CANADA'S CLOUD IMPERATIVE:

IMPROVING BUSINESS OPPORTUNITIES THROUGH ENABLING SERVICES

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EXECUTIVE SUMMARY

Cloud computing is creating new opportunities for enterprises across the Canadian innovation economy. Cloud solutions are today affordable, mainstream, and accessible to enterprises large and small. The potential economic benefits of wider cloud adoption extend into every facet of the economy, and it is critical that enterprises, users and policy-makers come to grips with those. In the existing discourse between these stakeholders, cloud's benefits are often not clearly communicated, while potential drawbacks overstated. It is ICTC's intent with this document to ensure that both the opportunities and challenges of greater large enterprise adoption of cloud are well-understood.

Already today, the Canadian cloud economy employs directly 38,400 workers, including more than 21,000 ICT workers. When we factor indirect and induced employment, this translates into a total labour market contribution of 48,000. Total direct employment will grow to 57,000 workers by 2018. When we factor indirect and induced employment, the total labour market contribution of cloud computing will exceed 71,000 by 2018. The opportunity is to increase this many-fold with conscientious leadership on the part of governments at all levels, and industry leaders.

Briefly, adoption of cloud services is not yet in Canada sufficiently widespread to be of full benefit to the economy. Easily quantified benefits such as reduced operating expenditures are the most obvious, but observers consider that these are secondary to more important benefits such as scalability for start-ups and small enterprises, reduced time-to-market for innovative new services, global reach and improved security.

Challenges to greater adoption such as security, privacy, regulation, and standards and vendor lock-in are often cited when discussing cloud services. But are these perceived challenges warranted? Do they reflect real concerns or is the fear of the unknown making industries slow to adopt solutions proven more cost-effective, scalable, and dynamic than other computing paradigms?

Existing privacy legislation such as the Personal Information and Electronic Documents Act (PIPEDA) makes Canada a safe haven for data centres, providing infrastructure providers with a safe and secure environment in which to store sensitive information. In this sense, people must become aware that cloud can be easily made compliant with acts such as PIPEDA.

This study from ICTC explores the emergence of cloud computing in order to shed light on the opportunities and challenges facing cloud adoption. We provide a comprehensive snapshot of the cloud economy to help navigate the Canadian and global cloud sectors, and to provide policy-makers with data upon which to determine appropriate supports.

This report presents a timely review of the adoption of cloud computing in Canada, highlighting its pathways to innovation, cost savings, reduced barriers to entry, and growth for the ICT industry and economy at large.

REPORT HIGHLIGHTS

- Half of the 360 Canadian enterprises (IT and non-IT) surveyed by ICTC have adopted identifiable cloud services. This figure is 71% for IT firms.
- 70% of cloud-using enterprises use some form of paid cloud service.
- 4/5 of paid users have recurring subscriptions to cloud services, and one-third (31%) have made a one-time purchase of cloud products/services.
- Nearly two-thirds (61%) of companies have reduced their IT costs by switching over to cloud. This number is 68% for IT firms.
- SaaS is the most commonly used public cloud service; more than half (53%) of cloud-using enterprises use SaaS, and an additional one-quarter are developing SaaS capabilities.
- The Canadian cloud economy directly employs a total of 38,400, workers, including more than 21,000 ICT professionals.
- By 2018, ICT occupations central to cloud computing will grow by 47%.
- By 2018, it is estimated that Canada's cloud economy will directly employ more than 57,000 workers. When we factor indirect employment, Canada will employ more than 71,000 workers in 2018 as a result of cloud computing.
- Key occupational categories hiring cloud professionals include: Computer and Information Systems Management, Information Systems Business Analysis, Software Engineering, Computer Networking, and Interactive Media Development.
- The disruptive impact of cloud has the potential to widen the skills and talent mismatch in key cloud-enabling occupations.
- Cloud professionals are difficult to recruit for because they require a combination of programming and administration skills—a rare combination in the ICT industry.
- The Canadian cloud economy contributes $4.6 billion annually to Canadian GDP, and by 2018, this contribution will grow to become $8.2 billion.
- Cloud computing is projected to become a $241 billion global industry by 2020.

1.0 THE NEXT STAGE IN THE INTERNET'S EVOLUTION

Cloud computing has generated significant discussion among participants and observers of the digital economy. Its strongest proponents view it as an outstanding value proposition, due to its inherent technological and economic benefits. In recent years, Canada has witnessed an increasing shift toward cloud computing, often referred to as the next stage in the Internet's evolution. The cloud is shaping and redefining the global ICT paradigm. With it comes the promise of scalability, efficiency, and reduced barriers to entry for start-ups and small and medium sized enterprises (SMEs). According to industry research, cloud computing will soon overtake corporate data centres and will grow 12-fold by 2015.[1]

Over the next ten years, cloud will dominate the ICT business paradigm in organizations throughout the economy and will become increasingly central to investors, start-ups, and multi-nationals alike. The lasting appeal of cloud computing among industry players is multi-faceted: on the one hand, clouds allow firms to outsource their ICT functions, reduce management costs, and reduce ICT infrastructure; on the other hand, clouds enable firms to enter the market without having to bear the burden of heavy infrastructure and other large-scale investments.[2] These benefits are applicable across all enterprises, but are particularly pertinent for small firms and start-ups that are the key drivers of national innovation and productivity.

The growing pervasiveness of cloud services will be felt in the ICT and non-ICT labour markets going forward. Much of the installation, configuration, and administration work currently performed in data centres will be automated, and there will be new demands for skills that intersect data collection, analysis, and programming. ICT workers currently hands on to the administration and configuration will be required to add new skills to their resumes such as managing vendor relationships. Due to its pervasive impact, non-ICT professionals in all sectors of the economy will require a basic understanding of cloud computing and how it impacts their industry.

Canada is currently ranked 9th out of 24 countries in the BSA Global Cloud Computing Scorecard, due largely to the lack of cyber security standards in Canada, as well as outdated copyright laws that are perceived to provide insufficient protection for online material. Existing security and privacy legislation for private firms is largely irrelevant to the cloud services industry. Despite these gaps in the regulatory framework, the Information and Communications Technology Council (ICTC) believes that cloud computing provides a high value proposition for Canada.

Thus, ICTC has developed the following study on Canada's cloud computing industry with the aim of understanding: (1) the economics (jobs, revenue and growth) of Canada's cloud industry; (2) the regulatory frameworks governing cloud-related services in Canada and internationally; and (3) the inhibiters and accelerators of cloud adoption from a firm perspective and national perspective.

2.0 METHODOLOGY

This study builds on primary and secondary research gathered from multiple sources, including:

- Desktop research (literature review and environmental scan of academic-, industry, government- and, non-governmental-based research),
- Key informant interviews (KIIs) with cloud industry experts nationally and regionally,
- Targeted consultation with the Canadian cloud industry,
- Vacancy analysis supplemented by ICTC labour force data,
- Cloud computing adoption survey of 360 Canadian companies in both IT and non-IT domains, and
- Validation process with three sets of stakeholders KIIs and targeted consultations.

Preliminary **desktop research** pertaining to the national and international cloud computing markets was conducted at the outset, which shed light on the global adoption outlook of cloud computing. This provided a comprehensive snapshot of emerging trends in the cloud economy, as well as a benchmark for international comparisons. Key organizations from across Canada involved in cloud services were also identified. These organizations were incorporated into a database that formed the basis of the expert consultation phase of the study.

Drawing from large, mid-sized, and start-up companies, as well as industry networks and not-for-profit organizations, ICTC conducted **key informant interviews (KIIs)** with national and regional experts within the field of cloud computing. A total of 11 KIIs were conducted. Because Canada's cloud industry is highly concentrated in the eastern part of the country, most of the KIIs were from Ontario and Quebec. Other KII provinces include Alberta and British Columbia.

Private firms represented ten of the 11 organizations involved in the interview process. The firms each share the following characteristics: they (1) provide cloud services (e.g., IaaS, SaaS, application, migration and/or hosting services) as part of their overall business, and (2) generate revenue from their cloud-based operations.

The KIIs provided ICTC with insights pertaining to the following:

- The potential impact of cloud on existing Canadian industries,
- Existing and emerging occupations engaged in cloud computing,
- The supply/demand outlook for cloud professionals nationally and regionally,
- The type (e.g. small, medium, large) of companies that are involved in the Canadian cloud economy, and
- Potential inhibiters and accelerators to firm and national cloud adoption.

Once the KIIs were completed and relevant information gathered, ICTC collected primary data through a **targeted consultation** with Canadian cloud providers at large in order to determine industry growth outlook, revenue sources, workforce composition, and skill requirements.

Using the advertisements published on the Job Bank and Working in Canada websites, two of the largest web-based networks of job postings available to Canadians, ICTC conducted a **vacancy analysis** in order to establish a benchmark for estimating the proportion of digital economy occupations that focus on cloud computing. Want ads were identified for digital economy occupations that require cloud computing skills and related work experience.

Collected primary data was compared and contrasted against Statistics Canada's Labour Force Survey (LFS) data, a monthly snapshot of approximately 54,000 households and 100,000 individuals. A comprehensive picture of Canada's cloud economy using multiple lenses is thus presented to the readers of this study.

The analyses and preliminary results were presented in multiple **validation sessions** to two sets of stakeholders: KIIs and organizations involved in targeted consultations.

Feedback from the above validation process was collected, synthesized and incorporated into the study to ensure the validity of the findings and accuracy of stakeholder input. All input was incorporated into the final report presented to you below.

3.0 CLOUD COMPUTING: WHAT IT IS AND WHERE IT STARTED

2011 and 2012 have each been described as the "Year of the Cloud." Cloud has become a dominant conversation in the ICT industry. All the exuberance surrounding it has led to various definitions of what the cloud actually is. In its simplest form, the cloud is the virtualized method of delivering and accessing computing resources on-demand,[3] over the internet, and detached from the local environment.[4] Clouds provide a full-range of internet-based ICT applications, processing capabilities, and storage capacity. Everything from virtual processing systems, application development, advanced hosting, and web-based software solutions can be provided over the cloud, thereby replacing applications conventionally installed on the personal computers of end-users.[5] In other words, cloud systems are infinitely scalable, provide multiple infrastructure sources, and can be used for every computing purpose ranging from disaster recovery to business continuity.[6]

The inherent economic benefits of cloud services are many-fold; they can provide on-demand resources that can be configured, expanded, and accessed on the internet easily by anyone. The security implications of cloud technology are more ambiguous. Although the cloud provides an affordable way to improve the security of small firms that otherwise cannot afford top-line security infrastructure,[7] others believe security concerns could limit the future appeal of cloud adoption. According to a recent cloud computing survey conducted by LinkedIn, more than one-half of respondents cited security as their top concern with cloud services.[8]

IBM's annual global Tech Trends survey forecasts cloud computing to be one of the most sought-after ICT skills over the next five years, and will dominate on-premise computing as the primary ICT delivery model by 2015.[9] It is also estimated global cloud traffic will grow at CAGR 66% by 2015 and will represent 57% of total data centre workloads.[10]

3.1 Sudden Arrival or Slow Evolution?

The emergence of cloud as a "new" paradigm is oft-discussed. The challenge to the use of predominantly local PC and network resources is the outcome of decades of computing evolution. Computer hardware time-sharing first appeared in the 1950s,[11] which enabled for the first time simultaneous shared use of a computer system by independent users. It was through this process the concepts of 'real-time' and 'online' first emerged.[12]

Once time-sharing expanded past the sharing of a single computer processor during the 1980s and early 1990s, it became known as utility computing and then grid computing. With the introduction of broadband in the late 1990s, the one thing holding back grid computing (e.g., an effective delivery mechanism) was no longer an obstacle. As broadband delivery continued to grow in the early 2000s, start-ups capitalized on the low barriers to entry and began offering computing services over the internet. And while cloud is often considered the competitive edge of start-ups, established businesses and multi-nationals soon recognized the potential of the cloud and began expanding their services to take advantage of the age-old concept that was finally a reality.[13]

The emergence of multi-tenancy has been key, in the minds of some observers, to the emergence of cloud as that is commonly thought of today. In a multi-tenant architecture, multiple users can share the same application running from a single machine without access to others' data – with associated cost benefits.

