
Feasibility of a Platform-as-a-Service Implementation using Cloud Computing for a Global Service Organization

Keke Gai
gaikeke@hotmail.com

Annette Lerine Steenkamp
asteenkam@ltu.edu

College of Management
Lawrence Technological University
Southfield, Michigan 48302, United States of America

Abstract

This paper reports on an investigation of information technology (IT) enablement for a global service organization (small/medium enterprise [SME]), with focus on the feasibility of an implementation with Platform-As-A-Service (PAAS) using cloud computing. A positivist-empirical research approach was followed to establish the feasibility of leveraging the benefits of cloud computing for an enterprise portal in a way that adds value for the enterprise. The following six tasks were performed, namely (1) problem analysis of services, (2) literature review, (3) conceptualization of problem, (4) initiation and scope definition, (5) feasibility study, and (6) conceptualization of proposed solution. There were two main deliverables, namely the feasibility report and a proposed implementation. The feasibility report provides analyses that align the IT strategy and enterprise strategy, strategic analysis, tactical analysis, business process analysis, a defined value proposition, cost benefit analysis, and process performance analysis. Based on this feasibility report, an acquisition proposal for a cloud-based portal with a PAAS implementation is developed. The paper provides cloud practitioners with some recommendations and practical references relating to implications for practices and procedures in the services agency domain, security requirements, training requirements, and phased process improvement. The findings of this investigation contribute to the body of knowledge for both academics and professionals regarding e-business. The investigation was conducted as part of an academic course in collaboration with a real-world small to medium size agency with limited resources. There are two limitations to this research. First, the proposed solution is conceptual and will be implemented in the next phase of the research project. Second, generalization of the proposed solution has potential and the solution could be examined for other services domains.

Keywords: cloud computing, Platform-as-a-Service, business process improvement, process performance matrix.

1. INTRODUCTION

Business process improvement which leverages information technology (IT) enablement has

become an important approach and a feasible solution in many organizations (Davenport, 1993; Shtub & Karni, 2010). Also, the number of the organizations utilizing advanced IT approaches

has been increasing in different industrial fields due to the rapid development of the Internet-based technologies (Dutta & Mia, 2010; Oliner & Sichel, 2000). Cloud computing, as a new computing model running on the Internet, provides many organizations with a number of new IT-based solutions that offer various benefits to the organizations, such as moderate cost, agility, and high efficiency (Gai & Li, 2012; Thomas, 2009). It is evident that leveraging cloud computing to improve business processes is a hot topic in many industries.

This paper reports on a research project on IT enablement that adds value and improve business processes for a global service agency (GESA), a small/medium enterprise (SME), which provides study abroad services to global customers. The purpose of the project was to examine the feasibility of improving the business processes and adding value for the agency by implementing a cloud-based portal with Platform-as-a-Service (PAAS).

The main problems of the enterprise were identified, and two research questions were formulated as follows:

1. What is the feasibility of creating new web-based services for a global service enterprise that would add value through a cloud-based approach?
2. What business processes of a global service enterprise are impacted when adopting cloud computing?

The main outcome of the investigation is a business and technical feasibility report, consisting of a variety of analyses and plans, such as business processes analysis, project activation analysis, acquisition process management plan, identified principles, driven-forces analysis, critical successful factors, project management plan, risk management plan, business process performance analysis, and strategic plan. This paper is structured in sections presenting the problem analysis, research methodology, findings, limitations, and conclusions.

2. PROBLEM ANALYSIS

In recent years IT has become an important option for enterprises to add value to their products or services (Maizlish & Handler, 2010; Alavi, Yoo & Vogel, 1997). In many situations IT systems can help enterprises to reduce costs,

increase efficiency, or improve/create services. With the advent of globalization the advantages of IT have become significant by connecting customers and corporations more efficiently. The characteristics of IT also bring some opportunities for companies to add value, improve their business processes, and enable a lean transformation by means of a range of IT-based solutions (Ilebrand, Mesoy & Vlemmix, 2010). In this context, problem analysis is a fundamental process of understanding the way of value creation by means of IT approaches.

The investigated global service agency facilitates study abroad offerings for mainly Chinese students. The vision of the agency is to promote global awareness and exchange of knowledge through cross-cultural education. The mission is to provide individuals or organizations with educational opportunities between China and the United States that enhance international understanding between the two countries, and a lifelong learning mindset.

In order to achieve these strategic aims the agency is operating a website that introduces basic information about the organization and its services. Nevertheless, the limited scope of the website cannot effectively support the business processes, and two main problems should be resolved as a priority. The first is that the functionality of the website is not sufficient to add value to the services and build a bridge between customers and the agency. Most business activities cannot be completed on the website and customers do not have access to acquire a service or send a service request via the interface provided by the website. Lack of services access results in a low-level interaction between the agency and its customers, and is also not positive for service improvement.

Secondly, the agency operates its business in a global context so that a comprehensive website is really important for the company to expand its market and communicate with its potential customers as has also been found by others (Liu, Arnett, Capella & Beatty, 1997; Turban, Leidner, McLean & Wetherbe, 2008). The current status of the website may not be able to enhance the fine reputation of the company in the target market and build a good customer relationship (Liang & Chen, 2009). Improvement of business processes via an IT innovation is a necessity for this organization.

These main problems have highlighted the opportunities for IT enablement. The objectives of service improvement were distilled to the following: (1) improving business processes through a cloud-based portal, (2) adding value to the existing services and creating new services, (3) reducing costs, and (4) increasing efficiency by leveraging state-of-art IT functionalities.

In order to attain these objectives, the proposed service improvement focused on a competitive strategy, key value chains, representative business processes in the services industry, approaches to process improvement, and cloud computing. The analysis of business process improvement is considered from three perspectives, namely strategic perspective, business process perspective, and technological perspective.

