Service Process Transformation in Public Sectors Based on Cloud Services

Wen-Hong Chiu[1] , Yan-Tsern Lin[2], Hui-Ru Chi[*]

[1] Associate Professor, Department of Business Administration,Asia University, Taiwan
[2] PhD Student, Department of Business Administration, Asia University, Taiwan
[*] Assistant Professor, Department of Business Administration, Asia University, Taiwan

Abstract: This study investigates the case of New Taipei City Government and transforms the governmental service process by means of cloud services, thus constructing cloud application intelligent service innovation modes for New Taipei City Government. Related secondary data about cases from 2011 to 2017 are gathered, the innovative events on cloud services in the whole case are collected and in-depth expert interviews are conducted. Three research findings are proposed in this paper: firstly, the public sectors popularizes open and innovative services by means of cloud computing technology in order to establish intelligent convenience services; besides, the cross-authority service process transformation is promoted and one-stop integrated service process is provided; finally, the cloud service functions are refined and E-intelligent city is constructed through cloud application services.

Keywords: cloud, cloud computing, service process transformation, New Taipei City Government, case study

1. INTRODUCTION

With continuous development of the global cloud computing technologies and service applications, facing the dramatic changes and opportunities brought by cloud computing across the world, all the developed countries are considering how to improve the overall national competency by means of the merits of cloud computing. Although cloud computing is not a brand-new technology, it reshapes the supply chain of information industry and starts the competitive age centered on software and services. In addition, governments across the globe compete to invest into cloud computing policy planning and expect to further enhance governmental administrative efficiency and provide the people with more convenient living environments with the cloud characteristics. The quantum leaps in information technology have remarkably transformed the interactive modes between the governments and the public, and promoted

governmental service transformation and innovation. On one hand, it is of pervasive and real-time value to construct government cloud as far as the public user side is concerned. On the other hand, it is of economic, agile and operational value for the government supply side (Chandrasekaran and Kapoor, 2011). It is shown by the investigation data collected by KPMG, a global counseling service corporation, in 2011 that about one fourth of the interviewees in public sectors over the world have started taking cloud computing import measures, including development of cloud strategies, conceptual verification and practical implementation. According to the market forecasting report by Gartner, an international research and consultant organization, the share of publicly-owned cloud services in the whole IT service market will gradually rise from 12% in 2012 to 22% in 2017 (Anderson *et al.*, 2013; Hale *et al.*, 2013).

To adapt to the changes to social and economic structure as well as population structure, the governmental governance models and service provision should be conducted under new thinking. In cooperation with the adjustment to governmental organization and application of communication technologies, it is more urgent and necessary to review and transform the related service processes, which is the key to improve the international competence of Taiwan. However, the previous literature related to cloud service mainly focuses on the cloud technology development and enterprise competence (Buyya *et al.* 2009; Rosenthal *et al.* 2010), cloud commercial model (David 2009; Marston *et al.* 2011; Sultan 2010), security and privacy protection (Wang *et al.*, 2012; Çokpýnar and Gündem 2012) as well as cloud service applications (Rimal *et al.* 2011), etc. In contrast, there are few related research topics probing into the service innovations of government and cloud applications. To adapt to the changes to social and economic structure as well as population structure, the governmental governance models and service provision should be conducted under new thinking. In cooperation with the adjustment to governmental organization and application of communication technologies, it is more urgent and necessary to review and transform the related service processes, which is the key to improve the international competence of countries. Consequently, based on the viewpoints on transformation of governmental service process, the objective of this study is to investigate how to effectively improve the overall governmental service quality, enhance international competence and provide the public with more superior and convenient life by means of demonstrating the value of public services, promoting government cloud services, inspiring integrated innovative services and spreading benchmarking learning benefits. In addition, the development profile about cloud application innovative service of New Taipei City Government is analyzed in order to gain an insight into the benefits from construction of intelligent and convenient services through government cloud application, thus proposing the management connotation of administrative strategies targeted at the future trends.