3.2 Deployment Models

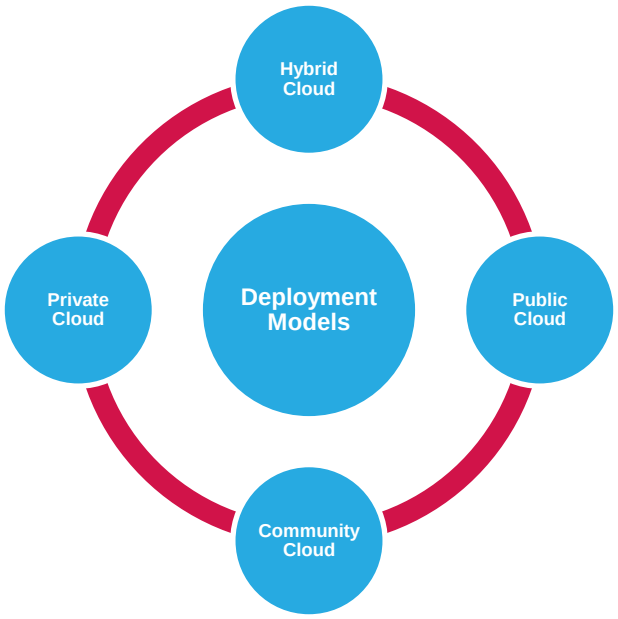
There are a few different deployment models for cloud services. Businesses can choose from a variety of these models, depending on their needs and capacities. The choice between a public cloud or private cloud will depend largely upon organization size and its ability to invest its own private cloud infrastructure. However, the public cloud is what drives the market, and is considered the catalyst for cloud adoption among enterprises and private users. The top publicly-traded cloud companies are already worth more than $100 billion.[14]

For a service to be truly classified as cloud, it must have all five of the following characteristics:

- Multi-tenant architecture that isolates all customer data and customizations in metadata layer, enabling code-layer upgrades without regression tests and rewrite;
- Provide upgrades to existing services without disruption or technology risk, usually included in the cost of service;
- Development teams that focus on supporting and advancing a single code base, rather than supporting multiple legacy versions still in-service;
- In the case of public cloud, the provisioning and usage of accounting systems; and
- "No Software" – what's paid for is function, not code. Continuous scrutiny of operations, maintenance facilities and world-class security standards are literally "part of the service."

Private Cloud

Private clouds are typically used by very large firms capable of providing cloud or cloud-like services internally through their own hardware, software, and service suppliers. Private clouds are primarily heavily virtualized server environments, and virtualization satisfies only one of the five characteristics of cloud computing according to the National Institute of Standards and Technology (NIST). The private cloud is driven primarily by hardware and traditional software vendors as they transition their business model to provide public cloud offerings. Many cloud companies offering private clouds mix virtualization efforts with public clouds.



Some observers raise questions as to whether private cloud services are properly thought of as cloud at all. While they make extensive use of virtualization, they may not always demonstrate four other attributes thought to define "cloud": on-demand self-service, broad network access, rapid elasticity and measured service.[15]

Private clouds have become more popular as traditional IT vendors have seen their market share eroded by public cloud providers. Services such as those sold by Amazon and Salesforce.com have diminished to an extent the demand for in-house equipment and software licenses. Offering on-premises equipment and software that replicates some of the functionality of cloud services is a strategy to stem some losses

Private clouds are popular in industries that have security concerns such as government and financial services. They enable these industries to control all aspects of their cloud services and safeguard all data and applications flowing through the organization. Private clouds are able to host any kind of service offered over the cloud (e.g., applications, processing capabilities, storage), but are most commonly used to develop and test new applications, an approach beneficial to organizations with large development staff.[16]

Public Cloud

Public clouds are used by a spectrum of enterprises, and have been the driver of most cloud-focused discussion and economic activity. However, since 2008 a significant number of large enterprises have embraced these new services, including GE, Toyota, BMO, Virgin, HP, Dell, Cisco and others. In fact, 2008 was a critical year for cloud services as the global economic crisis forced enterprises large and small to examine their cost structures and business processes. The public cloud provides computing resources on-demand, making it the most widely used business model in most industries. Among larger enterprises, the public cloud is often found alongside the private cloud.

In order to be considered a truly public cloud, observers consider that they should exhibit:

- Multi-tenant architecture that isolates customers' data and customization in the metadata layer, enabling code-layer upgrades that eliminate regression tests and rewrites
- Upgrades throughout the year without disruption or technology risk, accomplished seamlessly and included in the cost of service
- A single code base to which development teams focus all their effort on supporting versus multiple legacy versions that remain in service
- Provisioning and usage accounting systems; and,
- "No software", payment is for functionality, not code, implying the inclusion of continuous operations scrutiny, security and facility maintenance as included in the price.

Companies that provide public cloud services do so in three ways:

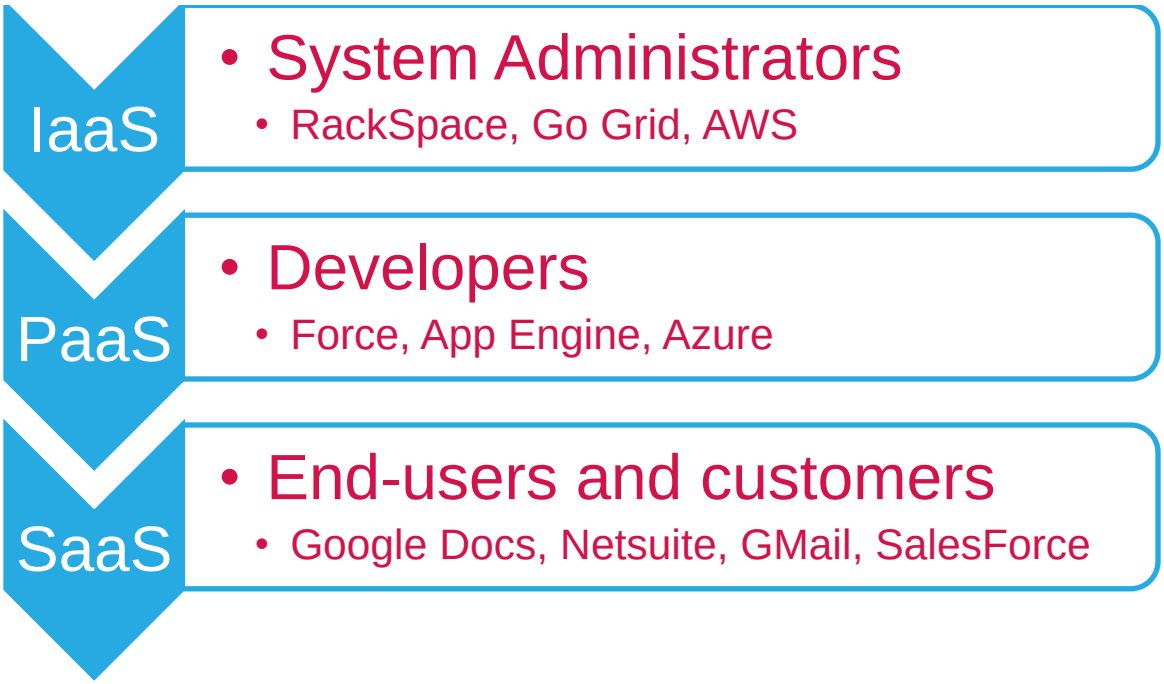
Software as a Service (SaaS): often described as on-demand software, SaaS delivers software applications over a centrally hosted cloud, enabling users to access applications from service providers through a web browser. This delivery model has become the most common for many business applications ranging from accounting to enterprise resource planning and through human resource management.

Infrastructure as a Service (IaaS): provides basic computing capacity and infrastructure (e.g. server or storage). IaaS services offer users the capacity to use extra storage space in services and data centres. Organizations that offer SaaS typically base their services on IaaS they purchase from other cloud suppliers.[17] To date, Google's entry into this space has been largely among consumers compared to Amazon's enterprise customers.

Platform as a Service (PaaS): sometimes defined as the middle ground between the other two delivery models, PaaS provides the computing capacity of IaaS and the platform required by application developers. With PaaS, software developers have all the tools to develop software services, such as an operating system, programming language, database, and web server, without having to buy and manage the underlying hardware and software.

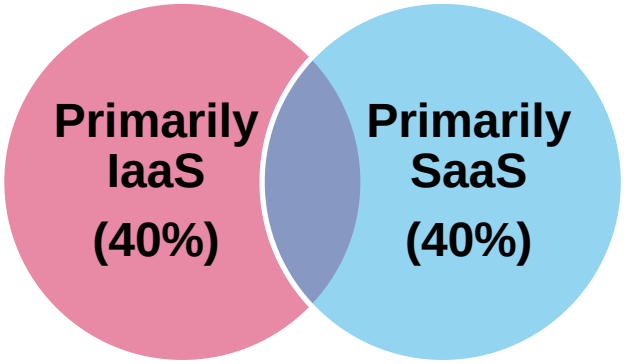
Figure No. 1 illustrates a simple flowchart that illustrates the interaction among public cloud services.

Figure No. 1: Public Cloud Flow Chart



During the key informant phase of the study, ICTC made a concerted effort to gather industry insights from a representative sample of cloud providers. In so doing, we came to learn that Canada's cloud industry, which is driven by services offered over the public cloud, provides mainly infrastructure services, software services or a combination thereof. Figure No. 2 provides a snapshot of the organizational breakdown of ICTC's key informant interviews.

Figure No. 2: KII Organizational Breakdown



"Computing is changing from something that each company needs to supply for itself to a utility model (analogous to the electric grid) where computing becomes available on demand, at whatever capacity is currently needed, for as long as needed."

Source: ICTC (2012).

