

A DESKTOP STUDY OF TRENDS IN COMPUTING AND ASSOCIATED BUSINESS MODELS

BOUBA DIEMÉ

University of Pretoria, Department of Engineering and Technology Management, Graduate School of
Technology Management, South Africa
boubadieme@gmail.com / u04301900@tuks.co.za

JOE AMADI-ECHENDU

University of Pretoria, Department of Engineering and Technology Management, Graduate School of
Technology Management, South Africa
joe.amadi-echendu@up.ac.za

Copyright © 2015 by the University of Pretoria. Permission granted to IAMOT to publish and use.

ABSTRACT

Important changes and developments in the ICT industry affect businesses worldwide. Predominantly, the industry has been undergoing much consolidation and convergence, in addition to the arrival of new business models. Beyond business growth, ICT has been providing opportunities to pursue new technological and business directions.

The rise of mobility, social networking, big data analytics and cloud computing are such changes and developments. Cloud computing, the new architecture for delivering ICT services, has proven to foster technological and economic growth, whilst causing markets disruptions across the world through the way ICT is consumed. It is enabling solutions and services with improved efficiency and productivity in many occupation areas like healthcare, education or financial services.

This paper provides a review of trends in ICT and includes a survey of industry practitioners with particular emphasis on emerging new business models for services provisioning.

Key words: ICT, Technology trends, Cloud computing, Technology-driven business models

INTRODUCTION

Over the past decade, cloud computing has emerged as a leading ICT trend. It enables an efficient and flexible way to acquire and deliver services. For instance, it is possible to both store and share information anywhere there is an internet connection, regardless of the device type.

An increasing number of business solutions are now cloud-based applications, for customer relationship management, human resources, accounting, office communications and more. These applications sit on distant distributed systems at times owned and operated by third parties, reached through an internet portal. It provides savings in terms of cost, ownership and resources.

Cloud services are not only associated with opportunities and growth, they are also becoming part of the core operations of businesses. Thus, it is important to understand how it has evolved particularly from a technological management perspective. Further, it is essential to have a view of the evolving landscape for the users and businesses. This is what this study attempted to understand.

For that reason, a desktop study of trends in computing and associated business models was conducted, it specifically sought to uncover:

- i. Key ICT trends and developments that will be significant in the future,
- ii. The extent to which computing services will evolve and impact businesses, and
- iii. How relevant technologies, services and offerings in computing relate to each other and to the ICT industry in the years to come.

RESEARCH METHODOLOGY

In order to fulfil the goals of the research, a qualitative, analytical-descriptive model using a narrative inquiry was selected. After a literature review, semi-structured interviews in combination with observations and analysis were conducted.

Data gathering process

The researcher studied articles, publications from academia and industry and other primary data, following this process outlined below.

Scanning

Scanning of the trends was conducted. Starting with a search using keywords such as trend, development, technology, change, cloud computing... within ICT and other industries.

Monitoring

During the research, each key trend was analysed and the researcher monitored these trends. Finally, the background and the motivation for each key trend were examined.

Forecasting

Key trends are recognized and predictions are then made, followed by an analysis of their impact.

Assessment

In this last stage, the importance of each trend was determined in relation to the industry.

Identification of the participants

ICT and cloud computing services concern everybody and numerous experts are found in various industries. Seeing that a full enquiry was not feasible due to time and budget limitations. Thus, key areas and representative industry leaders were identified after the literature review. The research participants were interviewed in relation to the findings from literature.

Interview questions

The interview questions developed were as follows:

- i. What are the key ICT trends and developments and how would they influence the industry?
- ii. What are the key cloud trends and how would they influence the industry?
- iii. What are the implications of the above on the ICT and cloud industries, respectively?

- iv. What changes could we expect to see in both cloud computing and the ICT industry?
- v. What are the upcoming important cloud computing technological changes to look out for?