Cast study method is applied in this study. The case selected is New Taipei City Government. In order to provide its citizens with rich and perfect cloud service applications, and further bring them intelligent and superior life, New Taipei City strives towards the objective of intelligent city (i-City) and developing cloud government, devotes itself to improving various information service levels, constructs itself into a "3O" government (namely One Government, Open Government and Government On-hand), and sets the goal of accomplishing i-Government, i-City and i-Citizen for the public. Although the government hasn't initiated related i-City transformation development until 2010, it has been gradually recognized by different international organizations, such as WeGo and IDC, for it employs information and communications technology (ICT) to increase administrative efficiency and public services. In addition, it is a municipal

government directly under the central government with the active promotion of service process transformation by National Development Council and regarded as a representative case in the cloud applications of public sectors in Taiwan. Hereunder, the literature on cloud computing and transformation of governmental service process is reviewed.

II. LITERATURE REVIEW

2.1. Cloud Computing

Cloud computing is an Internet-based computing mode and provides individual users or enterprises by virtue of Internet with demand-based services. It was put into market by Amazon for the first time in 2006, which promoted cloud services. National Institute of Standards and Technology (NIST) defines cloud computing as "use ubiquitous, convenient and on-demand Internet, share massive computing resources (such as Internet, servers, storage, applications and services) and quickly provide various services through minimum management events and service supplier interactions". Cloud computing possesses five essential characteristics: On-demand Self-service, Broad Network Access, Resource Pooling, Rapid Elasticity and Measured Service, and owns three service models, respectively Software as a Service (SaaS), Platform as a Service (Paas) and Infrastructure as a Service (IaaS). In addition, International Organization for Standardization (ISO) published ISO/IEC 17788 and ISO/IEC 17789 in October 2014, which provide specific standard definitions for cloud computing and reference architecture respectively, and clearly describe the cloud computing role, cloud computing events, cloud computing components and mutual relations. These two definitions serve as internationally-universal references. Promoting transformation of governmental service process comprehensively will better improve the overall service performance. Therefore, the relation of comprehensive promotion of transformation of governmental service process by cloud applications requires further investigation. Currently, there are few researches on the service innovations of government cloud applications. Therefore, based on the viewpoints of transformation of governmental service process, this study applies three service models of cloud computing, including IaaS, PaaS and Saas, and thus construct the cloud service innovation models and analyzes the development process (Figure 2). To sum up, the government cloud infrastructure service and architecture are distinguished by SaaS, PaaS and IaaS: centered on promoting the governmental applications closely related to the daily life of the public and aided by joint construction of platform and infrastructure, SaaS applies the advantages of cloud services to innovate the service process and enable the public to feel the cloud application services externally, and promote intelligent Internet office and improve inner administrative efficiency internally. Centered on integration and sharing of cross-authority common services, PaaS applies cloud computing technology to create on-demand service platform with flexible expansion capability on the basis of current electronic governmental service platform. IaaS provides the infrastructure construction required by development of SaaS and PaaS.

2.2. Transformation of Governmental Service Process

Globalization process and rapid social changes have driven the public governance into Post-New Public Management (Post-NPM) with extra focus on the creation of public value (Moore, 1994; Christensen & Lgreid, 2007). Based on this, many governments have successively developed various innovation integration services for the public. Their integrated services are shifted from "what services to offer" in the past to

"how to offer the services" at present. The shift of public service patterns lies in that more attention should be paid to how to coordinate and propose customized process in order to satisfy public demands (Sung and Huang, 2012). With the progress in information and communication technologies, countries across the world regard the improvement of Internet infrastructure construction, popularization of online services and provision of client-oriented services as their top administrative priorities. However, the expression form of government cloud services includes electronic and Internet public services. The primary feature is that the government applies Internet system to provide services for various businesses related to the public and construct virtual Internet government to interact with the public. The government cloud services demonstrate wireless, diversified, interactive, timeless and one-stop characteristics (Liao and Lu, 2010).