According to industry informants, understanding the difference between private and public clouds is critical if Canada is to overcome slow cloud adoption. IaaS providers go to great lengths to ensure the integrity of the data contained in their servers but perceptions around security and privacy are challenging to overcome. Early adopters have been invigorated by the potential of emerging technologies. Others have responded much more conservatively. As an example, the perceived privacy issue is leaving many potential adopters out of the market at this time.

Community Cloud

A community cloud is a shared infrastructure among several organizations that come together around a common concern, such as security or compliance. Community clouds can be managed and hosted internally or by a cloud provider.

Hybrid Cloud

Hybrid clouds refer to two or more cloud deployment models (private, public or community) that are both unique and bound together. They offer the benefits of multiple deployment models and require a mix of on-premise and hosted cloud infrastructure.[18]

4.0 GLOBAL CLOUD ECOSYSTEMS

The potential benefits of cloud computing are many-fold. Consumers, governments, and organizations ranging from multinationals to SMEs can all take advantage of the emergence of cloud as users and as vendors. Combined with open data, cloud services provide unlimited potential for innovation and collaboration across regions, jurisdictions, and nations. Despite this, there are concerns about intellectual property, personal privacy, and security,[19] not to mention corporate culture shock and lack of regulatory standards.[20]

European Union (EU)

The EU has identified the growth potential of cloud computing, and has embarked on the full-scale development of a European cloud ecosystem. Strong interest and participation from industry and academia has given the EU the backing it needs to move forward with its cloud efforts. The EU is currently mobilizing a joint research effort to scope out the requirements for developing such an integrated cloud ecosystem. Given the EU's strong R&D background in GRIDs and Service Oriented Architecture (SOA), the Union is well positioned for breakthroughs in cloud computing. However, barriers to entry for small firms are high. More technical- and business-oriented R&D programs are needed to encourage them to enter the cloud market.[21]

Data security and personal privacy: Communicating over public clouds, as opposed to keeping it entirely within a private network, is inherently risky. As is the case with many cloud providers, infrastructure is shared among many clients, often dispersed over several machines and data centres. On the privacy side, personal information is much more vulnerable to breach if it is stored over a cloud as opposed to in-house. Privacy concerns of this nature stem from the diversity of privacy regulations across the globe (Ernst & Young, 2011).

While hopes are high, significant challenges threaten the EU's cloud initiatives. Chief among these are concerns that emanate from early cloud adoption, such as **data security and the protection of personal privacy**. European policymakers are concerned about the protection of personal data and data flow. It is therefore vital for all cloud providers in the European Economic Arena (EEA) to provide clients with the information they need to reach an informed decision regarding cloud adoption, such as security, transparency, and legal certainty.[22]

Due to the rapid pace of technological change, the cloud represents a challenging but promising proposition for consumers and policymakers in the EEA. As a first step, defining the security concerns with regards to data protection is critical for the cloud industry to thrive in the EEA.

Japan

Cloud adoption in Japan has grown rapidly since 2010, when cloud services grew by almost 42% to reach US $540 million. Japan's market for cloud computing services is projected to be worth US $1.8 billion in 2014.[23] This rapid acceleration, combined with several other factors including laws and regulations governing cloud, ICT-related infrastructure, and broadband deployment, has made Japan the worldwide leader in cloud computing. In 2012 Japan ranked first on the BSA Global Cloud Computing Scorecard, due to its "… comprehensive suite of modern laws that support and facilitate the digital economy and cloud computing."[24]

Similar to the EU, privacy concerns and the integrity of intellectual property are some of the biggest challenges facing the Japanese cloud industry. To combat these challenges, Japan is tying the regulatory loose ends on the cloud industry by establishing comprehensive privacy laws that, among other things, protect **intellectual property** in the cloud.[25]

Intellectual property: Security officers who are responsible for safeguarding an organization's intellectual property will not readily give up direct control of the IT environment, especially considering the current state of cloud intellectual property laws. Comprehensive laws which safeguard organizations from misappropriation or other infringements to intellectual property created or stored over the cloud remain underdeveloped in most areas of the globe. (Ernst & Young, 2011; Ridout & Maybee LLP, 2010).

Australia

In 2013 Australia launched its national cloud computing strategy, which is aimed at increasing the adoption of cloud services in the public sector. Australia's cloud policy is an effort to modernize the government's approach to ICT. The policy requires "all government agencies to consider cloud services for new ICT procurements, test and development activity, and to migrate existing websites to cloud services at natural refresh points."

Australia's National Cloud Computing Strategy is the culmination of several months of consultation among several government departments, and reflects the country's commitment to advancing its digital economy. The underlying vision of the National Cloud Computing Strategy is to give Australians the opportunity to "create and use world class cloud services to boost innovation and productivity across the digital economy." This vision will be accomplished by maximizing the value of cloud services in the public sector, promoting cloud services to SMEs and consumers, and supporting the country's cloud services sector.[26]

United States (US)

While not fully matured, the market for cloud services has great potential in the US. With more than 100 million households projected to have access to download speeds of at least 100 Mbps by 2020,[27] the US will play a central role in the global cloud industry. The US is home to leading multinationals already providing cloud services on a global scale, such as Google, Microsoft, Apple, Dell, and Oracle, and Rackspace Hosting. Revenue generated by the US public cloud industry is projected to grow CAGR 18.5% to reach $43.2 billion by 2016.[28]

In 2011 the National Institute of Standards and Technology (NIST) released a Cloud Computing Technology Roadmap, which outlines ten requirements for successful cloud adoption, beginning with the need to establish an international consensus on the "… interoperability, portability and security standards" of cloud technology.[29] The US has established comprehensive legislation regulating e-commerce and cyber crime but has yet to establish sufficient privacy laws outside of a few sectors, such as health. This means the great majority of American companies are not protected by privacy legislation that guarantees such things as the protection of intellectual property.[30]

United Kingdom (UK)

The UK currently ranks eighth on the BSA Global Cloud Computing Scorecard, largely due to its government sector initiative targeted at easing the public sector procurement of cloud-based IT services. The UK's G-Cloud strategy is a government-led initiative committed to not only increasing cloud adoption in public sector bodies, but also delivering cloud computing resources. The goal of the G-Cloud strategy is to deliver fundamental changes in how the public sector operates and procures ICT. This includes achieving greater economies of scale, delivering ICT systems that are more responsive to government policies, capitalizing on emerging technologies to reduce costs, and meet environmental sustainability goals.

China

Elsewhere in Asia cloud computing represents one of the fastest growing industries. China's investment in cloud technology is projected to reach US $1 billion by 2016, an increase of 250% from 2011. In 2011, China represented ten percent of total worldwide cloud investment, which is no surprise, given that China accounts for close to eight percent of the global ICT market.[31]

China's Ministry of Industry and Information Technology has already outlined a roadmap for developing the country's cloud industry, beginning with a pilot program centred on five major cities: Beijing, Shanghai, Shenzhen, Hangzhou, and Wuxi. Eight additional provinces and cities have also announced cloud adoption strategies that once completed, will give China more than ten million cloud servers, representing a total investment of US $270 billion.[32]

Cyber Security Regulatory Compliance: Data stored and transmitted over the cloud can theoretically be dispersed all over the world. The question then arises as to whose rules must be followed. The cloud industry is a key beneficiary of globalization in that users can find cheaper services in other countries. But with globalization also comes challenges related to jurisdiction and data sovereignty. To combat these challenges, new policies which govern cross-country cloud consumption must be enacted (Ernst & Young, 2011; European Commission, 2010).

The Chinese government has clearly demonstrated a strong commitment to building its digital economy through the cloud and other means, which will serve to further enhance the country's economic prowess both regionally and globally. However, a lack of intellectual property enforcement and reluctance to integrate international IT firms serve as barriers to China's developmental goals. Despite these concerns, China is increasingly active in the global arena, having signed UN and WTO regulatory agreements, in addition to strengthening its **cyber security regulations**. At home, it continues to facilitate rapid adoption of the cloud, having made significant progress expanding its broadband coverage.[33] This is a critical step to ensuring that China's cloud pilots thrive and contribute to one of the world's largest cloud industries.

4.1 What It Means for Canada

Canada remains a leader in the global digital economy, but is ranked ninth out of 24 in the global cloud industry, lagging considerably behind Japan, Australia, the US, and Germany. Canada's underperformance is largely due to the lack of national **cyber security standards**, as well as the perception of outdated copyright laws that do not provide sufficient protection for online material.

Canada currently does not have any specific laws or regulations governing cloud security, despite extensive information security guidelines regulating most government agencies. While some security and privacy standards exist for private firms, they are generic and are largely irrelevant to the cloud industry. Currently, Canada's cloud service laws provide some protection against the misappropriation of cloud services but still require updated enforcement guidelines.

Cyber Security Standards: Currently, few standards are in place to guide the Canadian and global cloud economies. Cloud standards related to cyber security would enhance interoperability, legal certainty, and help firms to develop best practice. The benefits of globalization also leave the international market exposed to a host of cyber threats. In a globalized market, cloud penetration is expected to deepen as users seek cost-effective IT sources (European Commission, 2010; Data Protection Working Party, 2012).

Despite Canada's ninth place ranking on the global cloud scorecard, this represents a considerable improvement over the 2012 rankings, in which Canada placed 12th. Regulatory gaps notwithstanding, Canada has one of the strongest ICT infrastructures in the world, cutting across all industries, which together make up the nation's digital economy. Broadband penetration in Canada cuts very deep and by 2016, all Canadians will have access to internet speeds of at least five Mbps per second. Canada's firm digital infrastructure gives it great leverage to make up for its lagging cloud industry, which, as the next section reveals, is ripe with job opportunities.

5.0 CANADA'S CLOUD ECONOMY: EMPLOYMENT & CONTRIBUTION TO GDP

Cloud computing has already had a pervasive impact on the Canadian labour market, and over the next three years, this impact is expected to grow significantly. According to IDC, cloud computing will generate close to 14 million cumulative jobs globally by 2015. Media and communications, financial services and manufacturing industries will spearhead the growth of cloud-generated jobs, followed by retail and public administration.[34] Technical ICT professionals will have new opportunities to apply their skills in a virtualized service-oriented environment, whereas non-ICT professionals will benefit from the industry's overall growth, which means more jobs across a wide spectrum of enterprises.

Canada's cloud economy directly employs 38,400 workers.

When we factor indirect and induced employment, the total cloud economy and related employment in Canada in 2013 is estimated to be 48,000.

The economic benefits of cloud computing extend to several domains, including cost reduction, scalability, innovation, and enhanced organizational performance. As more organizations realize the benefit of cloud adoption, more will turn to the cloud at the expense of older legacy systems. Large firms will increasingly turn to private clouds to streamline process and enhance their security, while small firms will leverage the low start up costs associated with cloud adoption. All of this points to growing opportunities for cloud-enabled jobs covering a wide area, including technical and non-technical, direct and indirect.

The cloud-enabled labour market consists of jobs in small start-ups to established SMEs and up to large multinational corporations. Technical positions include areas such as software engineering, interactive media, computer networking, business analysis, and IT management.