Strategic Perspective

The strategic perspective focuses mainly on issues that contribute to business process improvement of strategy. The analysis of the strategic perspective considered the value chains, aspects of a competitive strategy and the development of a strategy map.

A value chain refers to a chain of processes and activities that fully depict all behaviors or actions in an entire business process, which usually includes designing, producing, marketing, delivering, and other supporting activities (Porter, 1980). Each activity is aligned with a transition process, from resource extraction to service delivery, which implies a step of adding value (Cohen, 2010). The primary and support activities for the generic value chain model of Porter (1980) were interpreted for GESA: the primary activities (including services, finance, marketing, and sales); and support activities (i.e. the organization infrastructure, electronic customer relationship management [eCRM], services management and training, and procurement). Figure 1 represents the value chain of the agency. Cognizant of the agency’s external environment on a strategic level, and understanding the value chains and main processes and activities, a competitive strategy may be formulated to guide the planning of service improvement (Harmon, 2007).

The competitive strategy theory supports enterprises to obtain competitive advantages by means of a set of methodologies and principles.

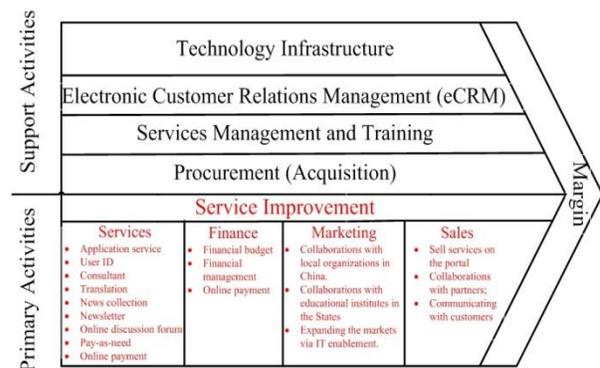


Figure 1. Value Chain of the Agency

When effective a competitive strategy can position value creation initiatives in a particular market situation (Porter, 1980; Porter, 1985, Steenkamp, Li & du Plessis, 2004). Three positioning strategies, namely cost leadership (low cost), differentiation (through high quality), and niche specialization (through targeting special customers) were considered (Gartner, 1985; Porter, 1985). Figure 2 presents a value map of positioning various services in the global education agency industry. By understanding the positions of value creation in the market place, GESA should be aware of the main changes and threats in the competitive global environment.

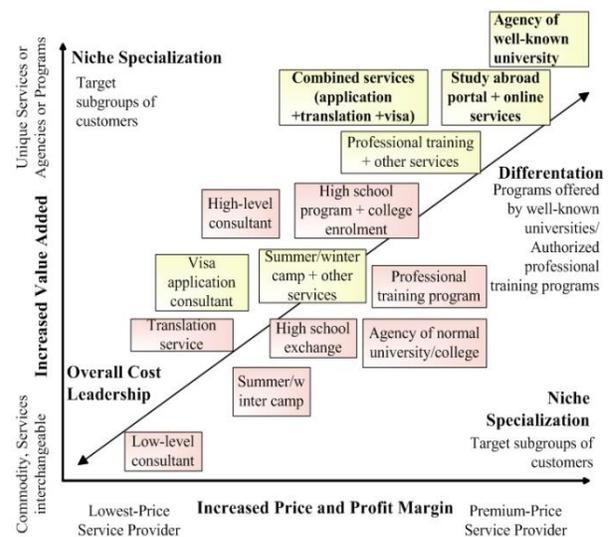


Figure 2. Value Map of Positioning Services.

Porter (1980) proposed the Five Forces Model (FFM), which identifies five main changes in the competitive environment and provides a (competitive) methodology that can enable a company to compete within an existing industry sector. The five forces include industry

competitors (other agencies), buyers (potential students), suppliers (educational institutions), substitutes (alternative service organizations), and potential entrants (new agencies) to an industry (the services industry). Figure 3 presents the FFM instantiated for GESA.

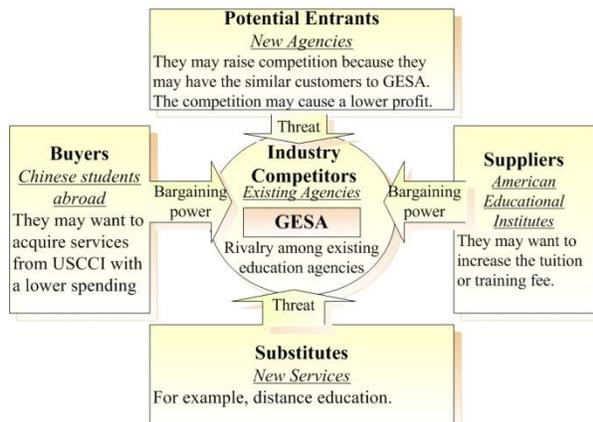


Figure 3. Five Forces Model instantiated for GESA

Based on the competitive strategy analysis, a strategy map leveraging an IT-based solution was developed using the Balanced Scorecard Approach model (BSA). This model was developed by Kaplan and Norton (2004), who have both greatly contributed to the body of knowledge in the Harvard approach to strategy (Harmon, 2007; Jensen, 2002). Kaplan and Norton (2004) emphasize that the performance measures for a strategy should include not only the financial perspective but also three other perspectives, namely customer perspective, internal perspective, and learning and growth perspective. The balanced consideration from four perspectives can provide an entire image of the strategy's performance measures, which may help enterprises to solve threats from different forces. Among these four perspectives, the internal perspective is a core component that describes the value-creating processes (Harmon, 2007). The analysis of internal measures is vital to eventually create a process strategy in a specific manner. Appendix 2 presents a strategy map that theoretically follows the BSA model and shows the ways of involving IT from various strategic perspectives.