LITERATURE REVIEW

In just a few decades, ICT has developed to become part of almost every occupation, propelled by massive technological progress such as digital processing and pervasive networking. ICT has changed the way people and businesses communicate, work, travel and live. It has led to a reorganisation of businesses along with a rise in productivity and collaboration. Starting with the exploration of current technology and innovation trends, the following provides a review of the trends from both academic and industry sources:

Important paradigm shifts in ICT

The following lists the major paradigm shifts noticeable within the ICT environment:

- i. Everywhere in the world, a favourable regulatory climate for growth is being put in place. Moreover, there is a new focus to invest with a total life cycle and future-proofing mind-set.
- ii. Nowadays, consumers have a higher level of awareness of ICT, forcing technologies and service providers to think and behave differently (Hinchcliffe, 2009). In the past, the technology side led market changes. As consumers become better informed, their needs and preferences drive the technology advances and innovations.
- iii. With better knowledge and awareness levels, there is a fundamental shift in how consumers approach ICT. Every business needs ICT, they all need to become 'digital' (Accenture Technology Vision, 2013). Cloud computing is expected to play a major role in this.
- iv. Technology is no longer the limiting factor; it is the strategic foresight of the company. Solutions must not only comply with standards and functions to satisfaction, they must help fulfil the business goals and needs.
- v. The business ecosystems are becoming more complex and there is an acceleration of the adoption of business-ready, self-service devices (mobile or not) and apps.
- vi. 'Consumeration' of IT and an explosion of data are taking place due to the proliferation of devices, apps, and devices deployed and connected to the internet. Delivery platforms are shifting towards mobile, social, hosted software, real time and cloud computing.
- vii. Communication and collaboration channels are being reinvented.
- viii. There is a global growth in data usage, which requires convergence and faster connectivity.

Underpinning the above are changes and improvements in functionalities that have fuelled major quality and productivity gains, followed by a transformation in industries and areas of social interaction. Mobility and cloud computing exemplify these changes.

Key trends and developments in ICT

The key ICT trends have been identified as follows:

The growth in the number of people and assets connected

The advances in the domain of networks and equipment, particularly in terms of speed, coverage and availability, has allowed an unexpected growth in the number of people connected and the connection of assets, the internet of things (Frost and Sullivan, 2011).

Pervasive computing and mobility - the new imperative

Developments in mobile offerings and data communication have propelled computing to become pervasive and impose mobility as the new imperative. In fact, the mobile internet, new mobile devices, applications, and new standards of networks such as the 4th generation (4G) mobile networks have been precursors (PwC Global Digital IQ Survey, 2013).

One other factor has been social networking, which are even used in corporate environment as new collaboration tools. Mobility and social networking have led to new phenomena such as bring your own device (BYOD), where workers bring their own personal devices to work and provision must be made for it by the IT team (North Texas Industry Thought Leaders, 2013:5).

Big data mining and analytics

To make better decisions, enterprises now need to manage their data and content more efficiently. The volume of information and data are such that important tools are required for data management and data visualisation, through multiple dimensions of data. In addition, simulation and scenario modelling are used to test and make decisions. These further improve collaboration internally and externally with customers (Burrus, 2012).

Gaming and gamification

“Gamification is a tool to design behaviours, develop skills and enable innovation” Gartner (2012). Gaming is being leveraged to transform how businesses and areas like medicine are done (Hawkins, 2010 and Deloitte, 2012).

Uniform experience and convergence

Users demand a uniform and seamless experience (Hinchcliffe, 2009). In addition, convergence across devices, networks and platforms is required. The latter between mobile voice and IP networks seems to be finally taking off, significantly affecting individual industries and reshaping some others.

Cloud computing

The uptake of cloud services has been on the rise. “This change has led to a wave of new capabilities delivered as services, including software, infrastructure, platform, applications and content” (McKinsey Quarterly, 2010). As a result, cloud holds the potential to significantly affect businesses.

What is cloud computing?