The deployment of clouds in all segments of Canadian business and society is creating a broad range of skill requirements for both technical ICT and non-ICT professionals. Cloud computing is the interface between existing and emerging technologies, thus necessitating a stronger understanding and application of the virtual environment. At the same time, non-technical workers require a basic understanding of the utility of cloud computing in order to streamline processes, introduce efficiencies, and establish linkages between emerging technologies and business opportunity.

5.1 Total Employment

According to ICTC's April 2013 Monthly Snapshot, there are 809,000 technical ICT professionals employed across Canada. Of these, there are 58,000 computer and information systems managers, 155,000 information systems business analysts and related professionals, 60,000 software engineers, 26,000 interactive media developers and 65,000 computer/network operators and web technicians (refer to Figure No. 3 for the unemployment rate for these occupations). Although not all of these 363,000 technical ICT professionals are employed in the cloud economy, many are. It is to be expected that the job descriptions and job titles of these professionals vary from industry to industry and company to company. Figures 4 and 5 provide a snapshot of ICTC's cloud labour force estimates. Some of the sample job titles include the following:

- **Computer and information systems managers**: software development manager, software design manager, systems development manager, data centre manager, IT manager

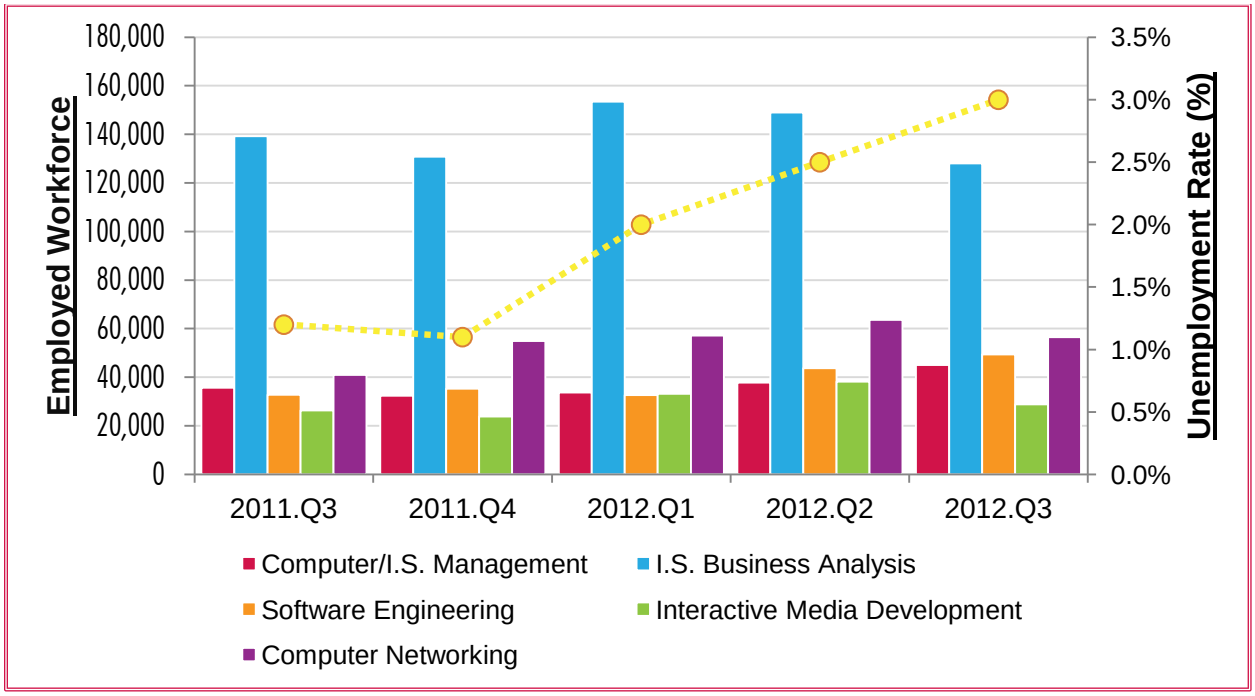
- **Information systems business analysts**: software quality assurance analyst, MIS analyst, informatics security analyst, EDP auditor, system integration analyst

- **Interactive media developers**: graphical user interface (GUI) designer; graphical user interface (GUI) developer; interactive media developer

- **Software engineers**: technical architect–software; telecommunications software engineer; telecommunications software specialist; applications engineer; enterprise architect

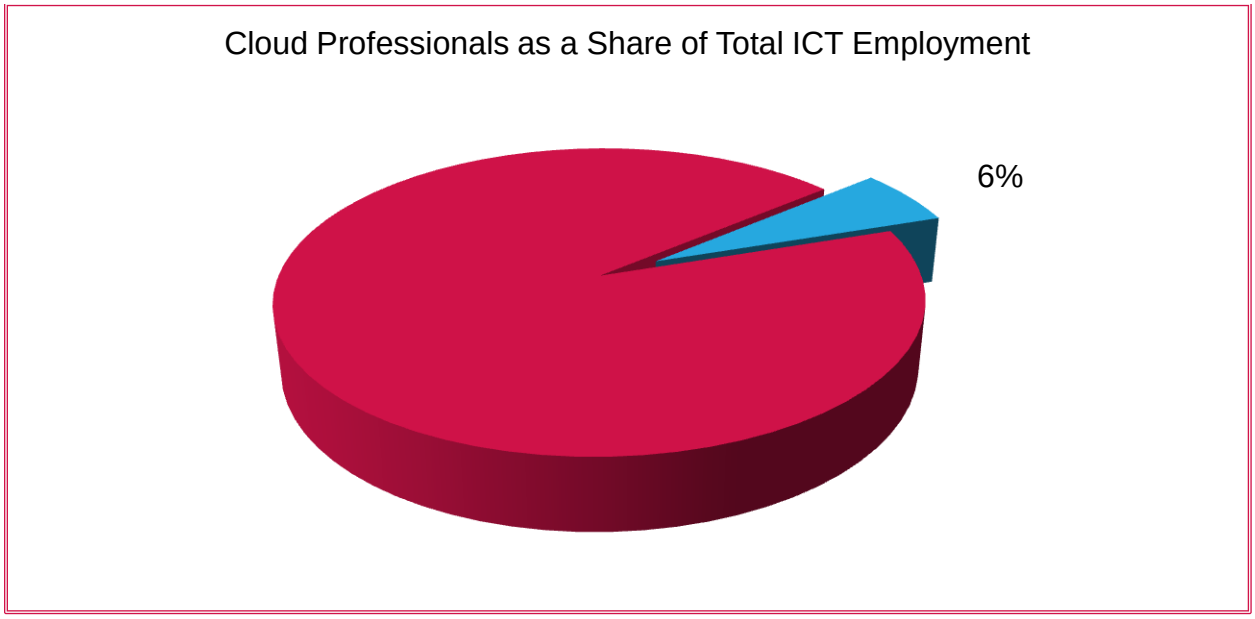
- **Computer network technicians**: Internet website technicians, LAN manager/administrator, WAN manager/administrator, controller—network, network administrator

Figure No. 3: Snapshot of ICT Occupations Employing Cloud Professionals



Source: ICTC (2012).

Figure No. 4: Cloud Professionals as a share of Total ICT employment



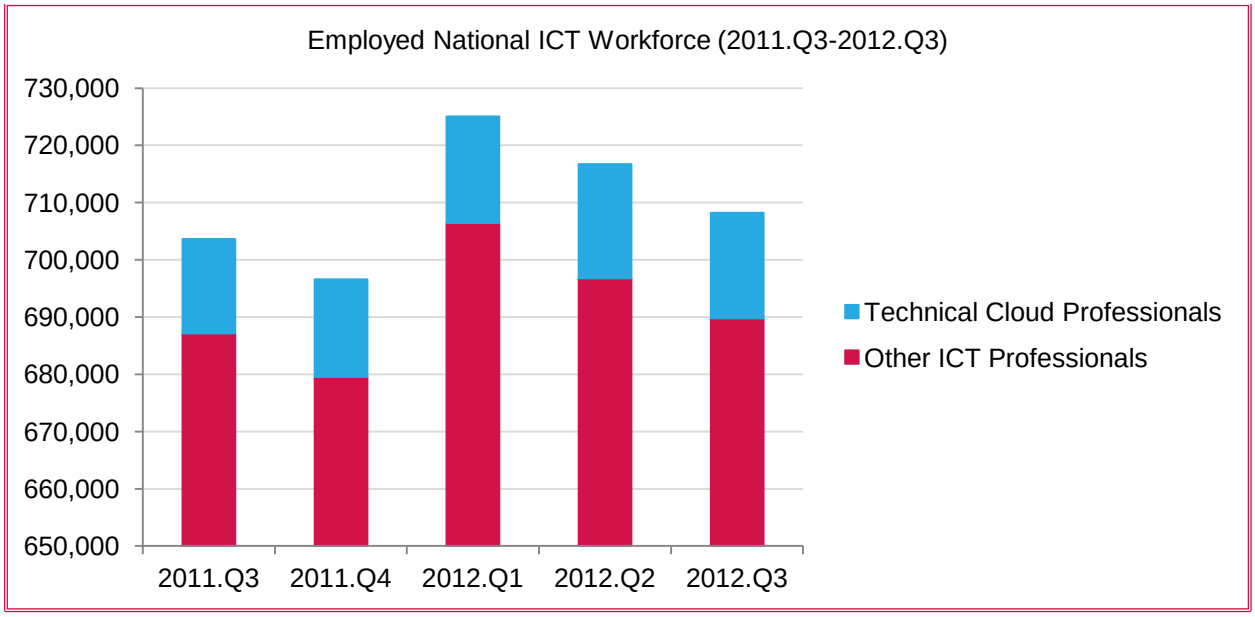
Source: ICTC (2013).

Based on job vacancies, social media adverts, Statistics Canada data, and the Working in Canada portal, Canada's cloud economy directly employs 38,400 workers. Of these, there are approximately 21,400 technical ICT professionals directly employed in the Canadian cloud services industry. In addition to these ICT occupations, cloud computing is reshaping many job descriptions in various technical and non-technical roles. Ultimately, the growth of cloud computing means that business and technology are becoming more interconnected and demand for ICT professionals with business development skills is higher now than ever before.[35] The importance of this relationship is magnified when one considers the skills that will drive ICT hiring trends for 2013. According to a recent study of US-based managers and recruiters, cloud computing and business intelligence skills are among the most in-demand skills for ICT professionals in 2013.[36] Accompanying them are skills in mobile technology.[1]

Roles such as enterprise architects, software engineers, and business systems analysts are strongly positioned to bridge the gap between the business side and IT domain.[3738] In an age when cloud computing is shaping and redefining the ICT paradigm, gaps separating business and IT will prove costly to firms. Enterprise architects and business analysts, among others, will play a catalyst role in championing the cloud into the business environment and overall management structure.[39]

[1] In 2012 ICTC identified that employment in the Canadian mobile app economy alone can expect to grow by 51% by 2016. For the full report, see: ICTC (2012): *Employment, Investment and Revenue in the Canadian App Economy*.