Business Process Perspective

From a business process perspective, the enterprise needs to understand the operations of the supply chain and business processes that are aligned with the results of strategic analysis.

Supply Chain Operation Reference (SCOR) model was adopted to interpret the supply chain architecture of GESA.

As one of the first cross-industry frameworks for supply chain operations, the SCOR model enables one to evaluate and improve the performance and management of an enterprise's supply-chain in diversified business environments, and has been adopted by many global companies (Gordon, 1997; Siegl, 2008). A SCOR thread diagram is given in Figure 4 to illustrate the GESA supply chain process.

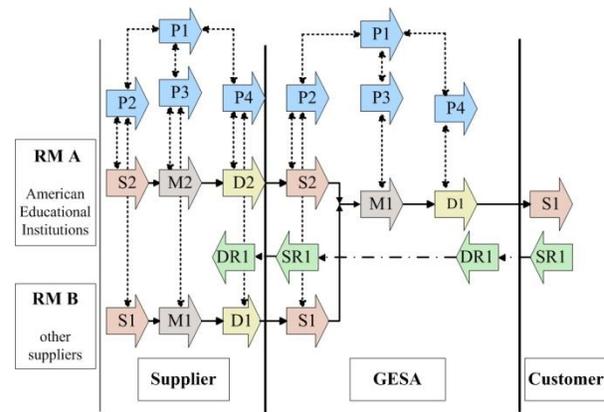


Figure 4. A SCOR Thread Diagram Illustrating the GESA Supply Chain Process

In this diagram, there are two supplier reference models (RM), namely RM A (American educational institutions) and RM B (other relevant organizations or individuals). In RM A, GESA collaborates with American educational institutions that literally offer customers training or instructional services. The existing program offerings may be revised or redesigned in terms of the needs of GESA's clients, which is considered as a Make process. In order to implement the Make process, the educational institutions should utilize their instructional source to formulate a number of educational service offerings, which can effectively support the collaboration between GESA and the educational institutions. The process of optimizing and collecting an educational source is defined as a Source process.

Meanwhile, GESA needs to re-organize the information of the programs offered by the American educational institutions in order to make them acceptable for their Chinese clients. For example, the introduction materials of the programs must be understandable by Chinese readers and the structures should follow Chinese

reading customs and logical thinking. After the process of information re-organization, the services are presented to GESA's customers, which is a Deliver process.

Similarly, other organizations or individuals that could play a supplier role may go through an analogous process in order to meet the demands of collaboration that are defined as RM B here. The thread diagram in Figure 4 explains the supply chain operation among suppliers, GESA, and customers. The letters in the arrows indicate that a process is a Source (S) process, a Make (M) process, a Deliver (D) process, a Plan (P) process, or a Return (R) process. The numbers after the letters represent the variation.

With the information from the suppliers, the enterprise is able to launch their supply chain process through the same procedure. Each process is corresponding to a Plan process. If customers cancel or change their intentions of service, a Return process will take place and the Source will be returned back to the supplier. Based on the implementation of the SCOR model, the business process analysis was completed by adopting the Performance Matrix proposed by Rummier and Brache (1990) in order to understand the vital concerns in each business process of GESA.

The matrix, also known as the Performance Framework, is widely accepted in business and also the software development industry because it can effectively describe nine main concerns that enterprises, attempting to change their processes, must consider. It may also be adopted as a framework for IT enablement that addresses issues in different perspectives (concerns) on three levels. The perspectives include goals and measures, design and implementation, and organizational management. The three levels refer to the organizational, process, and activity or performance levels that explicitly represent the hierarchy of various processes and activities during process improvement. Appendix 1 is the performance matrix for GESA.

The analysis of the strategic perspective and business process perspective informs the methodology of implementing IT-based approaches for a global service organization. A technology perspective includes cloud computing performance in the global service industry.

Technology Perspective

Cloud computing is a recent computing model that supports information sharing and services on the Internet or Intranet, and clients can determine the service contents without dealing with cloud providers (Linthicum, 2009; Gai & Li, 2012). Linthicum (2009) identified at least six common benefits of using cloud computing, namely cost effectiveness, ease of access, driver forces of innovation, expandability, simple operations, and environmental protection. For GESA, a cloud-based solution is anticipated to result in reducing costs, increasing working efficiency, creating new services and adding value to the existing services, and improving business process management.

Lower cost of maintenance and simplified business processes can help GESA to cut costs and enhance operational efficiency. Software maintenance would be the responsibility of the cloud provider and GESA would be able to focus on information input, content management, and marketing. Moreover, cloud computing provides an on-demand network, which introduces the possibility of creating new services via the cloud-based portal (Armbrust et al., 2010; Lin, Fu, Zhu & Dasmalchi, 2009). A number of new services, or some services that were formerly only offered offline, may be delivered via PAAS using cloud computing.

PAAS allows the customer to use virtual platforms rather than host a physical machine by accessing the virtual machine supported by a database running on the cloud (Stenzel, 2011). This service model of cloud computing can help enterprises to establish and test systems and new applications in a short period. New services are delivered by the applications running on the platform provided by the cloud. In this context, the enterprise is considered as a cloud client, who is acquiring services from cloud providers, and this represents a convergence of cloud computing and service-oriented architecture (SOA).

The convergence of cloud computing and SOA is a promising and effective approach for an enterprise to provide a variety of online services. SOA provides a strategic meta-framework with a full set of principles and methodologies to design and develop software that provides customers with web-based services. From the perspective of the supply chain process, SOA adoption would improve the customer-side effectiveness of the electronic supply chain (Kumar, Dakshinamoorthy & Krishnan, 2007). The

improvement would lead to a stronger connection between GESA and applicants, and achieve higher electronic supply chain performance. Appendix 3 illustrates a conceptual map of leveraging cloud computing in the global context. With the delivery of services on the cloud and communicating with potential applicants GESA would become more efficient because its clients can access the GESA portal directly via the Internet and acquire services as needed.