Cloud computing platforms build on previous platform generations as shown in Figure 1, with a fundamentally different approach. It has its unique advantages and drawbacks. The basic principle of cloud is to make the computing be assigned to a distributed network, rather than a local server room (Frost and Sullivan, 2011). Geng Lin et. al., (2009:1) explain the meaning cloud computing has for different groups of users:

- i. For users, it is IT as a service (ITaaS), the delivery of computing, storage and applications over the internet from centralised data centres.
- ii. For developers, it is an internet-scale software platform and runtime environment.
- iii. For infrastructure providers and administrators, it is the massive distributed data centre infrastructure connected by IP networks.

Cloud computing is a model for delivering ICT services by the use of the internet instead of a direct connection to servers. Further, cloud allows provisioning in minutes. Its solutions can be scaled instantly and in a flexible manner. To finish, its pricing is pay-per-use model with an operational expenditure model with no major upfront costs.



Figure 1: Illustration of the evolution of computing [Adapted from mybusiness.singtel.com (2013)]

Types of cloud services and deployment models

The service architecture is a three-layered model illustrated in Figure 2 and Figure 3.

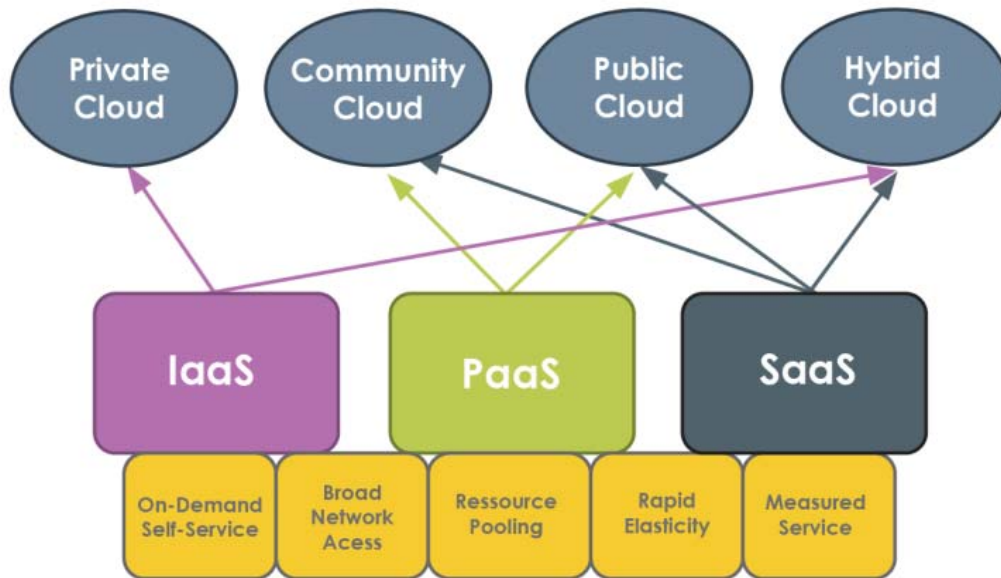


Figure 2: Cloud computing deployment models [Adapted from NIST (2011:6)]