Government service process transformation should be proposed according to the user-centered demands. Considering that the public are not able to go to the counter in the person due to working hours when applying for cases in governmental authorities, if the government can apply communication technology into governmental service items, the public are able to handle case application procedures through Internet or mobile carriers without the need to visit the counter personally, which will bring great convenient to the public. However, there are still some case applications which require the public to handle at the counter in the flesh. For these cases, the principle will be that related application documents should be collected at just one place while service will be provided in the whole course. In addition, the cross-authority and cross-departmental cooperative integrated service process is applied to enable the public to finish the application procedures in only one visit to the counter. Apart from provision of online and counter services, the government will actively provide more customized and amiable on-site services for the public in some remote areas or weak groups who are not able to visit the counter themselves. The three major methods include (Figure 1) (Sung and Huang, 2012): 1) the public can handle everything without leaving their home, and the government applies communication technologies, keeps renovating diverse governmental service channels, integrating and planning electronic governmental services in different authorities, innovating and providing single electronic governmental access, assisting the public in acquiring governmental services on mobile carriers, or establishes entrance website for investment attraction and services, offers single service windows and customized services over the whole course. 2) the public can finish all the procedures by only one visit to the counter, and the authorities should comprehensively review the implementation of one-stop document collection and whole-course service, remove the necessity of attaching copies of certificates, facilitate the public to apply for cases, execute one-stop service for both major and minor issues since birth, or actively review the necessity of attaching copies when the public are applying for cases in order to reach the objective of comprehensively removing the necessity of attaching copies. 3) Government should provide active and care services for households, and the frontier service officers offer active on-site services targeted at the public in need and the site officers accept and handle the services online, and the connection among governmental authorities and between the government and the social welfare organizations should be strengthened by social network. To sum up, the government should base themselves on the demands of the public, take both major and minor affairs of the public seriously and develop sympathetic and active services, thus enabling the public to personally experience the service concept of customer first. Therefore, with a start point on the demands of the public, the transformation of governmental service process is to further provide comprehensive convenient services and to design patient-oriented service process which can be applied and promoted more effectively.

III. RESEARCH METHODS

3.1. Case Selection

The case in this study is New Taipei City Government in Taiwan, which was upgraded to a municipality directly under the central government from previous Taipei County and renamed as New Taipei City in December 25th, 2010. It has been awarded with nine international awards and four national first prizes in the aspect of related i-City development. In addition, it has been recognized by 19 distinguished performance awards and its execution achievement has been recognized by international organizations. Furthermore, it is a municipal government directly under the central government with the active promotion of service process transformation by National Development Council and regarded as a representative case in the cloud applications of public sectors in Taiwan. In combination of service technology, cloud technology and mobile technology, New Taipei City Government conducts cross-authority certificate integration and data calculate, and actively provides them for the use of citizens by means of the governmental information opening and delivery services. Based on the mobile carriers as the service platform, it enables the citizens to enjoy the convenience from i-City and happy life. Its development profile is as follows: 1) Service cloud(2013-2016): target at all the public and legal representatives in New Taipei City, establish complete service capital flow, service logistics, service information flow and case management system in order to integrate all the application items, service passages and service contents in New Taipei City Government,
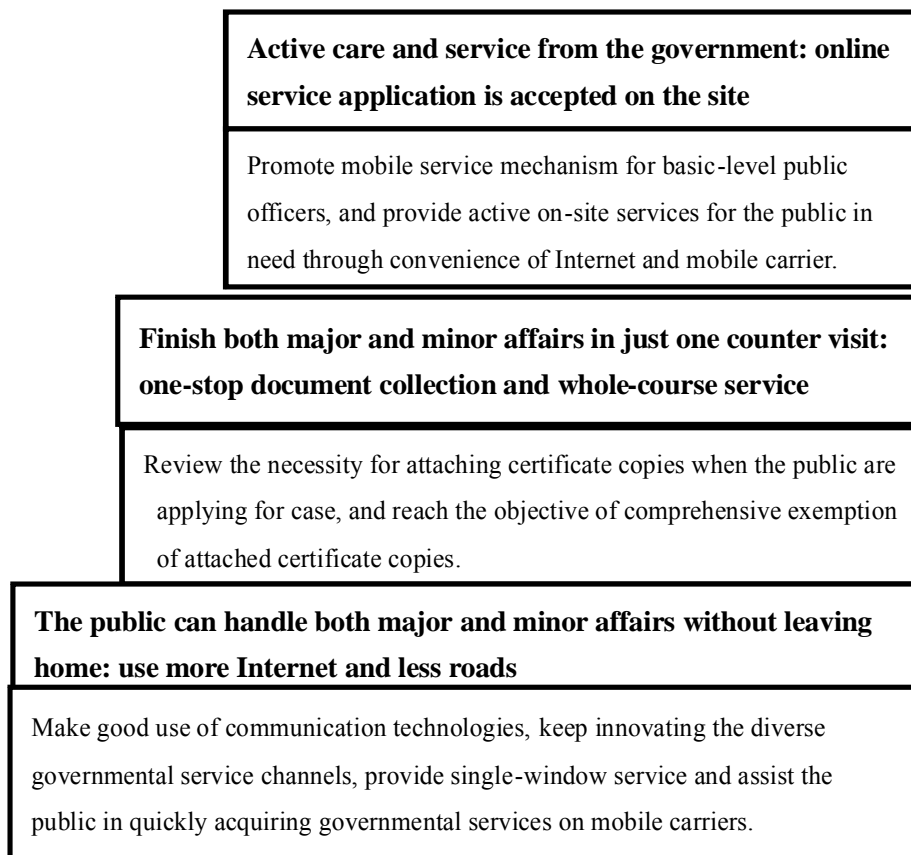
Active care and service from the government: online service application is accepted on the site