3. RESEARCH METHODOLOGY

This section focuses on the research methods that were used and the rationale for adoption. A summary of the research design is given complementary to the information in Section 2. An positivist-empirical research approach was followed to establish the feasibility of implementing PAAS, and leveraging cloud computing for GESA. In analyzing the research questions the investigation considered an IT enabling initiative for the agency which supports study abroad offerings for Chinese applicants, as explained in Section 2. The phases and steps of the research process model given in Appendix 4 are elaborated below.

Phase I – Initiation

The investigation began with an IT initiative proposal for a cloud-based portal for GESA, which provides an analysis of the competitive strategy and business processes leveraging a cloud-based portal. A feasibility analysis was done including establishing the value chains, business process analysis, and strategy mapping and resulted in a Feasibility Report. The BSA model was used to develop a balanced strategy in order to ensure the agency's survival in a competitive environment. The SCOR model was selected to identify the business processes that may be supported by PAAS because the model provides an effective approach to analyze supply chains in various industries.

Phase II – System Acquisition

An acquisition proposal for a cloud-based portal that provides a PAAS solution was developed. The acquisition proposal focuses on the main activities of the acquisition process, the modeling processes and activities. The acquisition process was elaborated to explain the process of obtaining an IT system that satisfies the demands of customers, and consists of a number of sub-processes, namely acquisition

preparation, supplier selection, supplier monitoring, and customer acceptance.

Phase III – Findings

The main findings of the investigation relating to the feasibility study and development of the implementation proposal are reported in Section 4.

4. FINDINGS

This section highlights the key aspects of the feasibility report, as well as the proposed implementation.

Feasibility Report

The feasibility analysis results in a feasibility report, and includes the improvement of the service improvement value chain, an effective supply chain, an IT enabled strategy map, and optimization of the acquisition process. Other benefits of leveraging cloud computing are provided, including the cost/ benefit, agility, and high efficiency.

As shown in Appendix 2, utilizing IT-based solutions is beneficial for the enterprise from four perspectives. Business processes may be improved via IT enablement in an internal perspective. The Operation Management Process is supported by a cloud-based supply chain, and the new services provided by a portal for GESA would strengthen customer management processes and innovation processes. The agility of the system is positive for dealing with the regulatory and social processes as well. Furthermore, considering the GESA customer value proposition, a healthy customer relationship would provide several benefits to applicants, such as lower price, more service selections, multiple accesses to information, and ease of operation. Moreover, with the improvement of business processes and customer relationship, the agency would be able to maintain a positive financial status. IT enablement can improve the cost structure, increase asset utilization, expand revenue opportunities, and enhance customer value in the financial perspective. Improvements from different perspectives suggest that the agency would be able to gain long-term shareholder value.

In order to optimize the acquisition process, evaluation criteria of supplier selection aligning with the agency's vision and objectives, were developed. The criteria, given in Table 1 focus

on six aspects, namely cost, quality, safety, service, convenience, and agility. The criteria were based on the needs and goals of acquisition, and aligned with new services using the cloud-based portal. The new services include online application, online user identification, online consultant, online database service, translation service, news collection, newsletter system, online discussion forum, service cost calculator, and online payment access. The alignment of business demands, technological support, strategic guidelines, and business processes is a necessary condition for operating the cloud-based portal for GESA.

Table 1. Evaluation criteria of supplier selection.

Criterion	Description
Cost	The cost of the service should be accountable for the enterprise. The system establishment fee and maintenance cost must be affordable.
Quality	The quality of the supplier must meet all the requirements listed in Appendix 5.
Safety	The supplier must guarantee the safety of the information for both the company and customers.
Service	An in-time service is required; the supplier needs to give a timely response to the company's request.
Convenience	The system needs to be updatable, maintainable, and sustainable without extra financial burden.
Agility	The new services are addable; the information is able to be transferred to other cloud providers in the future.

Proposed Implementation

This section offers recommendations and practical references to cloud practitioners that cover the following aspects: implications for practices and procedures in the services agency domain, security requirements, training requirements, and phased process improvement.

For the purpose of improving phased processes, enterprises should identify the business processes, sub-processes, and activities. Appendix 6 illustrates the drilling down into the online application process to examine three specific levels of processes, and is an example of the method of modeling processes and activities instantiated for various value chains (Harmon, 2007). As shown in the diagram, GESA provides a number of value chains, with the customer orders as the inputs and school enrolments as the outputs. One of the value chains are formed by the new service that helps students to apply for admission to American educational

institutions directly on the portal. The core process, "Applying for Schools", takes place in the production functional unit and the process consist of a few sub-processes, namely customer condition analysis, selecting schools, application material preparation, sending application package, contacting schools, and finish application. Drilling down into each sub-process, identifies the activities and their main steps. Appendix 7 is a process diagram which elaborates the process of the online application service. Customers need to complete the service order process, which consists of five processes, namely place order, receive order, review service request, revise order, and re-review order. Once the agency receives service requests from customers, a payment process and "Applying for School" process will take place synchronously. If the service is successfully delivered, the enrolment letters will be sent to customers after the full service fees are paid. If the service is unsuccessfully delivered, the agency will refund customers a certain amount of money (specified in the services agreement).

5. LIMITATIONS

There are two main limitations of this investigation. First, the proposed solution is conceptual, and lacks the demonstration of concept in a practical implementation. The next phase of the research project is to implement the proposed solution in a real world environment. Second, the investigation focused on one agency (GESA) offering global services for the study abroad domain. The solution has the potential of generalization in other services domains, and is in planning for continued research.

