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Application for the Innovation and Technology Fund

University-Industry Collaboration Programme

Matching Grant for Joint Research Scheme

Development of an Intelligent Knowledge Management System for Knowledge Intensive Service Business

Submitted by
CMA Industrial Development Foundation Limited
and
The Hong Kong Polytechnic University

Section A – Basic Information

(When an application is approved, the information in this section will be published at the ITF website (denoted with #) and/or carried forward as pre-filled data in the related progress/final reports.)

1. Project Title#

1.1. English (not more than 20 words):

Development of an Intelligent Knowledge Management System for Knowledge Intensive Service Business

1.2. Chinese (not more than 30 words):

智能知識管理系統開發及其在知識密集型服務業的應用探究

2. Abstract

(Please provide a brief summary of the objectives, R&D methodology and the impacts and benefits of the project on the company.)

2.1. English (not more than 200 words):

This project aims at developing an intelligent Knowledge Management System (KMS) for Knowledge Intensive Business Services (KIBS) enterprises. This KMS is the first smart system that innovatively applies text-mining techniques to conduct knowledge classification automatically and integrate analysis modules to visualize customer data and operational data dynamically. A smart, dynamic knowledge repository will be embedded in the proposed system. All necessary knowledge classification will be done at the back-end without user intervention. Its underlying search index and classification schemes will be generated and refined on a continuous basis automatically via state of the art text mining algorithms. Search and information retrieval will be personalized dynamically based on user profiles and usage records, and thus will be efficient and effective. Current operation condition and business capacity of the company will also be taken into account when performing real time management and R&D analysis through the system.

2.2. Chinese (not more than 300 words):

本項目旨在為知識密集型服務企業研發一套完整的智能知識管理系統。該知識管理系統運用先進的文本挖掘技術進行自動知識分類，并整合了數據分析模塊，為管理層提供可視化的客戶數據以及清晰的運營狀況評估。無需人工操作，該系統的動態知識庫即可在後台自動儲存知識分類，且其搜索引擎以及分類表會隨著當前文本挖掘算法的改變而自動更新。此外，根據不同用戶的信息及使用記錄，該系統的資料搜索將會個人化，使用戶獲得更好的使用體驗及更高的工作效率。最後，在進行管理及研發分析時，系統內儲存的公司的運營情況，業務容量可作為重點依據納入考量。

3. Objectives

(Please state in clear and specific terms the technological challenges that merit the participation of the collaborating university, and the benefits this proposal would bring to the company.)

The objective of this project is to construct an intelligent knowledge management system, which will enable a knowledge intensive business service provider to effectively and efficiently collect, share, and reuse available organizational knowledge. Through the development and deployment of the proposed system, business values will be created, and real time support will be provided to the employees, and existing and potential customers of the company. It will make knowledge visible and accessible throughout the organization.

Based on the above, the system will deliver three unique features by leveraging on the latest text and data mining technologies, without user intervention. First, search efficiency will be optimized by personalization of search results according to user profiles and usage records. Second, there will be no information overload. Only relevant information will be displayed, and

the amount and types of information will be automatically personalized to user needs continuously over time. Third, there will be back-end automatic analysis for better generation and organization of useful information.
The unique features are possible through innovative application of advanced text and data mining techniques. The system will use innovative text and data mining algorithms to generate and refine classification schemes of a dynamic knowledge repository on a continuous basis automatically. Learning from how users make use of the system, search and information retrieval will be personalized, so that the whole process will be efficient and effective.

4. R&D Methodology

(Please provide a brief description of the technology to be developed and/or the innovative use of existing technologies. Details should be provided in Section C.)

In this research, advanced text mining and data analytics techniques will be applied innovatively to build a dynamic knowledge repository for a knowledge intensive business service provider. The knowledge repository will have a dynamic search index. It will be built by agglomerating two sources of data. First is from the back end and real time processing of unstructured text stored in the knowledge repository using latest text mining techniques. Second is information from applying data analytics on user profiles and usage records of the system. Both will be combined to continuously update the dynamic search index for efficient and effective information retrieval. Combined with available capability and capacity data, advanced data analytics techniques will be used to provide real time analysis not available before, to visualize current business conditions as well as discover new niche areas for R&D.