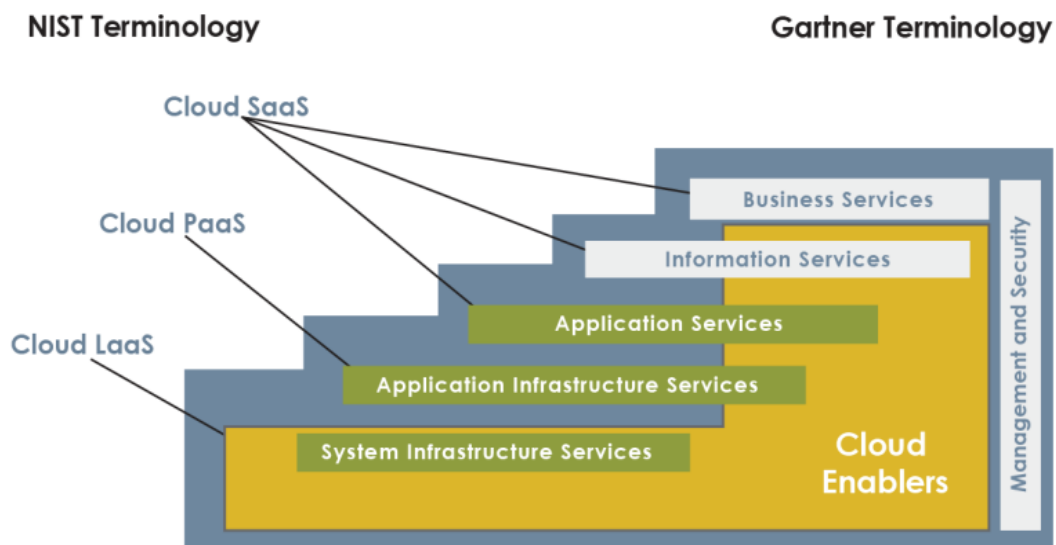


Figure 3: Cloud computing service architecture [Adapted from Gartner (2012)]

Advantages and disadvantages

Cloud solutions offer vast benefits from enabling lower initial investment for services to consistent supply chain management and the consolidation of systems in data centres with scalability and convenience. Rajan and Jairath (2011) highlights the following as the major advantages of cloud:

- i. Faster and simpler,

- ii. Elastic and flexible services,
- iii. Optimised utilisation of computing resources,
- iv. More resources such as unlimited storage available,
- v. Everything can be provided as service,
- vi. Less power consumed on hardware and software, and
- vii. High availability and scalability and no loss of data.

However, the cloud faces many challenges, which require constant attention. The security environment is not yet clearly defined. Cloud computing is not fully clear in terms of security and the way in which security should be set up to promote business activity. This is because one "...can no longer point to the room, server or tape that contains our information" Capgemini™ (2012:9). Even so, as with any new technological concept, some of the challenges are due to the fact that cloud computing is still a fairly new concept. Thus, the major issues relate to reliability and security.

In the long run, the success of cloud computing will ultimately depend on the secure flow of traffic along networks, on the internet. Better understanding of cloud computing and the roles of its various stakeholders is important, as is more research into the technical and legal issues that the cloud introduces (Hay, Nance and Bishop, 2011).

Changes brought by cloud computing

Cloud computing has seen a boom in spite of the global economic downturn in the late 2000s. Its platforms are transforming businesses through innovation. They take advantage of the evolution of ICT. Figure 1 illustrates the evolution of computing from the 1960s. It highlights the prominent forms of computing that have marked the past decades, leading to cloud computing.

Cloud computing solutions have become a transformational alternative for businesses across many industries. Because, they alter the value chains and provides the chance to businesses to focus on their core business while adopting new technology models that allow them to compete and achieve higher profits and/or important savings. The transformation of businesses that cloud computing promises in the long term is becoming clearer and clearer. The following are a number of them:

- i. The rise of new industry leaders and IT vendors,
- ii. The creation of a new generation of products and services,
- iii. The advent of numerous consumer-grade technologies,
- iv. A new awareness and leverage of the internet,
- v. Additional self-service IT from the business-side (SaaS, self-service, IT demand...),
- vi. New business models and a radically more complex business environment,
- vii. New forms of real-time partnerships and outsourcing with IT suppliers, and
- viii. More acceptance and leniency of businesses for innovation and experimentation.

What next for cloud computing?

With regard to the evolution of cloud computing, some significant patterns should be considered:

The internet coverage has been growing particularly thanks to improved and reliable mobile, fibre, satellite and Wi-Fi networks. Cloud services are delivered through connections to the internet. Thus, it can be expected that cloud computing will mature as the infrastructure behind the internet advances and better quality services are enabled. This will also have a major impact on the manufacturing of devices.

The cloud has been characterised by a slow but steady growth at its early days when Amazon.com™ first introduced the Elastic Compute Cloud™ in 2006. This triggered a new paradigm, even though, the subsequent five years were characterised by much hype. In the years to come, a consolidation of markets is to be expected as consumers become more knowledgeable about cloud and its offerings. For businesses, the focus of leaders of the industry will be on the following:

- i. Choosing the right cloud solutions and cloud adoption strategy,
- ii. Selecting the best approach in terms of types of services and of deployment,
- iii. Interoperability and vendor dependence, and
- iv. Preparing applications to be ready for cloud solutions migration.