6. CONCLUSIONS

The key findings of the investigation are twofold, namely that it is indeed feasible to implement a cloud-based portal for a global service organization, and there are real prospects of value creation and service improvement. The small/medium sized global service enterprise, GESA, is expected to obtain some competitive benefits from leveraging PAAS with cloud computing. The benefits that were identified include reducing costs, business processes improvement, optimization of customer relationship, and new services creation. It was found that the SCOR model can aid an enterprise to understand its supply chain in a cloud-based environment. Moreover, modeling

processes and activities should be conducted on three levels, namely processes, sub-processes, and activities with specific goals and measures in mind. The outcome of modeling processes and activities allows the enterprise to gain insight into the details of the business processes and behaviors on different levels.

A few questions for further consideration are (1) what is a feasible solution for security when a cloud-based platform is operated by a SME global service organization? (2) What would be the actual performance of the proposed implementation? and (3) Can the proposed solution be generalized in other service domains?

7. ACKNOWLEDGEMENT

The authors would like to express their appreciation to the sponsoring organization which gave us the opportunity to conduct this research project. A special word of thanks to Dr. L. A. DeGennaro for his support and collaboration during the investigation.

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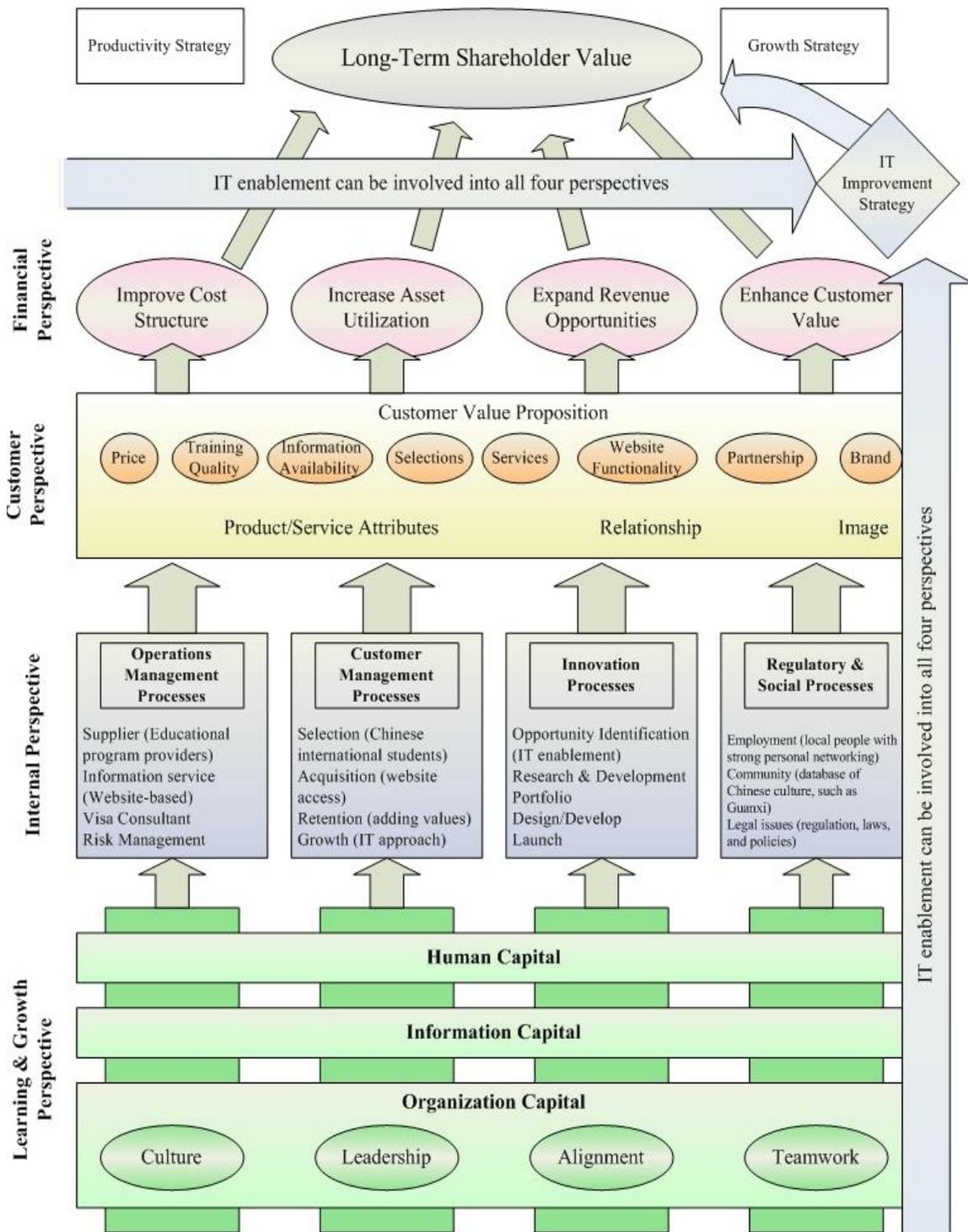
Appendices

Appendix 1 GESA Performance Framework

The columns show three perspectives and the rows display three levels. The corresponding information is respectively represented in the elements of the matrix.