Promote mobile service mechanism for basic-level public officers, and provide active on-site services for the public in need through convenience of Internet and mobile carrier.

Finish both major and minor affairs in just one counter visit: one-stop document collection and whole-course service

Review the necessity for attaching certificate copies when the public are applying for case, and reach the objective of comprehensive exemption of attached certificate copies.

The public can handle both major and minor affairs without leaving home: use more Internet and less roads

Make good use of communication technologies, keep innovating the diverse governmental service channels, provide single-window service and assist the public in quickly acquiring governmental services on mobile carriers.

Figure 1: Objective and practice of transformation of governmental service process (Sung and Huang, 2012)

and create high-quality service environment; besides, public officers can strengthen service capacity, improve service efficiency and implement service quality through integration of various information and processes; the overall architecture is mainly divided into service subject, service passage, service item and service platforms, and all the information systems should be mutually integrated and operated synergistically in order to accomplish the public service transformation. 2) Public affair cloud (2013-2014): apply newly-emerging communication technologies, including cloud computing, human factors engineering, smart phone and tablet PC, and make comprehensive improvement on application items, functional connotation, information integration, user interface friendliness and mobile office, and provide the municipal governmental public officers with highly-efficient public affair handling platform complying with one-stop service and 2A (Any Time, Any Where) demands in order to accomplish the internal mobile process transformation. 3) Platform cloud (2013-2014): realize Infrastructure as a Service (IaaS) and Platform as a Service (PaaS), which mainly include the construction of 12 units: hosted virtualization, integrated data center, data bus, data integration, data publicity, user management platform, information integration center, application center, cloud file cabinet, cloud conference room, communication security and administrative information network. 4) Internet friendly city (2013-2016): implement the ideal of "the right to use Internet" and set up wireless Internet environments in all the public buildings, blue highway, ferries, sightseeing spots or sports parks and stadiums in order to establish friendly Internet city and entitle the citizens with equal access to Internet.

3.2. Analytical Architecture

Cloud services include infrastructure service, platform service and software service relying on the Communication as a Service to carry and provide services in Internet cyberspace (Sultan, 2010). The development trend of government cloud services is nation-wide cloud application services targeted at related public, governmental authorities and enterprises. It is key to promote single and integrated management service platform on administrative planning, disaster prevention and rescue application as well as cloud information security protection for all the governmental authorities. In addition, the cloud mechanism of governmental service platform is applied to deepen the current governmental access websites, and construct cloud platform services which are capable of providing service and integration foundation for all the authorities; besides, cloud service infrastructure is to integrate current governmental hardware service resources and construct government cloud data center based on high-speed broadband exchange and access network in order to apply cloud infrastructure services in all the authorities and establish flexible cloud infrastructure services with expansible service capacity; in addition, New Taipei City vigorously strives towards the objective of i-City, namely the development of cloud government, and is devoted to improving various information service levels in order to establish efficiency-based government and implement the objective of district administrative services. Consequently, the public sector service process transformation defined in this study combines three service categories of cloud computing, and their collaboration offers the clients with innovative modes of cloud services, thus developing into the analytical architecture in this study (Figure 2).