Figure No. 5: Employed National ICT Workforce (2011.Q3-2012.Q3)



ICTC's primary data, among other sources, demonstrates that Canada's cloud economy is a very young industry. Cloud developers and service providers are typically small firms employing less than 50 workers. As is often characteristic of tech start-ups, technical professionals outweigh non-technical workers. Therefore, it is estimated that an additional 17,000 non-technical professionals are directly employed in the cloud economy, bringing the total direct employment to 38,400.

Although the cloud economy is still an infant industry, job creation extends far beyond the confines of cloud start-ups and cloud service providers. The basic rationale for determining both the spillover effect of the cloud economy and its future growth is that IT innovation drives business innovation, which increases revenues and thus creates more jobs. On this basis, a conservative multiplier is used to estimate total employment in Canada's cloud economy. Therefore, the total cloud economy and related employment in Canada in 2013 is estimated to be approximately 48,000.

Although job opportunities in the cloud are not limited to the five occupational categories listed previously, these five areas provide an initial snapshot of where technical cloud workers—those developing, managing, and delivering cloud services—are employed. ICTC gathers data and provides labour market environment analysis for these occupations on a regular basis. ICTC also gathers and collects data on other, non-technical workers employed in the ICT industry. Combined with ICTC's primary consultations with cloud service providers and the rapid pace at which cloud adoption is occurring, ICT occupations central to cloud computing are estimated to grow 47% by 2018. Therefore, the Canadian cloud economy will directly employ approximately 57,000 technical and non-technical professionals by 2018. When we factor indirect and induced employment, the cloud economy will generate more than 71,000 total jobs in Canada by 2018.

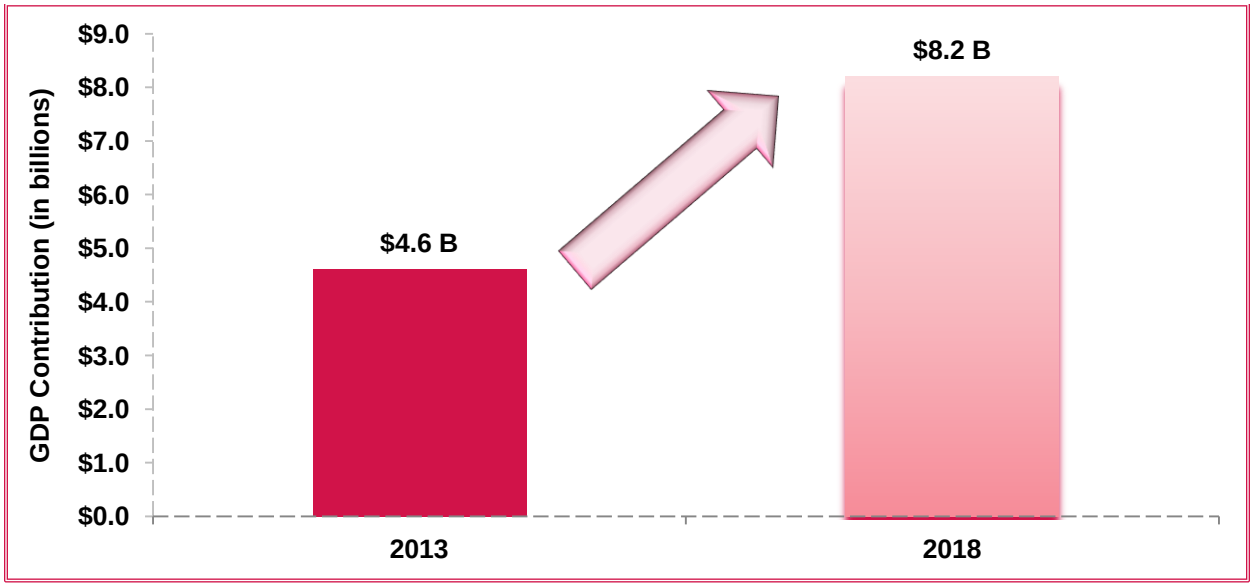
5.2 Contribution to GDP & Future Growth

While these figures point to considerable growth in the Canadian cloud arena, they are conservative estimates, and are based on the current composition of technical versus non-technical roles currently employed in small cloud-based companies.

Canada's cloud industry is already making significant contribution to the Canadian economy. The demand for cloud technologies and other virtualization tools has not only created jobs for capable ICT professionals, but for marketing, administrative, management and other professionals. These job opportunities will continue to grow as the Canadian cloud economy flourishes.

On the basis of the cloud industry's total direct employment, ICTC estimates that the Canadian cloud sub-sector contributes up to $4.6 billion annually to Canadian GDP. As job opportunities in the cloud economy continue to grow and salary for ICT professionals continues to appreciate in response to growing demand for their services, the annual contribution will become $8.2 billion by 2018 (see Figure No. 6). This projection takes into account anticipated inflation rates—based on historic trends—as well as the cloud industry growth rate. According to primary consultations with Canadian cloud companies, the cloud services industry is expected to grow 20% in five years.

Figure No. 6: Projected GDP Contribution by 2018



6.0 SKILLS OUTLOOK FOR CLOUD PROFESSIONALS

ICTC's consultation with cloud industry experts substantiated the findings of other international studies. Key informant interviews unanimously agreed that the growth of cloud services will impact the skills IT firms demand in the near-term. While not all jobs that require cloud skills are cloud-centric (in other words, jobs specializing solely in delivering and maintaining cloud operations), an understanding of the virtual environment will be what separates the current paradigm from the future one.

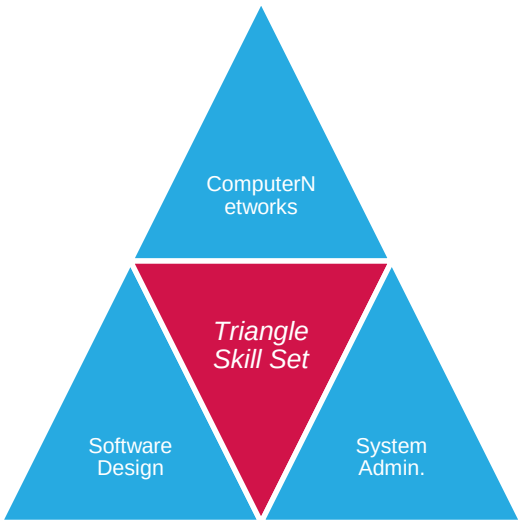
Demand for technical cloud specialists will be concentrated in cloud provider industries, such as IaaS providers.

The demand for technical cloud occupations will be highest among cloud providers more so than for end-user industries and small enterprises specializing in SaaS, PaaS, and cloud applications. This is due to the fact that cloud infrastructure providers must become expert at planning, sourcing, building, and maintaining reliable and redundant cloud computing resources that scale with demand. They must also become expert in helping their customers architect and take advantage of the cloud computing resources they offer.

End-users of cloud services in the private and business domains do not require comprehensive in-house infrastructure development and maintenance support to deliver or use the services. That is, in a sense, one of the underlying benefits of the cloud.

For end-user industries the most important roles are the planning and architecting of cloud resources based on the individual firm's needs. Beyond that there is the need to monitor these virtual systems to ensure that they are highly available and functional per the firm's needs. The ability to interconnect and manage the firm's existing network with the new cloud resources is also paramount. However, for these functions we are witnessing a blending or 'up-skilling' of existing roles as opposed to cloud specialist occupations.

6.1 The Demand for Skills: The Triangle Skill Set



In the near term, companies that have production-grade cloud applications ready to offer will require sales and marketing personnel to establish the cloud offering as a viable option for their market. In this sense, the shift toward the cloud does not change the existing internal staffing process of firms operating in this market. However, firms that require specific cloud professionals on the technical side may experience challenges recruiting for these types of positions.

Some organizations involved in the key informant interview process identified that they needed to scale back their requirements for cloud-specific ICT professionals. For example, advertising for the position of cloud developer often receives no hits, so firms instead look for a software developer who could be later streamlined into a cloud-specific role.

Firms that require these cloud-specific skills report challenges finding workers with a blend of knowledge pertaining to both traditional-discrete components and new technologies. Knowledge of both the

traditional and virtualized IT domains remains one of the most sought after skills for companies looking to hire cloud professionals. More specifically, ICT professionals who specialize in cloud are required to have what one informant called the *triangle skill set*, which includes: computer networks, software design, and system administration (especially in the area of IaaS). This triangle skill set is difficult to recruit for because the combination of programming and administration is difficult to find. Typical ICT applicants are skilled in one or the other, further proof that the cloud is interfacing between existing and emerging technologies and previous versus prevailing IT paradigms.

7.0 CANADA'S CLOUD ECONOMY: ENTERPRISE ADOPTION RATE

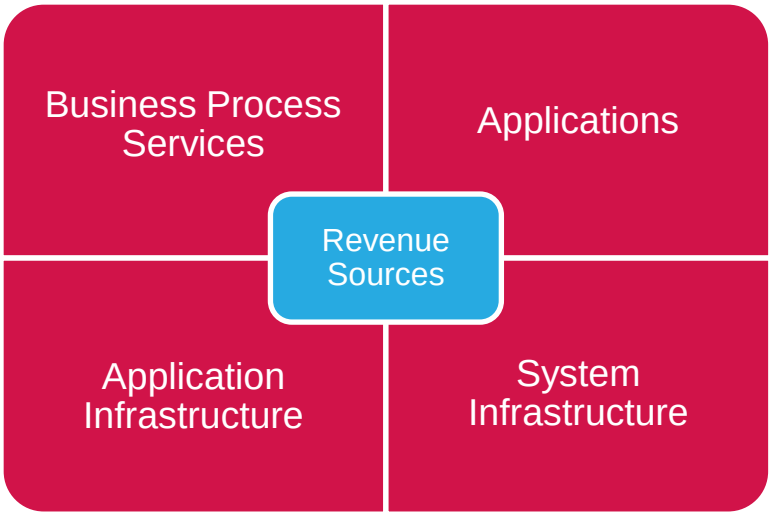
The cloud economy consists of a combination of larger firms with the resources to build out the networks and data centres that make the cloud a reality and smaller firms that offer cloud-based services and products. The very existence of the cloud itself makes it viable for smaller firms to come to market with cloud-based services and products.

The Cloud Economy contributes up to $4.6 billion annually to Canadian GDP.

- ICTC (2013)

The Canadian economy represents a growing cluster of cloud service providers. While leading vendors continue to be large, multi-national corporations, such as Salesforce, Microsoft, Cisco, and IBM, the growing uptake of cloud services has created a competitive market for Canadian-based service providers.

ICTC's primary consultations with Canadian SMEs revealed that small many service providers are increasing their share of the cloud market, with small-size firms offering IaaS, PaaS, or a combination of both. The main sources of revenue for these companies, among others, include: business process services, applications, application infrastructure, and system infrastructure. As cloud uptake continues to grow and businesses continue to leave behind expensive legacy applications in favour of cost-effective cloud solutions, the market for cloud services is expected to grow significantly.