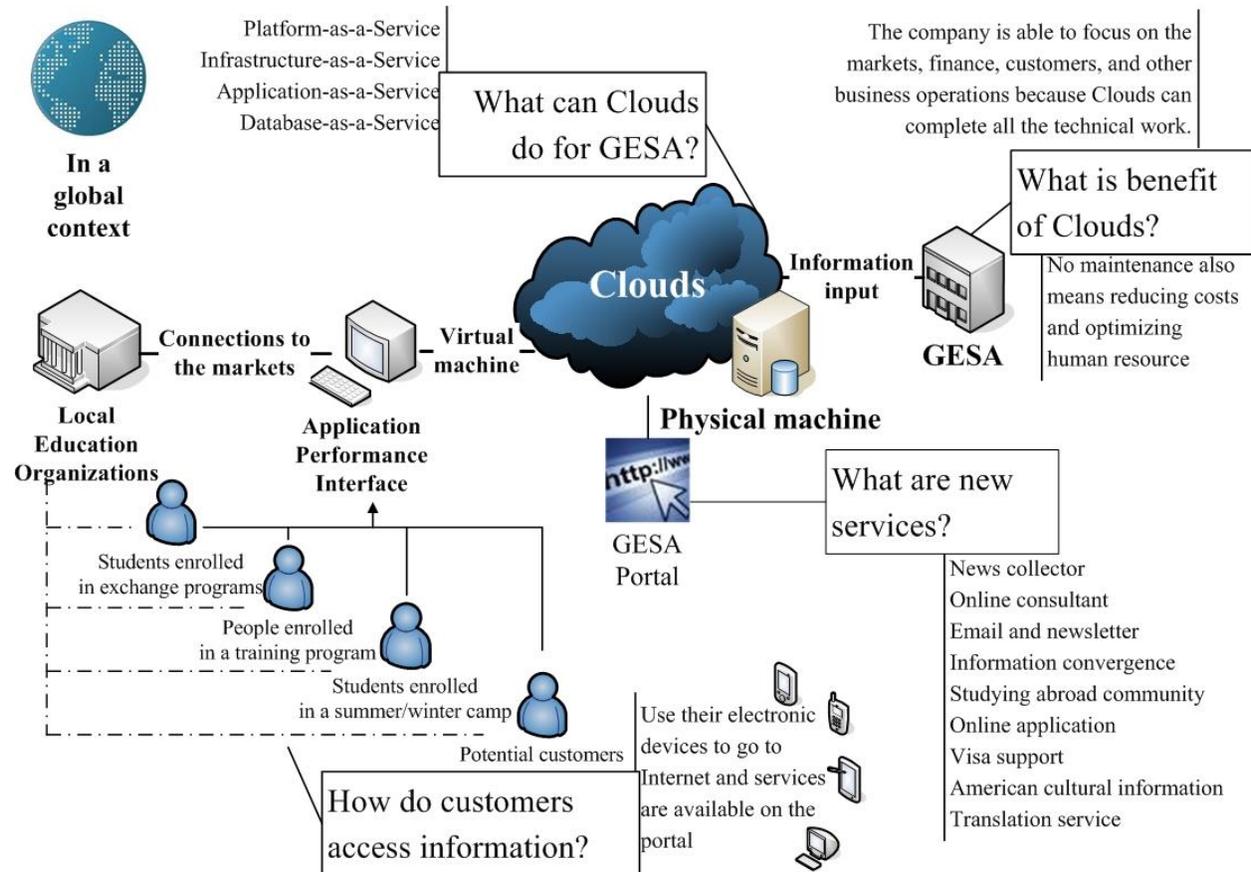
	Goals and Measures	Design and Implementation	Organizational management
Organizational Level	Goal: Provide clients with quality services relating the studying abroad. Measure: align with enterprise's vision, objectives, and missions.	<ul style="list-style-type: none"> - Develop the Strategic Plan for the purpose of delivering new services. - The plan should be feasible for the existing and new systems. 	<ul style="list-style-type: none"> - Design, plan, execute, monitor, control, and evaluate the implementation of the portal. - Effective management ensures the quality of the initiative's operations.
Process Level	Goal: create ten new services through leveraging IT solutions, such as online application service, news collection, etc. Measure: use the criteria of supplier selection.	<ul style="list-style-type: none"> - Develop the IT Strategic Plan, identify the business processes and make sure the processes are operational. - Determine how the company can add value for service improvement. - Analyze the processes from different perspectives, such as financial, customer, internal, and learning and growth perspectives. 	<ul style="list-style-type: none"> - Design, plan, execute, monitor, control, and evaluate the strategy of IT enablement. - Align the IT Strategic Plan with the Strategic Plan.
Activity level	Goal: risk management, acquisition management, project management. Measure: whether the outcomes match the service order and whether the performances follow the principles and concerns.	<ul style="list-style-type: none"> - Develop the IT Project Plan (Utilize a feasible technical method to achieve the goals and objectives, such as using Cloud computing in SOA. - The portal may be implemented in the Cloud). 	<ul style="list-style-type: none"> - Design, plan, execute, monitor, control, and evaluate the implementation of IT enablement initiative in terms of the IT Project Plan. - Design a training process for employees. - Ensure and measure the new systems create new services with adding values. - Align the IT Project outcomes with the IT enablement strategic plan.

Appendix 2. Strategy Map Formulated by Balanced Scorecard Approach Model (on the basis of Harmon, 2007). Adapted from "Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals (2nd ed.)" by Harmon, P. p.51.