3.3. Data Collection and Analysis

Based on the multiple evidence source criteria proposed by Yin (2003), this study establishes New Taipei City Government cloud service innovation database. The data sources include three major parts: the first

part contains secondary case documents, including official case websites, professional newspapers, magazines, journal papers and related professional books; the second part includes open documents related to government-controlled authorities; the third part includes related reports, including e-paper. Above three data sources are integrated, and all the related planning reports, public interview reports of senior directors, public information and related reports on New Taipei City Government from 2011 to 2017 are collected to establish the database in the early stage of this study. The case study emphasizes on secondary documents, rigor of study design and theoretical foundation. Compliance with above principles will produce relatively accurate and profound results (Cutler 2004). In addition, this study adopts secondary documents as its main analytical data and conforms to the longitudinal, objective and reproducible advantages (Chen *et al.*, 2008).

4. RESEARCH RESULTS

4.1. Governmental Process Transformation on Cloud Services

(a) Apply cloud technology and construct i-Government: promote the integration platform for collection, storage, exchange and application of municipal data and integrate it with related analytical technologies on massive data. Thus, the decision-makers can grasp the key municipal statistical analytical information as early as possible and achieve the objective of quick response and adaptive governance; for instance, open value-added application data platform, smart chief and public affairs cloud APP, etc.

(b) Make good use of communication technology and improve intelligent life services: set up citizen cloud system, integrate membership data and municipal services at different bureaus and offices and combine with citizen membership system of New Taipei City in order to gain an insight into the utilization conditions of different municipal services by the public, which serves as the administrative reference; for instance, intelligent community interaction platform, welfare information integration system, 1999 single window intelligent service and integration of e-paper resources for provision of timely information, etc.
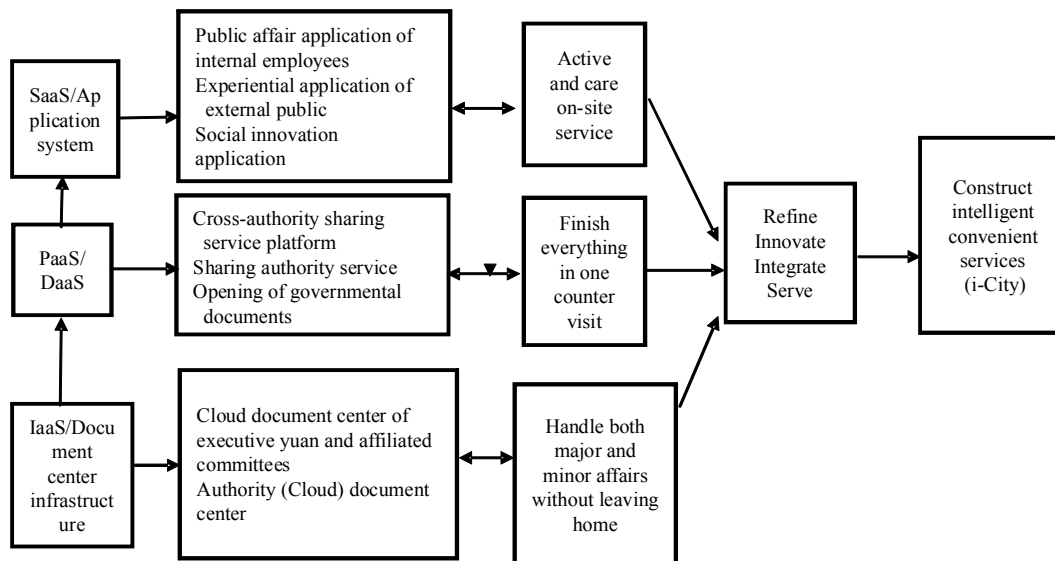

Figure 2: Analytical architecture for public sector cloud service process transformation

(c) Create i-City: implement digital hope project, offer digital courses, free Wi-Fi and innovative information services, reduce the difference in computer and Internet access of information-weak groups, create opportunities for remote areas and weak families with the access to digital computer and Internet, and create the i-City with zero information difference; for instance, wireless Internet in public spaces, free wireless charging service, and digital care and education, etc.