In order to better understand the current and future adoption rates of cloud services in the Canadian market, ICTC undertook primary market research to explore the cloud adoption trends of enterprises operating across the country. In total, 360 firms were contacted to explore cloud usage and adoption trends in the Canadian economy. This sample included 160 ICT companies and 200 non-ICT companies.

The Canadian cloud market is past the early-adopter stage, as enterprises across a range of industries and levels of technological sophistication have adopted cloud services. In 2013 cloud services can be described as **mainstream**, as one-half of all companies surveyed indicated that they are using or plan on using cloud services. Approximately three-quarters of ICT firms surveyed indicated they are using or plan on using cloud services.

It should be noted that cloud adoption is likely underreported in many firms. It is likely that many reporting managers don't recognize that a service they are using is cloud or actively consider where their services come from, especially when these services are free of charge. As an example, the Google search engine is a cloud service. As a relatively new technology, cloud services aren't as identifiable as traditional software and hardware resources. These factors lead us to the conclusion that far more than half of all Canadian companies employ cloud services and related tools.

Among the various types of cloud provision available, public cloud continues to dominate. Among public cloud provision, SaaS adoption is more common. Figure No. 7 illustrates the extent to which ICT and non-ICT cloud-users employ SaaS solutions. More than one-half of companies that use cloud services use SaaS. By contrast, 44% of all cloud-users use PaaS, and 41% use IaaS.

Figure No. 7: Enterprise Use of SaaS Cloud Services

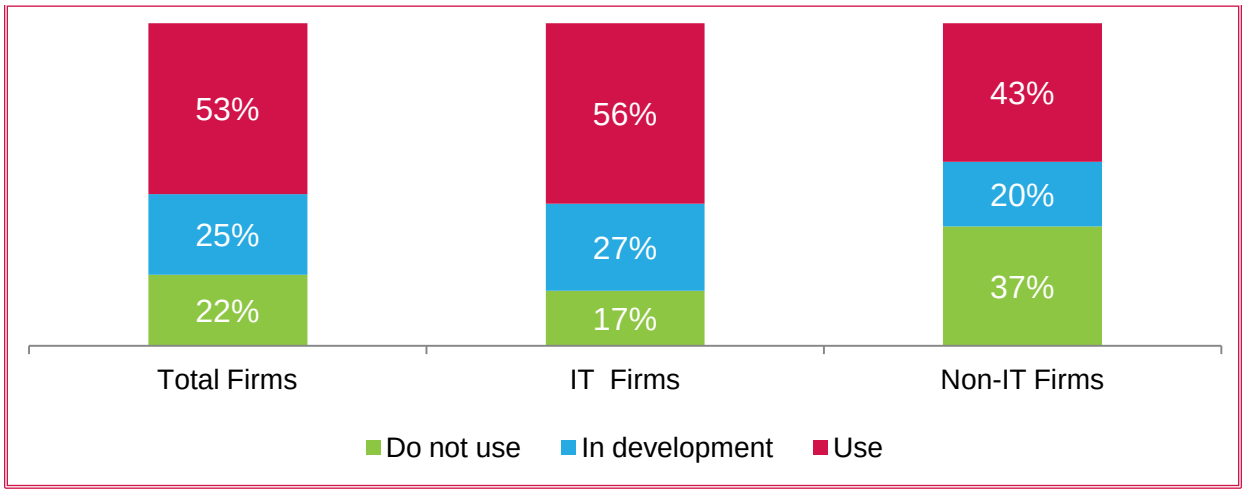
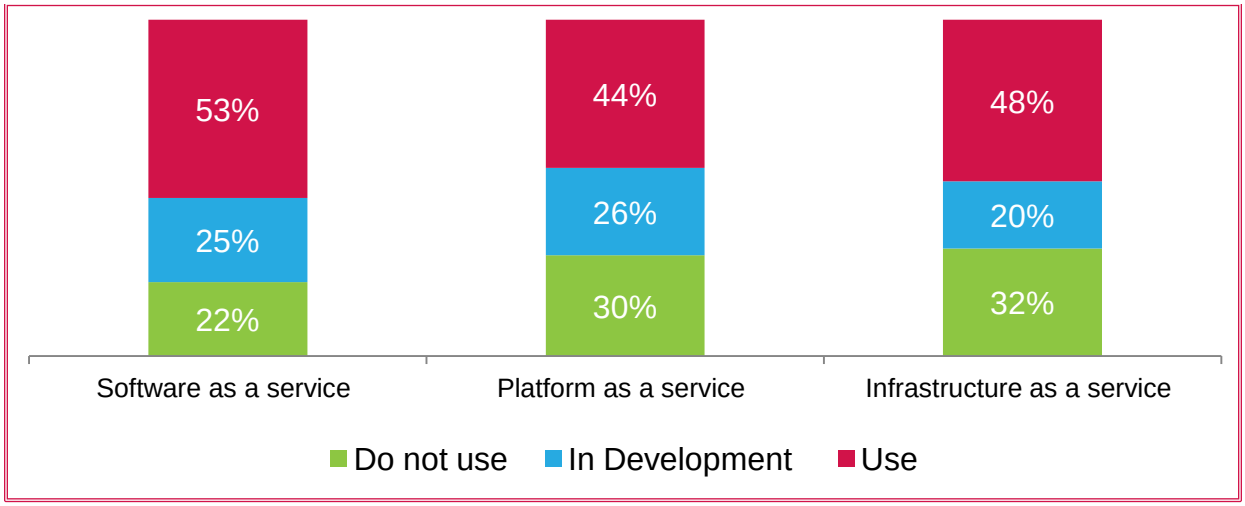


Figure No. 8 illustrates the extent to which cloud adopters use the various types of public cloud services.

Figure No. 8: Enterprise Use of Public Cloud by Service Type

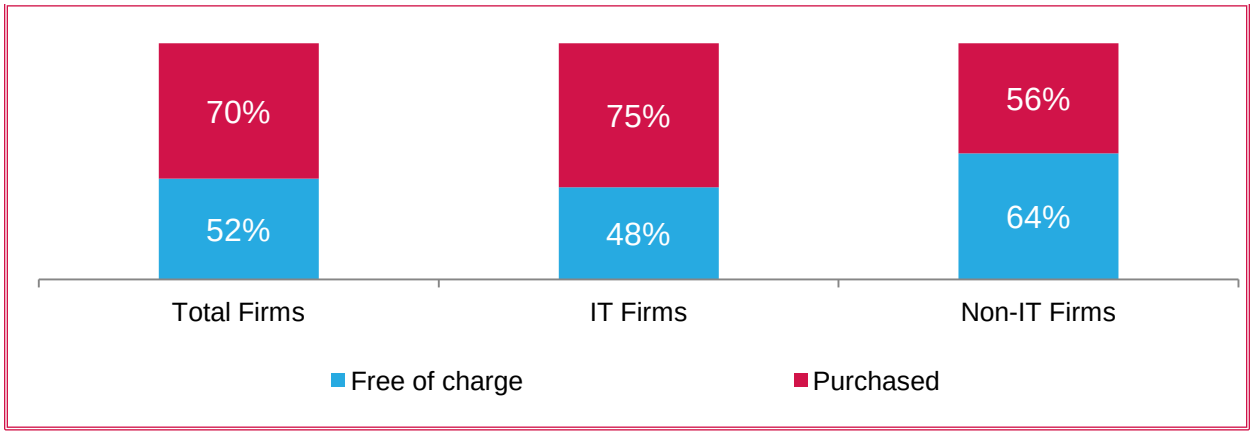


At the enterprise level, cloud service subscription/maintenance costs run from less than $200/month to over $10,000/month. More than one-half of the companies surveyed enjoyed at least some cost savings due to cloud adoption. Larger enterprises are much more likely to achieve higher costs savings than are small and mid-sized companies.

Figure No. 9 illustrates the extent to which Canadian companies are purchasing cloud services. According to ICTC's primary research, 75% of cloud-using ICT companies have purchased cloud

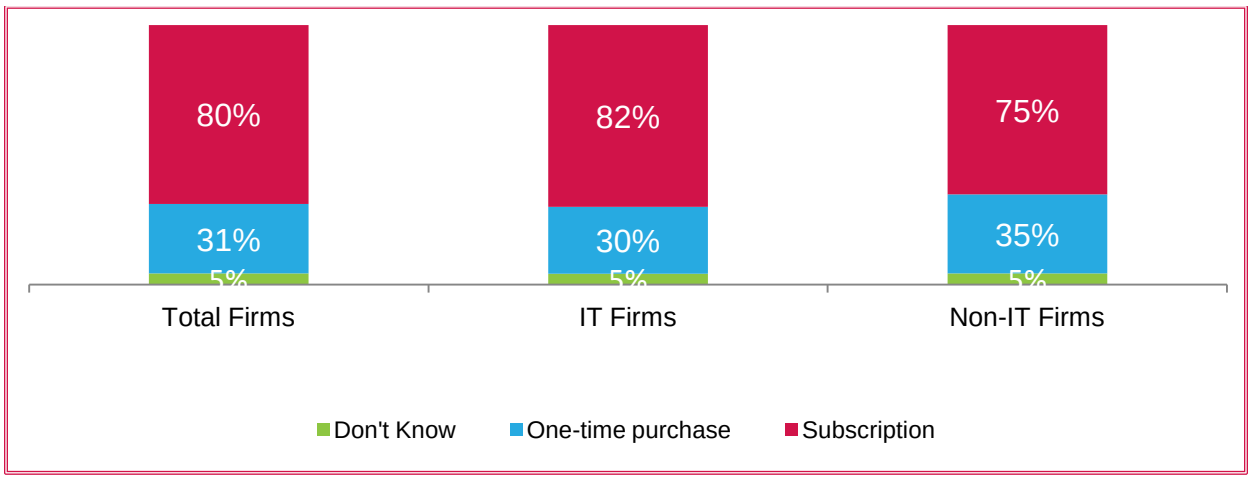
services, versus 56% of cloud-using non-IT companies. In total, 70% of cloud-using organizations purchase cloud services.

Figure No. 9: Enterprise Use of Cloud Services: Free Vs. Purchased



80% of companies that purchase cloud services do so on a monthly basis (e.g. subscription), and 31% of all purchasers also report to making a one-time purchase (refer to Figure No. 10 for a complete breakdown). These figures are relatively consistent across ICT and non-ICT firms, as evidenced by the following figure.

Figure No. 10: Enterprise Spenders on Cloud Services: One-time Purchase Vs Subscription



The market appeal for cloud services is growing. The research findings suggest that, once companies adopt cloud solutions, they use them across a range of functions. Almost one-half of all companies that report using cloud services use four or more services, ranging from storage to software applications and up to processing capabilities.