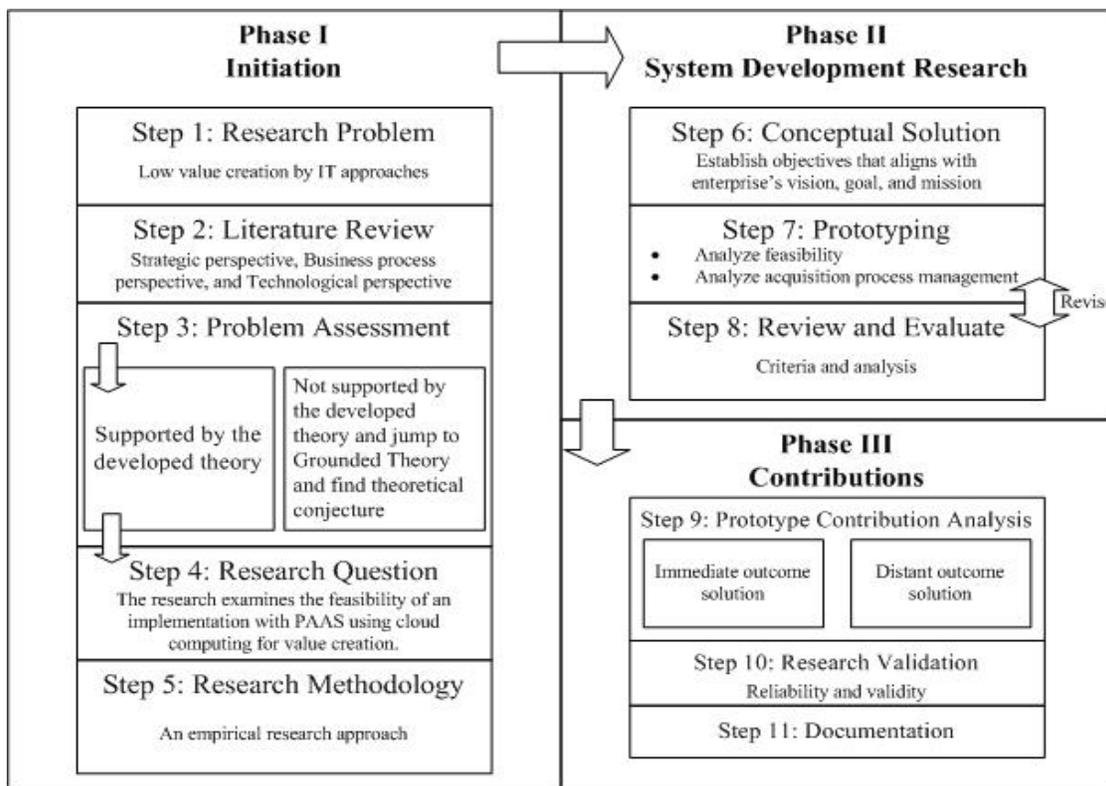


Appendix 3. A Conceptual Map of Leveraging Cloud Computing in a Global Context.

This diagram illustrates a conceptual map of leveraging cloud computing in the global context. With the delivery of services on the cloud and communicating with potential applicants GESA would become more efficient because its clients can access the GESA portal directly via the Internet and acquire services as needed.



Appendix 4. Positivist-Empirical Process Model

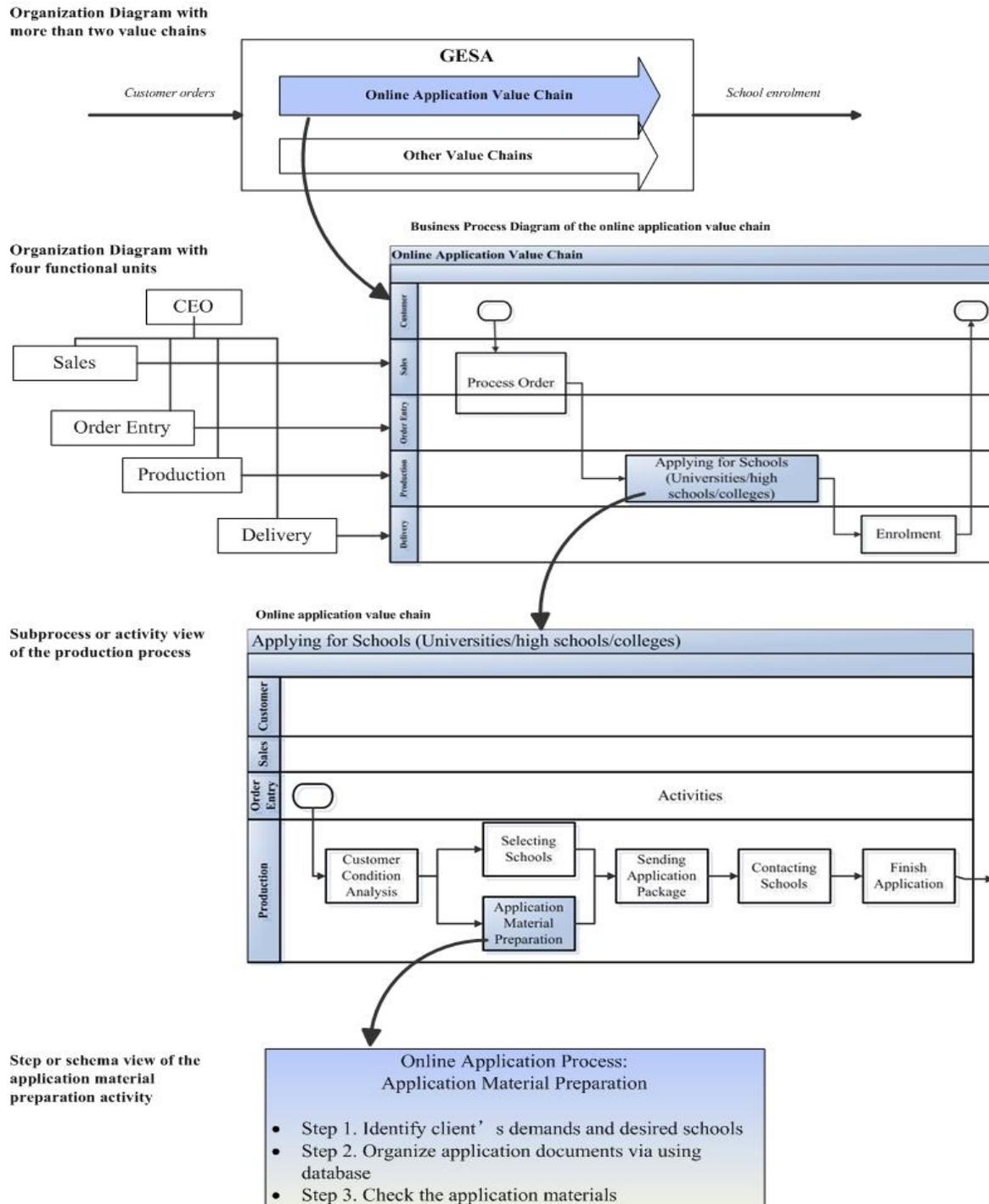


Appendix 5. Needs and Goals of the Acquisition.