The past few years have been about learning what the cloud is and how best to integrate cloud services. Mostly due to mounting pressure for businesses thriving to stay relevant, the adoption of cloud computing will continue to rise and it will enter its full maturity phase.

RESEARCH FINDINGS

As outlined in the methodology, the next step included a narrative inquiry, observations and analysis, where the key trends and developments were discovered and analysed.

Observation discussions

The following are the results of a corroboration of the responses from participants, by looking for patterns, repetitions, anecdotes, other evidence and an interpretation of the data by logical deduction and induction. This was facilitated by separating the data into categories and then examining them in a holistic manner. For the analysis, the data were later examined for coherence, consensus and utility.

Ubiquitous ICT and digitisation

Driven by the vision of universal ICT, virtualised services and cloud computing significantly mark the industry by enabling a new paradigm. The business environment has been characterised by much consolidation. Moreover, new forms and new types of business models along with specialised businesses such as over-the-top providers and 'pure cloud' providers, have emerged.

From a technology perspective, a number of key trends stand out. Confirming, an increased level of awareness and consideration for energy efficiency and the environment, the majority of the respondents seemed to agree with predictions from industry literature on the major technology trends as being:

- i. cloud computing,
- ii. social media,

- iii. mobility,
- iv. big data analytics, and
- v. internet of things (IoT),
- vi. video,
- vii. machine-to-machine communications (M2M),
- viii. virtual world and
- ix. gamification.

For operations, advances in ICT permit improved synergy between on-premise and off-premise computing. Colleagues and businesses collaborate and perform better and are more productive.

Lastly, the on-going proliferation of mobile devices and the rise of cloud computing converge to offer on-demand and flexible advantages. This requires networks that constitute the underlying infrastructure to be reliable and to adapt and adjust to enable faster and improved levels of services.

Cloud reaches maturity

For many years, security concerns have slowed down the adoption of cloud. With its maturity, users are getting a higher level of understanding and the associated risks become manageable. Security of information remains a top concern to users, chiefly in terms of intellectual property (IP), privacy and data integrity. Hence, due to the growing market confidence in cloud computing, a good number of security and trusted service providers have started to emerge.

Recently, the market has even seen the emergence of cloud security and risk management service providers. However, firms still face challenges in terms of best approaches and best practices for cloud adoption strategies.

Cloud services are more available, the intake and adoption continue to rise. Moreover, the focus is now on consumer services as opposed to enterprise services previously.

Another important pattern is the increased adoption of private cloud services particularly (managed private clouds and virtual private clouds), even though migration towards public cloud continues with decreasing concerns. This pattern has the potential to change the IT infrastructure of firms.

New service delivery methods security and compliance

Respondent D expressed a view that is shared by most other respondents: 'everything in the world becomes ICT-based'. The participants agreed that cloud computing changed the way ICT services are deployed and delivered. IT is no longer just an isolated department. Now, IT is delivered as a service (ITaaS) in the form of platforms, infrastructure, software and storage. As a result, cloud computing provoked multiple new types of businesses, supply and reseller models, and also value-added services along with horizontal and vertical integration, in addition to collisions amongst businesses.

In addition, there is a rising demand for more freedom, interoperability vis-à-vis of vendors, and neutrality. Moreover, additional values and cost efficiencies remain hot topics. For these reasons, open-source technologies are being also being considered. Lastly, a particular trend highlighted by one respondent is the interconnection of cloud systems similar to that of infrastructure networks.

Focusing on underlying technologies, virtualisation and cloud orchestration became leading topics. They are primordial, as with the rise in the use and the dependency on cloud computing. Conversely, on the front-end, there are early solutions in cloud service management and image automation, in addition to cloud on-premise dynamics, network synergy, data migration, data management, etc.