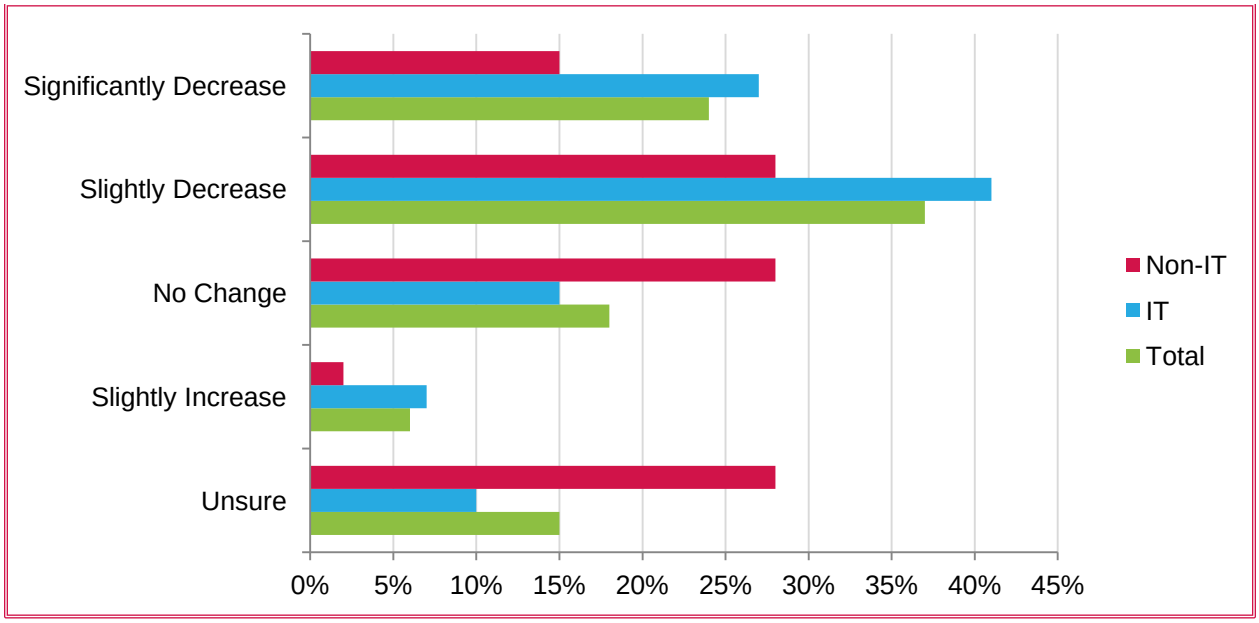
The research revealed that many of the appealing features attributed to cloud are being actualized in the marketplace. The biggest motivating factors for cloud adoption among SMEs are: (1) improving productivity and efficiency, (2) reducing costs, and (3) choosing a solution that is scalable and flexible.

Other notable factors include low infrastructure requirements and increased opportunity for collaboration and creativity.

Reduced costs are inherent to cloud provision (Figure No. 11 illustrates the impact of cloud on IT costs). By removing the need for large scale IT investment, companies can access the power and creativity computing has to offer without the costly databases, terminals, and other equipment. In addition, many cloud services are provided free-of-charge over the internet. Approximately one-half of all cloud adopters use some form of free service. Those who pay for cloud services are far more likely to pay for a subscription service, as opposed to a one-time fee.

Nearly two-thirds (61%) of companies have reduced their IT costs by switching over to cloud. This number is 68% for IT firms. Approximately one-quarter of all companies say that cloud computing has significantly reduced their IT coasts. This figure is 27% for IT firms.

Figure No. 11: Impact of Cloud Computing on IT Costs



The underlying impact of cloud computing on the Canadian enterprise market appears to be strengthening, as both ICT and non-ICT companies continue to migrate toward cloud solutions. Although the economic impact of the switchover has yet to be determined, one-half of SMEs believe that cloud adoption has reduced their ICT infrastructure costs.

7.1 Impact of Risk Aversion on Adoption

Key informants interviewed by ICTC indicated that demand for cloud is lower than it should be in Canada. Canada is moving very slowly in this space because organizations are risk averse. Cloud is still very new and society, firms, and the nation at large are still trying to understand what it all means. People typically feel insecure if the data is not in the physical building or office. In this sense, marketing plays a huge role in the promotion of cloud. While there is widespread concern about security and data integrity, security requirements are the same for the cloud as they are for traditional data centres. However, security breaches in the cloud are potentially more damaging for multiple reasons, such as:

- data for many organizations may be stored by one cloud provider,

- the cloud is often accessed over the public internet, which means everyone could potentially gain access to data in a public cloud, and

- data are no longer under the direct control of the organization that generates and/or records the data.

There is a perception among industry that communication over public cloud carries inherent risk. For many data providers infrastructure is shared among many clients, which means that client information is often scattered over several machines and, in the case of larger infrastructure providers, several data centres. Security- and privacy-related factors have led some firms to approach cloud with caution, or maintain current legacy applications until they feel confident in the new wave of computing. However, ongoing investment in cloud computing is synergizing the business and ICT domains in organizations throughout the economy. The ability of cloud services to lower costs and enable firms to do more with what they have means that those who are risk averse may inevitably need to consider migrating to the cloud. Given the rapid growth of the cloud industry as a global phenomenon, these considerations will have to be made sooner rather than later.

8.0 THE CLOUD ECONOMY & ITS ACCELERANTS

While section 4 touched upon notable adoption inhibiters, there is strong reason to believe that, with the proper frameworks in place, these challenges can be transformed into the most influential drivers of cloud adoption. Take security as an example. Today, security is one of the greatest inhibiters to cloud adoption, but tomorrow, it can very well become cloud's greatest accelerator. It is expected that cloud service providers will increase their investment in security infrastructure many-fold over the next five years. If this does indeed occur, it will diminish much of the obstacles associated with present-day cloud adoption. Other factors that will lead to greater adoption of cloud services are highlighted below.[40]

Cost savings: The cloud enables users to forego traditional (and often expensive) aspects of computing, such as hardware purchase, installation and maintenance. This significantly reduces the start-up costs that have traditionally inhibited small firms from entering the market. IT-related cost savings associated with cloud adoption have been estimated to be as high as 50% among government agencies.[41]

Elasticity and on-demand service: Elasticity is an essential characteristic of cloud computing and one of its strongest offerings. The cloud provides users with a pay-as-you-go service that is capable of expanding or retracting on demand, thus transforming computing into a demand-based service. In a recent US survey of private and public cloud users, elasticity was cited as one of the most important benefits of cloud adoption.[42]

Reducing barriers to entry: Low start-up costs and elasticity have enabled start-ups and small businesses to not only enter the marketplace, but to expand their reach internationally. The cloud industry is expected to reach $241 billion by 2020 and start-ups and SMEs will be the lifeblood of this new economy. In 2012 *Network World* released its list of 12 cloud start-ups to keep your eye on, which have already generated $160 million in business.[43]

Developing standards for the cloud industry: Led by the US NIST, cloud computing standards are being developed by the EU, the Distributed Management Task Force, and the Open Cloud Consortium. What these bodies share in common is a global membership dedicated to standardizing the cloud industry on an international level.[44]

Among the principal drivers of cloud acceleration is uptake by high profile vertical industries, which are now beginning to see the potential of cloud computing. As an example, cloud technology is creating new possibilities for the financial services industry, which is using the cloud to tap into the social media revolution. Today's financial services industry is placing greater emphasis on hybrid IT that is capable of driving the multichannel digital ecosystem banks require to enhance end-user experience.

8.1 Investment

Ongoing investment in cloud computing will synergize the business side and ICT domain in organizations throughout the economy, both public and private. The adoption of innovative technology allows firms to produce at lower costs, thereby shifting their cost curves downward. With lower costs, firms are willing to supply a greater quantity of their product or service at a lower price. This has the potential to fundamentally shift the market supply curve rightward, which, in the case of cloud, means more infrastructures on which to build capacity and generate business. As the new supply curve intersects the growth in demand, the quantity produced increases and the price falls, thereby leading to an effective equilibrium for the cloud market.

At the enterprise level, cloud adoption can free up large expenses tied up in maintaining legacy systems. Commonly referred to as the "legacy drag," organizations spend too much of their IT budget on the

maintenance of legacy applications. It is estimated that 75% of global IT spending is tied up in legacy systems and upgrades, which inhibit an organization's ability to innovate and shift to low-cost computing.

In 2011, approximately 15% of global IT spend was devoted to public cloud IT services, which translates into $28 billion per year. It is estimated that, by 2015, cloud-driven business revenues could reach $1.1 trillion per year.[45]

8.2. IaaS and Offshore Outsourcing

While offshoring has existed for hundreds of years, its impact was perhaps most noticeable during the 1990s, when many large-scale Canadian firms moved their IT services and infrastructure overseas. General office services such as finance, accounting, and HR management soon accompanied IT services, as Canadian firms sought more cost-effective platforms for delivering their services. This trend was not limited to Canada; other developed countries such as the United States led the way in IT service outsourcing, taking advantage of the increased efficiency and declining costs of satellites, fibre optics, and telecommunications.

Over the past two decades, leading IT multinationals such as IBM and Hewlett Packard have increasingly offshored their IT services. Emerging IaaS providers specializing in cloud services face stiff competition from large counterparts who are shifting their service provision over to cloud. However, cloud-based IaaS providers have a two-fold advantage over the larger IT service providers. On the one hand, the cloud is much more versatile and innovative than the infrastructure currently provided by traditional data centres, leading to the kind of innovative solutions for which there is growing demand, especially in the realms of private cloud and consulting. On the other hand, many, if not most, of traditional data centre functions are shifting toward the cloud, so new companies specializing in cloud-based IaaS may be well ahead of the curve. The extent of the success they enjoy will depend largely on how quickly they can take advantage of increasing consumer preference for cloud-enabled services and whether they can get their foot in the door before large data centres begin switching to the cloud.[46]

The dual challenge faced by providers of IT outsourcing (ITOs) over the foreseeable future is meeting the growing demand for cloud IaaS while at the same time providing their traditional IT services. Traditional IT services continue to be a large source of revenue for ITOs, but the demand for cloud cannot be overlooked. ITO providers that are incapable of providing this hybrid delivery system—namely, increasing their cloud services alongside traditional IT—run the risk of losing business. At the same time, increasing cloud services comes at the benefit of ITOs since it enables them to reduce costs. The migration toward cloud will likely be gradual and this will benefit new players in the IaaS arena.[47]

8.3 Impact of Mobile Technologies

The growth of cloud computing has had a positive impact on the use of mobile devices, supporting more flexible working practices by providing services over the internet. The cloud has had a broad impact on the mobile tech industry, which includes the devices, network infrastructure, apps and services, and middleware. With mobile applications increasingly becoming more sophisticated, interacting with cloud and residing on multiple interconnected devices allowing machine-to-machine (M2M) connectivity, additional opportunities will stem from the interaction of digital media with hardware and software, creating a rich opportunity for enterprises of all sizes to participate and contribute to Canadian GDP.

Through cloud computing, mobile technologies are better able to connect backend systems and create an environment for making many decisions in-field where production is taking place. Cloud applications and services allow automating much of the installation and configuration of IT work. Through cloud, large

firms are able to outsource their IT management functions, reduce maintenance and operational costs, and focus on business development.