(d) Provide household administrative mobile convenient services: apply on-site mobile carriers to assist people with mobility inconveniences in handling household administrative businesses, improve service efficiency, offer household administrative itinerary services, and handle household administrative services in remote areas on a regular basis.

4.2. Improvement of Governmental Service Quality by Transformation of Governmental Service Process

To create diverse service platforms and provide the citizens with intelligent application and integration system, communication technology is applied to integrate and optimize municipal service processes as well as develop diverse mobile application services; to assist the citizens in improving the digital fundamental capacity, reducing the digital difference, and promote various planned value-added services from different perspectives in the expectation of bringing intelligent and convenient one-stop services to the citizens.

(a) Comprehensively promote the exemption of attached certificate copies when the public are applying for cases: establish "cloud certificate package information system" to enable authorities to inquire or download certification documents through this system, and to quickly handle the application cases of the public, thus saving the costs and time it takes the public to go to different authorities to apply for copies of different certificates.

(b) Plan diverse and convenient payment service: provide Easy Card for fee payment service in small amounts, keep increasing the quantity of Easy Card payment service spots in authorities and district offices in the municipal government, and enable the public to pay for application fees by Easy Card, which not only saves time but simplifies the authorities' administrative operations.

(c) Promote the cross-authority notification service for transactions in household registration documents: after finishing transactions in household registration documents in household administrative offices, citizens of New Taipei City can directly apply for synchronous data update in other 12 categories of authorities/companies through cross-authority notification system.

(d) Provide passport owner identification and passport commissioning service: apart from assisting the Ministry of Foreign Affairs in handling the passport owner identification, the household administrative office applies for first passport issuance or passport replacement by collecting and handling passports on the behalf of the citizens whose old passports do not comply with their household registration documents.

(e) Establish digitalize comparison system for seal imprint: comprehensively open up cross-district application of seal imprint business so that the citizens can apply for seal imprint certification, registration, alternation and abolishment at any household administrative office.

(f) Promote the legal counseling service for the citizens, and expand the handling of legal counseling service for remote areas by video conferencing; employ lawyers who are capable of Hakka and

foreign languages, and offer the legal counseling service for Hakka tribes and new residents with diverse cultural background by video conferencing; set up online reservation system for legal counseling, and provide 24h real-time and convenient reservation service.

(g) Expand the E-convenient service of administrative appeals, implement opinion statement and online application for opinion statement in remote areas by video conferencing, apply for reading and inquiring the whole documents and resolution proposals.

(h) Improve governmental statistical mobile E-services, enrich and maintain contents of statistical database in order to create value-added application benefits for data and improve the public-oriented service quality.

4.3. Discussion

(A) Open up innovation service to construct intelligent service process

Cloud services can be divided into Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). Specifically, SaaS is a supply mode for software services, and the users only need to rent this service from the dealers without the need to establish information systems by themselves. In addition, the users can use the service of this software through Internet. The expression mode of government cloud service is electronic and Internet public service. The principal feature is that the government applies Internet system to provide services for various businesses related to the public, and constructs virtual Internet government to interact with the public (Liao and Lu, 2010). To accelerate the improvement effects of electronic services, the frontier public-oriented service authorities not only need to conduct effective and real-time connection with the back-end data but expand into cross-departmental and cross-authority data integration, thus satisfying the public demands. Government cloud application service should innovate cloud service development to improve the living standards of the public and strengthen the governmental operational efficiency through computer room in order to develop the spirit of "resource sharing" (Lin, 2013). Therefore, this study is based on the government cloud application platform, including bottom cloud computing infrastructure (Infrastructure as a Service, IaaS) and cross-authority information integration and exchange platform (Platform as a Service, PaaS) in order to share resources, and expects to construct intelligent convenient service for governmental application services.