Finally, Respondent H explained that ‘...there is a shift of responsibility, which requires managing quality of service, service level agreements and third-party contracts.’ Therefore, standards are required to guide and control the frameworks. A major aspect of cloud services is the fact that the hosting of the solution is borderless. The solution provider can be located in a different country from that of the client. The latter begs the question of which particular laws and regulations the third-party providers shall abide by. These have implications everywhere, from human resources and technology perspectives, to how people live, work and play.

Each country has its own sets of rules and regulations for markets, to safeguard data and ensure privacy thereof. Therefore, an important adjustment to consider is the changing legal and regulatory environment. In fact, one strategic consideration in the process of adopting cloud would be managing third-party contracts and agreements. Matters of responsibility, compliance, quality, billing and service agreements are essential, a new adapted environment to cloud.

ICT continues to be the engine room for change and transformation

All the respondents agree with the fact that the intake of cloud computing is linked to the continuing digitisation process. At this stage, the industry is living a re-design; new markets and business models also continue to emerge. The potential for disruptive innovations has never been bigger. The way ICT is delivered and consumed is going through a significant change. Respondent D put ‘IT would continue to be the engine room for change and transformation’.

The drivers of innovation in cloud computing have been scale, speed, agility, flexibility and cost effectiveness. These efforts have given rise to specialised service providers (cloud builders, cloud solutions operators, cloud vendors and inter-cloud network service providers). Lastly, increased efforts and investments are starting to pay-off, enabling security, data analytics and collaboration.

Continuation of the disruption

From the interviews, it is noticed that there is a significant amount of transitioning to using cloud computing (partially or completely). This phenomenon is disrupting industries and business realities. Moreover, cloud computing is entering new areas of utilisation. Health, education, manufacturing, banking and many other industries can now leverage the benefits of this new way of consuming ICT.

However, this development leads to stringent requirements. For instance, in the health sector, doctors are able to perform operations and other tasks from a distance. Thus, the risk associated with performing medical services remotely need be considered. Therefore, the reliability of the underlying network infrastructure and technology should also be robust.

CONCLUSIONS AND RECOMMENDATIONS

This section presents the conclusions and recommendations of the research. The findings in relation to the research objectives are discussed and analysed. Thereafter, some recommendations are made for future research as this study could not cover every element of the topics at hand.

Research results

Business environments are risky and market changes hard to predict, same with consumers' behaviours. Hence, they need solutions that are flexible, agile and reliable to be productive and efficient. In the ever evolving computing environment, cloud computing emerges as key. Its adoption has been rapid and it is starting to become an integral way of how ICT services are delivered. It is in this breath that businesses increasingly look to evolve in ways that will demonstrate value in developing trends, cloud computing and mobility in particular.

In this study, the drivers of change have been identified to be the pursuit of seamless computing and the enduring digitisation process, in conjunction, to the fact that computing has been widening due to the growing awareness and confidence of businesses and users. The following is a summary of changes in the market and a list of the major ICT and computing trends:

- i. Consolidation and convergence of businesses and the development of new forms and types of business models and more specialised businesses,
- ii. The improvement of network infrastructures to become reliable and ensure quality of services,
- iii. Though, security remains a top concern the associated risk now becomes manageable,
- iv. The emergence of cloud security and risk-management service providers,
- v. The institution of standards and of a clearer legal and regulatory environment,
- vi. The establishment of industry wide best approaches and best practices,
- vii. The need to manage third-party service providers,
- viii. The cloud will continue to develop added-value and cost efficiencies for consumers,
- ix. The number of businesses that abandon the use of their own servers will continue to rise,
- x. The synergy between on-premise and off-premise computing improves,
- xi. PaaS and SaaS rise in popularity in the form of private cloud computing services,
- xii. Cloud systems interconnection and cloud orchestration will be hot topics, and
- xiii. Early solutions in cloud service management and image automation appear.

Furthermore, the following broad predictions can be deduced:

- i. As ICT continues to be more ubiquitous, cloud computing would soon reach its full maturity,
- ii. Cloud computing continues to change the way ICT is deployed and delivered,
- iii. Cloud will continue to disrupt the industry and business realities, and
- iv. Additional new markets and new businesses models will emerge.