9.0 THE FUTURE OF CANADA'S CLOUD ECONOMY

Cloud is having a definite impact on Canadian industries and is creating new opportunities for small companies looking to enter the market. While adoption continues to grow among businesses and small IT firms, more education is required to truly move Canada toward the next phase of cloud adoption. Adoption inhibiters must be addressed directly, and cloud computing must be positioned as an enabler that frees organization from existing IT limitations.

In Canada there remains an underlying fear preventing cloud adoption—fear about handing over your IT to a third party.

Educating managers at the government and enterprise levels about the benefits of cloud computing will at the same time extinguish current anxieties over privacy and security. According to ICTC's key informants, concerns over data residency and other privacy dimensions are overblown and can potentially put Canada further behind the adoption cycle. Global indicators point to Canada lagging considerably behind other industrialized nations in embracing the cloud. Because technology is advancing faster than the adoption cycle, there is a lag in switching over to the cloud. This lag is often precipitated by the fear of adoption. People are not quite sure what cloud computing means. What they do know is that it reflects a big change from the traditional data server model. However, as ICTC reveals, one-half of Canadian businesses have used or plan on using cloud services, which means that cloud computing is already a mainstream market.

Businesses that still have security and data residency concerns must be made aware of how cloud technology works and how it can be made compliant with existing legislation. Education on the inner-workings of cloud services could greatly reduce apprehensions of migration and increase adoption among late-responders. According to one insider, "the approach to security is no different in the cloud; the tactics to address security remain the same."[48] For many Canadian infrastructure providers, security does not pose a significant challenge because encrypted protection is provided by the cloud server. Data stored over the cloud is therefore no less secure than remote connections.

Early adopters are making tremendous use of cloud technology. It is enabling firms to compute in ways that previously required high end infrastructure, expensive computer equipment, and costly maintenance fees. The cloud removes all these requirements, enhancing firm interoperability, innovation, and collaboration. The cloud enables firms to store and organize information, as well as share and work across applications more efficiently.[49]

The global digital economy is fast becoming aware of the cloud's inherent potential. At home, almost three-quarters of Canadian ICT companies have already adopted or are planning to adopt cloud computing. This broad interest is expected to grow as organizations realize that the cloud enables them to "become dramatically more agile and cost effective."[50] As early as 2010, global revenue from cloud services reached $68 billion and in 2011 public and private clouds accounted for around 15% if global IT spending.[51] Where Canada fits into this global paradigm is up to the federal government, industry associations, and enterprises themselves, which together must decide whether Canada is to play a leadership role in technological innovation, or whether it will follow the lead of the United States, Japan, and Europe.

Canadian government and industry associations can promote greater cloud adoption in Canada by highlighting the capacity of provinces such as Quebec, which has favourable conditions for hosting cloud data centres (e.g., hydro-electricity, climate, and renewable energy). Hydroelectricity can greatly reduce operating costs of cloud infrastructure providers, as can the colder climate, which helps reduce cooling

costs associated with maintaining large servers. The challenge however is getting fibre to more remote locations; this is why data centres are being located in urban centres, where fibre optic lines are more readily available.

Legislation such as the Personal Information and Electronic Documents Act (PIPEDA) makes Canada a safe haven for data centres, providing infrastructure providers with a safe and secure environment in which to store sensitive information. In this sense, people must become aware that cloud can be easily made compliant with acts such as PIPEDA.

Canada's comparative advantage in this regard must be promoted more ambitiously to grow the cloud industry and make it a viable alternative in regions throughout the country. Today, cloud providers are mainly concentrated in the eastern part of the country. Tomorrow, more cloud adoption will be needed from coast to coast if Canada is to reap the benefits of what the experts are calling a $241 billion industry by 2020.

Cloud computing has already left its mark on the Canadian economy, spurring the creation of tens of thousands of direct jobs in both ICT and non-ICT domains. The direct contribution of the cloud economy has been shown to have indirect and induced effects as well. ICTC's conservative multiplier suggests that for every four jobs in cloud economy generate one job in the rest of the economy.

The five most critical jobs in the cloud economy—those responsible for developing, maintaining, and updating Canada's cloud infrastructure—are expected to grow 47% by 2018. Canada's ICT industry is already facing a talent crunch, as employers struggle to fill critical ICT occupations in traditional domains alone. The growth of cloud computing and mobile technologies has created even greater demand for highly-skilled ICT talent at the intersection of traditional and emerging technologies, programming and administration.

Organizations that require cloud-specific skills have already reported challenges finding workers who can combine traditional-discrete components with knowledge of emerging technologies. ICT professionals with a balanced knowledge base consisting of computer networks, software design, and system administration will be highly sought-after. As the cloud economy continues to grow and deepen, traditional job descriptions will continue to erode to meet the dynamic, fast-paced demands of the virtualized, service-oriented IT environment.

10.0 CONCLUSIONS & WAYS FORWARD

ICTC's Series on Emerging Sub-Sectors is intended to shed light on Canada's new and emerging growth industries. This report provides a reference guide to help Canadian enterprises identify and address the opportunities and challenges associated with cloud adoption. As has been demonstrated in the preceding pages, cloud computing suffers from a lack of awareness and misplaced judgment of the critical fault lines associated with adoption. No one is suggesting that fears over data residency and security are not valid, but with every challenge comes an equal or greater opportunity, and as cloud service providers increasingly demonstrate the reliability and security of their features, more organizations will warm up to the idea that cloud adoption makes sense.

In Canada there remains an underlying fear preventing cloud adoption—fear about handing over your IT to a third party.

✚ **Cloud adoption: critical for all industries and governments**

The digital economy has created new organizational demands for agile, scalable, cost-effective solutions that enable firms to generate more sophisticated business intelligence and manage large data volumes. The digital economy's expansion and deepening sophistication has given birth to new paradigms, including big data and integrated ecosystems. Somehow, large firms must come under the view that "more data is better." The social and digital media phenomena require more sophisticated data analytics to drive business.

Cloud computing better prepares both large and mid-sized enterprises to capitalize on the big data revolution, and shift their focus from individual projects to company-wide solutions that move beyond traditional data collection and analysis approaches. Cloud systems make this transition easier, and allow organizations to abandon single enterprise solutions in favour of multiple content management systems, data warehouses, data marts, and specialized file systems that will enable them to do more with data.

As the market turns to integrated ecosystems, or an enterprise-level approach that uses technology to accelerate business growth and make data analytics smarter, cloud computing will play an integral role in how successfully firms can integrate new technological innovations. The line separating hardware and software has become increasingly blurred, signaling a shift in how software and related services address infrastructure and application workload. Unfortunately, most organizations haven't reached the stage where they can increase capability while reducing IT costs.

Advances in technology and growing uptake of cloud services are showing us that highly efficient and strategic data centres cannot be achieved without an underlying system that integrates the entire process. The adoption of cloud services does not necessarily entail that organizations abandon all other forms of IT. Rather, cloud can be used to synergize the group of technologies and related processes that package software and services to address infrastructure and application workload.

The forces of technological change and cloud-based innovations have the potential to create greater economies of scale and lower-cost production for firms across a range of industries. While the role of government should not be to regulate this space, creating an enabling environment that guides service providers and offers funding programs that incentivize the cloud are essential. Federal and provincial governments must provide a roadmap for industry players to guide them through the regulatory environment pertaining to privacy, security, and intellectual property.

Currently, the Canadian government is currently exploring more avenues for cloud adoption.[52] Early signs suggest that private clouds are being used for some human resources and financial data services, which are controlled by Shared Services Canada. It is clear that the federal government has found a great deal of value in cloud computing. Once shifting more services to the cloud becomes a more viable option, governments should trumpet this move as reinforcement to the private sector that the technology is ready and useful.

✚ Industry best practice

The cloud economy is in need of strong industry champions capable of demonstrating the potential of cloud computing. Currently, few standards and best practices are in place to guide the cloud industry. Industry best practices are needed not only on a national level, but internationally as well. In a global market, the cloud has the potential to intensify the forces of globalization.

Industry standards and best practices must emanate from the providers and users themselves. As the epicentre of the Canadian cloud computing industry, the Greater Toronto Area (GTA)[53] is likely the most prepared to lead the charge. Industry associations must collaborate around common concerns and must build a *cloud consensus* in Canada that can transcend the globe. Government support is necessary but insufficient to spearhead best practice. Rather, domain experts must collaborate around the common challenges and opportunities facing the Canadian cloud economy.

The cloud industry must identify and define the forces at work in today's cloud-enabled market. We know that two forces are at work in a market undergoing technological innovation. Firms that adopt the new innovation are well poised to enhance their business output and increase profit. Canadian firms both large and small and across a range of industries have already demonstrated the direct and induced benefits of cloud. Canadian start-ups in the Toronto area are already generating millions of dollars from cloud-enabled products and services. Inevitably, this will lead to greater entry into the cloud market by firms looking to capitalize on the opportunity.

As more and more players enter the cloud arena, concerns over best practice will intensify. It is therefore vital for the Canadian cloud industry to mobilize and coordinate around common concerns and identify a set of best practices and standards that can guide the industry over the next five years.

✚ In conclusion

ICTC will monitor these developments and suggest pathways toward best practices that can link industry players across the country toward common objectives. ICTC believes that cloud computing provides an inherently strong value proposition for organizations and the nation at large. The direct and induced benefits of cloud adoption can be reaped in virtually every industry. Cloud adoption can make organizations smarter, lighter, and more adept at addressing complex issues. For this reason, cloud adoption offers strategic and commercial benefits to organizations operating in all areas of the digital economy.

11.0 ANNEX

Prominent Canadian Cloud Companies

- BLACKIRON Data Inc.
- Comwave
- Esri Canada
- Fujitsu
- 10th Magnitude
- Adobe Creative Cloud
- Adrive
- Amazon Cloud Drive
- Bell
- Box
- Carbonite
- CentriLogic Cloud Hosting
- CiRBA
- Cisco WebEx Cloud
- CloudPockets
- Computer Professional Services
- CX
- Dell Cloud Computing
- Dropbox
- EzeCastle Integration
- Fort Technology
- Freshbooks
- GreenQloud
- HP Cloud
- HuaWei
- IBM SmartCloud
- Infosys
- Joyent Go
- Lexcom Cloud Computing
- MediaFire
- Mmedia
- Mozy Stash
- MSI
- Netelligent
- NetSuite
- Nulogy SaaS
- Oracle CLoud
- Rackforce's Cloud Portfolio
- Radiant Cloud Computing
- Rypple/Work.com
- Salesforce Marketing Cloud
- Savvydox
- Skydrive
- Smarsh
- StoragePipe
- SugarSync
- Symform
- TELUS AgilIT
- Tenzing's Everest Cloud
- TitanFile
- VirtuStream Enterprise Class Cloud
- VMware Cloud Solutions
- Windows Azure
- Wuala

12.0 ENDNOTES

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