cloud Computing in the Public Sector – A Strategic analysis of the business case and overview of initiatives across Asia Pacific, Frost & Sullivan Consulting Market Insight.

Chang, V., Wills, G., De Roure, D., Chee, C. (2010), Investigating the Cloud Computing Business Framework - modelling and benchmarking of financial assets and job submissions in clouds, In UK e-Science All Hands Meeting 2010 "Research Clouds: Hype or Reality?, Workshop, 13 - 16 Sep., Cardiff, UK.

Chang, V., Li, C. S., De Roure, D., Wills, G., Walters, R., Chee, C. (2011 a), The Financial Clouds Review, International Journal of Cloud Applications and Computing, 1 (2), pp. 41-63. ISSN 2156-1834, eISSN 2156-1826.

Chang, V., De Roure, D., Wills, G., Walters, R. (2011 b), T., Organisational Sustainability Modelling for Return on Investment: Case Studies presented by a National Health Service (NHS) Trust UK, Journal of Computing and Information Technology, 19 (3). ISSN Print ISSN 1330-1136 | Online ISSN 1846-3908.

Chang, V., De Roure, D., Wills, G., Walters, R. (2011 c), Case Studies and Organisational Sustainability Modelling presented by Cloud Computing Business Framework, International Journal of Web Services Research. ISSN 1545-7362.

Chang, V., Wills, G., Walters, R. (2011 d), Towards Business Integration as a Service 2.0 (BIaaS 2.0), In: IEEE International Conference on e-Business Engineering, The 3rd International Workshop on Cloud Services - Platform Accelerating e-Business, 19-21 October, Beijing, China.

Chang, V. (2011 a), A thorough investigation of Cloud Computing: Sustainability Modelling and Enterprise Portability for Industry and Academia. At "Set for Britain" 2011, The House of Commons, The Parliament, UK.

Chang, V. (2011 b), Cloud Computing: Tsunami and seismic simulations to study impacts to Japan. At United Nations World Summit Information Society, Geneva, Switzerland, 16 - 20 May 2011 (Chang, 2011 b).

Chang, V., Wills, G., Walters, R., Currie, W. (2012 a), Towards a structured Cloud ROI: The University of Southampton cost-saving and user satisfaction case studies, In Sustainable ICTs and Management Systems for Green Computing, IGI Global, page 179-200.

Chang, V., Walters, R. J., Wills, G. (2012 b), Business Integration as a Service, International Journal of Cloud Applications and Computing, 2, (1), 16-40.

Chang, V., Walters, R. J., Wills, G. (2012), Cloud Storage in a private cloud deployment: Lessons for Data Intensive research.. In The second international conference on Cloud Computing and Service Sciences (CLOSER 2012), April, Porto, Portugal.

Chang, V., Walters, R. J., Wills, G. (2013 a), The development that leads to the Cloud Computing Business Framework, International Journal of Information Management, 33 (3), June.

Chang, V., Walters, R.J., Wills, G. (2013 b), Cloud Storage and Bioinformatics in a private cloud deployment: Lessons for Data Intensive research. In Cloud Computing and Service Science, Springer Lecture Notes Series, Springer Book.

Chang, V. and Wills, G. (2013 c) A University of Greenwich Case Study of Cloud Computing – Education as a Service. In, E-Logistics and E-Supply Chain Management: Applications for Evolving Business, IGI Global.

Chang, V. (2013 a), Business integration as a service: computational risk analysis for small and medium enterprises adopting SAP, International Journal of Next-Generation Computing, 4, (3).

Chang, V. (2013 b), Brain Segmentation – A Case study of Biomedical Cloud Computing for Education and Research. In Learning Technologies Workshop, Higher Education Academy (HEA), University of Greenwich, June.

Chang, V. (2013 c), Cloud Computing for brain segmentation technology. In IEEE CloudCom 2013, 02 - 05 Dec, Bristol, UK.

Chang, V. (2013 d), Cloud Bioinformatics in a private cloud deployment. In Advancing Medical Practice through Technology: Applications for Healthcare Delivery, Management, and Quality, IGI Global.

Chang, V. (2013 e), Business Integration as a Service: The Case Study of the University of Southampton. In, Trends in E-Business, E-Services, and E-Commerce: Impact of Technology on Goods, Services, and Business Transactions., IGI Global.

Chang, V., Walters, R.J., Wills, G. (2014 a), Review of Cloud Computing and existing Frameworks for adoption, Advances in Cloud Computing Research, Nova Publishers.

Chang, V., Walters, R.J., Wills, G (2014 b), Financial Clouds and modelling offered by Cloud Computing Adoption Frameworks, Advances in Cloud Computing Research, Nova Publishers.

Chen, H. (2011), Large Research Infrastructures Development in China: A Roadmap to 2050, Book, ISBN 978-642-19367-5, Springer.

Chinese Prime Minister's national speech (2012), available on Chinese government portal (http://english.gov.cn), March.

Chu, A. (2008), Doing business in a changing China, PwC white paper , Issue 13 reprint, China-US Business Services.