It can be seen that the majority of national governments in the world introduce cloud computing to share infrastructure, promote demonstrative application service, open up data access, accelerate massive data application innovations, formulate legal standards and perfect environmental development, thus jointly driving the development of related industries, including open documents, Big Data, IoT, i-City and Industry 4.0. To sum up, government cloud applications are based on the nation-wide overall governmental information services, and IaaS and PaaS cloud infrastructure, and utilizes cloud computing to reach an economic scale, provide Software as a Service (SaaS) and improve service quality.

(B) Cross-authority service process transformation and provision of integrated service process

It is shown by the global electronic government investigation report by United Nations in 2010 that the majority of countries in the world adopt improving Internet infrastructure, popularizing online services and providing client-oriented services centered on the public as their administrative priorities. The public

in Taiwan have universally accepted electronic governmental services through promotion of each stage of electronic government plan. However, the services related to the life of the public which electronic government can provide are of value to the public. In the future, the services should be developed towards helping the public solve both major and minor affairs in life and prioritizing the public-centered services. In addition, the service functions must be integrated with the services themselves in the mode of single-window and whole-course services. In combination of expert system, the services should help the public minimize their efforts and time spent on handling affairs related to the government (Shiang, Yang, 2014). Through cloud technology and application, New Taipei City Government expands and integrates all the services provided by the bureaus, district offices, household administration offices, land administration offices and related organizations in the entire municipal government. Thus, no matter where the citizens are handling their affairs, or if they want to know about the latest information and events & activities of the municipal government, New Taipei City Government enables the citizens to experience the high-quality services provided by the municipal governmental teams and becomes their good helper in their lives.

(C) Refine cloud service functions and construct E-intelligent city

Connotation of government cloud application services is distinguished by SaaS, PaaS and IaaS. The promotion items on each hierarchy are as follows (Sung and Yang, 2013): 1) SaaS: centered on promoting the governmental applications closely related to the daily life of the public and aided by joint construction of platform and infrastructure, SaaS applies the advantages of cloud services to innovate the service process and enable the public to feel the cloud application services externally, and promote intelligent Internet office and improve inner administrative efficiency internally with the main focus on improvement of internal administrative efficiency. 2) PaaS: centered on integration and sharing of cross-authority common services, PaaS applies cloud computing technology to create on-demand service platform with flexible expansion capability on the basis of current electronic governmental service platform, which serves as the data exchange platform for authorities (systems) across the whole country; its service mode is provision of Web Service or Application Programming Interface (API), and national common service modules are provided, including single login, information agency, process integration and electronic payment, etc. 3) IaaS: IaaS provides the infrastructure construction required by development of SaaS and PaaS.

V. CONCLUSIONS

Based on the case study of New Taipei City Government, this study constructs New Taipei City Government service process transformation through three major service categories of cloud computing in order to realize intelligent service innovations in cloud application. This study proposes the open and innovative service to construct intelligent service process, which means that New Taipei City Government plans and develops valuable government cloud applications, and implements these applications on governmental administration. With the continuous improvement on Internet software technology, new innovations in the front-end equipment and the back-end cloud computing are introduced, and Web 2.0 social network keeps growing prosperously. The development of these communication technologies will be key tools for introduction of new governmental services (Sung and Huang, 2012). In addition, this paper proposes **the cross-authority service process transformation** among public sectors **and offers the service integration**

process. Apart from new thinking, the provision of governmental service process is combined with the adjustment to governmental organizations and application of communication technologies. It is more urgent and necessary to review and transform related service processes, which is the key to improve the international competence of Taiwan. Moreover, public sectors must refine cloud service functions and construct E-intelligent city by virtue of cloud application services. After the Intelligent Community Forum (ICF) and IBM selected New Taipei City Government as the i-City paradigm case, Cloud Security Alliance, an international organization, designated New Taipei City Government as the first candidate for cloud security cities in the whole world. New Taipei City Government became the first city to participate into and accomplish international certification on cloud security in 2013. With the sharp growth of electronic governmental service utilization rate and scale, to seek effective resource utilization, the government should provide service on demand and improve information service capacity. Government cloud applications are based on the nation-wide overall governmental information services, and IaaS and PaaS cloud infrastructure, and utilizes cloud computing to reach an economic scale, provide Software as a Service (SaaS) and improve service quality.

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