Research results analysis

From the study, it has been learnt that cloud computing is not a new technology in itself; it is rather a new way of deploying and delivering ICT services. It is explained that "cloud computing represents

the confluence of technology and business developments in the internet, web services, computing systems and applications that have evolved over the past few decades.” (Geng Lin et. al., 2009:1).

Cloud computing is considered to be the next step in the evolution of ICT as shown in Figure 1. It constitutes the future of ICT and that of the internet, called the fifth generation of computing after mainframes, personal computing, client servers, and web services, respectively (Rajan and Jairath 2011). Going forward, cloud computing will be synonymous with ICT from both a technology and a business perspective.

However, to achieve the latter, there is an urgent need for new sets of standards and regulations. Private sector and Public stakeholders have to agree and put in place common standards platforms for this new era. Next, governments around the world should work to put in place coherent enabling policies and regulations. A legal and regulatory setting that is shared would benefit all stakeholders. This would determine the ways industry and businesses will continue to flourish and to innovate.

Conclusions

The technological trends analysis has provided the key ICT and computing trends with technology and business information. The business world is affected by major changes and trends that characterise the ICT industry, mainly, consolidation and convergence, cloud computing, mobility, social media and big data analytics, with new forms and types of business models.

Cloud computing is the new architecture for delivering ICT services without limits. In the years to come, by leveraging high performance networks and the advances of the internet, cloud computing can be expected to deliver business benefits amidst newer high-impact trends and developments in technologies and in the business markets.

The internet becomes the technology to go by and cloud computing the way to use ICT services. Further, it can be expected that the majority of internet and communications technologies will be based on cloud computing, delivering services consumers and businesses depend on. Thus, cloud computing has the potential to positively impact businesses and users, with enhanced and more specialised services and solutions.

Recommendations

Based on the study that was conducted, the following are some recommendations:

- i. Business decision makers should start considering cloud computing within their strategic management as a core deployment option,
- ii. Due to the challenges of adopting cloud, its potential risks and benefits, risk assessment, security frameworks and service selections are required to boost vital cooperation,
- iii. Governments and businesses, together, should work to develop frameworks that make optimal use of the possibilities brought by cloud computing, and
- iv. Governments across the world must align their security, privacy policy and legal regulations to the context that cloud computing causes in the business ecosystem.

Research contribution, gaps and further studies

In terms of contribution and value-add, this research presented key trends of ICT and computing within the industry, followed by an industry analysis of the significant developments.

For further investigations, new researchers could focus on select more specific topics such as cloud security, cloud orchestration and cloud computing in Africa. For instance, studies to investigate how cloud computing would cause the replacement of physical wallets, why cloud computing is making life easier for education or how cloud computing would affect the cost of life and the retail markets, would be valuable.

ACKNOWLEDGMENTS

The researcher wishes to acknowledge and thank his family and friends for their support, patience, understanding, encouragement and prayers during this Masters journey. Much gratitude is expressed to the industry leaders who graciously offered their time and input to this research. A special thanks to my study leader, Prof Joe Amadi-Echendu, for his patience, wisdom and mentorship throughout. Finally, yet importantly, the researcher would like to express thanks to the many members of staff of the University of Pretoria, who have generously offered their support whenever needed.