Ci, L. (2001), Disasters of Strong Sandstorms over large areas and the spread of land desertification in China, Chapter Ten, Book Chapter, China's Experience with Calamitous Sand-dust Storms.

City of London Economic Development (2010), The Shanghai International Board: Challenges and Opportunities, Government Report prepared for the City of London Corporation by Trusted Sources, June.

Council for Economic Planning and Development (2011), Cloud Computing – Taiwan's Next Trillion Industry, strategic paper and government official announcement, Taiwan.

Dickens, P., Ormrod, J. (2007), Towards a sociology of the universe, ISBN 0-2-3-94150-0, printed by Rouledge.

The Economist (2011), The dating game: We invite you to predict when China will overtake America, special edition, December 27th.

Fisher, R. (2011), China's Space Plane Program, Research Article, International Assessment and Strategy Center, July.

Health Effects Institute (2004), Health Effects of Outdoor Air Pollution in Developing Countries of Asia: A Literature Review, Special Report, April.

IBM white paper (2011), A Chinese municipal government delivers service in the cloud: IBM WebSphere CloudBurst and IBM Rational help reduce data center overhead, white paper, December.

Inkpen, A., Ramaswamy, K. (2006), Global Strategy: Creating and Sustaining Advantage Across Borders, Oxford University Press, ISBN: 978-0-19-516720-7, Copyright.

International Monetary Fund (IMF) report (2011), World Economic Outlook Database, IMF Edition, September.

Lall, S. (1992), Technological Capabilities and Industrialization, World Development, Volume 20, Number2, page 165-186.

Lehrman, S. (2008), The Christian Man's Evolution: How Darwinism and Faith Can Coexist, article, Scientific American, November 2008.

Lennox, J. (2010), As a scientist I'm certain Stephen Hawking is wrong. You can't explain the universe without God, article, Mail Online, September.

Liang, E, Eckstein, D., Liu, H. (2008), Climate-growth relationships of relict Pinus tabulaeformis at the northern limit of its natural distribution in northern China, Journal of Vegetation Science 19: 393-406, March.

Liu, S., Wang, Z., Gong, Z., Huang, L., Peng, Q. (2007), Physically based animation of sandstorm, Computer Animation and Virtual Worlds, Comp. Anim. Virtual Worlds; 18: 259–269.

Lüthje, B. (2004), Global Production Networks and Industrial Upgrading in China: The Case of Electronics Contract Manufacturing, Working paper, No. 74, East-West Working Center, Honolulu, Hawaii.

Koepp, R. W. (2012), Betting on China, John Wiley and Sons, ISBN 978-1-118-08716-9, Singapore, copyright.

Lehrman, S. (2008), The Christian Man's Evolution: How Darwinism and Faith Can Coexist, article, Scientific American, November.

Ministry of the Environment Japan (2008), Dust and Sandstorm, scientific article.

ObjectStore White Paper (2008), Real-Time Data Caching for Enterprise Applications.

Oxfam Briefing Paper (2009), Suffering the Science: Climate change, people and poverty, Oxfam International, July.

Pandey, S., Karunamoorthy, D., Buyya, R. (2011), Workflow Engine for Clouds, Chapter 12, Cloud Computing: Principles and Paradigms, ISBN-13: 978-0470887998, Wiley Press, February.

Peng, H.T., Chang, C.F., Liao, S.L., Liao, M.Y., Lai, F., Ho, J.M. (2012), The Development of a Real-time Valuation Service of Financial Derivatives, IEEE Computational Intelligence for Financial Engineering and Economics, March 29-30, New York City, USA.

Qiu, J. L. (2009), Working-Class Network Society, Communication Technology and the Information Have-Less in Urban China, ISBN: 978-0-262-17006-2, The MIT Press.

Teradata (2006), Introduction to Teradata Warehouse, User Guide, September.

Torun, H., Cicekci, C. (2007), Innovation: Is the Engine or the Economic Growth?, Working Paper, Ege University, Turkey, April.

Vouk, M. A. (2008), Cloud Computing – Issues, Research and Implementations, Journal of Computing and Information Technology - CIT 16, page 235–246, Volume 4.

Wang, A., Wheatley, A. (2010), China overtakes Japan as No.2 economy: FX chief, special column article, Reuters, June.

Wang, C.F., Chokkalingam, U. (2006), National Overview, Chapter 2, Book Chapter, Learning lessons from China's forest rehabilitation efforts.

Wilson, M., Corey, K. E. (2008), Global Positioning: Strategic Planning for Urban Competitiveness, Working Paper, Urban Policy Research Series, Michigan State University.

Xu, G..X.; Liu, J.H.; Tao, Z.H. And Li, X.C (2007), The Research and Development of the Highway's Electronic Toll Collection System, World Academy of Science, Engineering and Technology, Issue 31, July.

Zhang X.L., Wang Y.C. (2001), Weather analysis and numerical simulation of sandstorm in Beijing area, Gansu Meteorology Journal, Beijing Institute of Meteorological Science, Beijing, China.