Functions/Services	Description
Online Application	The portal provides students with an online application forum so that the GESA is able to obtain applicant's information and submit the application forms to various universities.
User Identification	The portal provides each client with an identification account (ID) that access to the services.
Online Consultant	The portal provides clients with an access to GESA's consultants. The consultants need to be specialized in the entire industry.
Online Database	The portal needs provide clients with abundant information related to the international education industry, such as general information of visa application and American general culture. The clients with authorized ID are allowed to obtain the information.
Translation Service	The portal needs two versions, one is in English and the other version is in Chinese. A translation service is available and the document submission system is required by the portal.
News Collection	The portal should provide the relevant updated news about the international education, such as new policies, statistics, and trends.
Newsletter	The portal needs have a newsletter function so that either authorized ID holders or website holders are able to receive updated information from the company.
Online Discussion Forum	An online discussion forum is required for sharing, discussing, or consulting.
Pay-as-need	The portal provides a service payment calculator, which can count the service costs on the basis of service items.
Online Payment	An online payment access should be available.

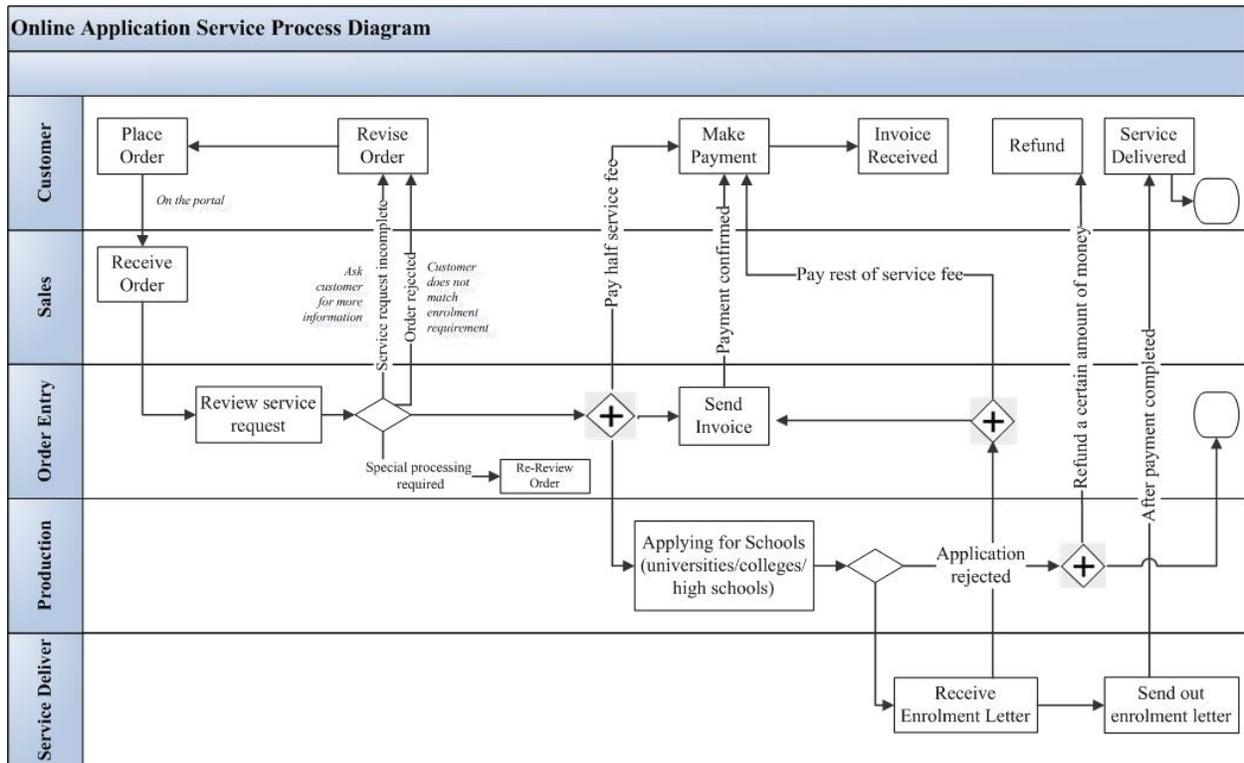
Appendix 6. Drilling Down into an Online Application Process to Examine More Specific Levels of Processes. Adapted from "Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals (2nd ed.)" by Harmon, P. p.238.

This diagram illustrates drilling down a super process to examine three specific levels of processes, and is an example of the method of modeling processes and activities instantiated for various value chains (Harmon, 2007). (Refer below Appendix 7 for the notations used.)



Appendix 7. A Process Diagram Elaborating the Process of the Online Application service.

This process diagram elaborates the process of the online application service. Customers need to accomplish five steps in order to complete the service order. Once the order process is completed, an "Applying for School" process will occur synchronously and the agency will start delivering services. (Refer below for main notations used.)



The main notations used in Appendix 6 and Appendix 7 are as follows:

Main Notations	
Notation	Explanation
◇	Refers to gate way or decision making process
⊕	Refers to parallel all inputs go to all outputs, but only when all inputs are ready to go together.
⊖	Refers to exclusive, multiple input but the actual inputs come via only one path multiple output paths but only one is actually taken.