REFERENCES

- Accenture Technology Vision, 2013. Every Business Is a Digital Business, Seven trends [Online] Available from:www.accenture.com/technologyvision [Accessed 20 October 2013]
- Adam Selipsky, Amazon.com. 2012. Amazon Web Services Key Note – Your future with cloud computing. [Online] Available from:www.slideshare.net/AmazonWebServices/keynote-your-future-with-cloud-computing-dr-werner-vogels-aws-summit-2012-nyc [Accessed on 1 July 2014]
- Burke, B., 2012. Gamification 2020: What Is the Future of Gamification? Gartner [Online] Available from:www.gartner.com/doc/2226015?ref=SiteSearch&stkw=Top%20Strategic%20Technologies&fnl=search [Accessed 7August 2014]
- Burrus, D., 2012. Top Twenty Technology-Driven Trends for 2013, Burrus Research Associates, Inc. [Online] Available from:www.burrus.com/resources/daniel-burrus-top-twenty-technology-driven-trends-for-2013/ [Accessed 21 October 2013]
- Capgemini, 2012. Trends in Cloud Computing Secure Journey to the Cloud - a Matter of Control N/1B-052.11a. [Online] Available from:www.capgemini.com/resource-file-access/resource/pdf/Trends_in_Cloud_Computing_Secure_Journey_to_the_Cloud____a_Matter_of_Control.pdf [Accessed 22 April 2014]
- Frost and Sullivan, 2011. Top Technology Trends in ICT (Technical Insights) - Key Slides, D2A4-TI [Online] Available from: www.slideshare.net/FrostandSullivan [Accessed 23 October 2013] (Frost and Sullivan, 2011)
- Gartner, 2012. Press release: Five Cloud Computing Trends That Will Affect Cloud Strategy Through 2015. [Online] Available from:www.gartner.com/newsroom/id/1971515 [Accessed on 1 July 2014]
- Geng Lin, David Fu, Jinzy Zhu, Glenn Dasmalchi, 2009. Cloud Computing: IT as a Service, IT Pro March/April 2009 Published by the IEEE Computer Society 1520-9202/09

Gradmalaysia ICT, 2012. Current and Future Trends in ICT 2012 [Online] Available from: <http://www.gradmalaysia.com/career-sector/article/current-and-future-trendsi-ct>- [Accessed 23 October 2013]

Hawkins, R. on Edutech, 2010. 10 Global Trends in ICT and Education [Online] Available from: blogs.worldbank.org/edutech/10-global-trends-in-ict-and-education [Accessed 23 October 2013]

Hay, B, K Nance, and M Bishop, 2011. "Storm Clouds Rising: Security Challenges for IaaS Cloud Computing", 2011 44th Hawaii International Conference on System Sciences.

High, P., 2013. Top 10 Strategic Technology Trends For 2014 [Online] Available from: <http://www.forbes.com/sites/peterhigh/2013/10/14/gartner-top-10-strategic-technology-trends-for-2014/> [Accessed 22 October 2013]

Hinchcliffe, D. for Enterprise Web 2.0, 2009. Eight ways that cloud computing will change business | ZDNet. Available from: www.zdnet.com/blog/hinchcliffe/eight-ways-that-cloud-computing-will-change-business/488 [Accessed 26 October 2013]

McKinsey Quarterly, 2010. Clouds, big data, and smart assets: Ten tech-enabled business trends to watch Available from: www.mckinsey.com/insights/high_tech_telecoms_internet/clouds_big_data_and_smart_assets_ten_tech-enabled_business_trends_to_watch [Accessed 23 October 2013]

Mybusiness.singtel.com , 2013. The Cloud Gets Huge [Online] Available from: mybusiness.singtel.com/techblog/top-6-technological-trends-smes-2014#sthash.MbQg6sBf.dpuf [Accessed 3 Aug 2013]

National Institute of Standards and Technology (NIST), 2011. The NIST Definition of Cloud Computing [Online] Available from : csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf [Accessed 23 July 2013]

North Texas Industry Thought Leaders, 2013. Future trends in information technology identified, May 13, 2013 [Online] Available from: www.interlink-ntx.org [Accessed 23 October 2013]

PwC Global Digital IQ Survey, 2013. Top 10 Enterprise IT Trends. [Online] Available from: www.pwc.com/us/en/advisory/2013-digital-iq-survey/top-10-technology-trends-for-business.jhtml [Accessed 21 October 2013] (PwC Global Digital IQ Survey, 2013).

Rajan, S. and Jairath, A. 2013. Cloud Computing: The Fifth generation of Computing, 2011 International Conference on Communication Systems and Network Technologies.