5. Deliverables

(Please set out the deliverables, itemized as appropriate, together with their *detailed technical specifications*, of the project.)

5.1. English

1. An intelligent Knowledge Management System with the following innovative elements:
   1.1 A dynamic knowledge repository
   2.2. Real time analysis support for business condition monitoring and R&D management
2. A user manual of using the system
3. A system performance evaluation report from both general end users and expert users

5.2. Chinese

1. 一套具備以下創新元素的智能知識管理系統：
   1.1 動態的知識庫
   1.2. 可實時監測公司業務狀態，並為研究開發工作提供數據分析支持
2. 使用該系統的用戶手冊
3. 系統性能評估報告

Section B – Implementation Schedule

(When an application is approved, the information in this section will be published at the ITF website (denoted with #) and/or carried forward as pre-filled data in the related progress/final reports.)

1. Overall Schedule#

(Please schedule the project commencement date to be least 30 working days from the date of submission.)

Commencement date (dd/mm/yyyy) : 12/9/2016

Completion date (dd/mm/yyyy) : 11/9/2018

Project duration (month) : 24

2. Project Milestones

(Please set out individual milestones to be achieved at different stages of implementation. Detailed account should be provided Section C.)

Period		Milestones
From (dd/mm/yyyy)	To (dd/mm/yyyy)	
12/9/2016	13/3/2017	Project Setup and data collection, and knowledge repository construction
14/3/2017	14/9/2017	Development of the system core functions: case archive, enquiry handling, management review, R&D reference
15/9/2017	15/3/2018	Development of the visualization module and user interface
16/3/2018	11/9/2018	Integration and final refinement of the system, and user training

案例归档，
咨询应答，
管理评审，
研发参考

Section C – Project Details

Section C

1. Background

1.1. General background leading to this project. Please provide supporting documents, such as company brochures and/or published papers demonstrating relevant experiences of your company, the collaborating university and/or the project team members.

This project aims at developing an intelligent Knowledge Management System (KMS) for Knowledge Intensive Business Services (KIBS) enterprises. This KMS is the first smart system that innovatively applies text-mining technique to conduct knowledge classification automatically and integrate analysis modules to visualize customer data and operational data dynamically. The system will be easy and efficient to use, with no intervention needed from the end user side. Important know-how and knowledge (such as working experience, customer preference, training manual, and customer database) will be stored in a single repository. Valuable information can be obtained through its powerful analytical module. For example, management could predict future market trend by reviewing current customer cluster, or, R&D division could design new product and service by knowing customer requirement. Thereby operation efficiency and performance can be greatly increased.

KIBS rely heavily on professional knowledge. They provide the necessary professional and technical support, mainly related to business processes, for other organizations. In Hong Kong, examples of KIBS include testing and certification service, financial consultancy, and business and management consultancy activities. KIBS accounts for 27.4% of total Hong Kong GDP in 2013. Employment structure of this industry mainly consists of scientists, engineers and specific experts. There are four features for KIBS enterprises, which includes tacitness, variability, dispersibility and innovativeness. Tacitness means that knowledge occurred in KIBS is less teachable, more complex, and more difficult to codify than explicit knowledge. Variability refers to variation in the service's standard or nature. Knowledge keeps changing all the time. Dispersibility is the degree to which the knowledge generation and consumption can occur in a different time and space. It is hard for KIBS to conduct centralized control. Lastly, KIBSs are embedded in a high velocity environment, thus innovativeness represents potential opportunities to achieve a competitive advantage. Above attributes clearly state that knowledge is the key to KIBS's success or failure, but KIBS also face hard challenges on knowledge management. Considering the variability and dispersibility of knowledge, it is hard for enterprise to systematically control changing knowledge through the whole organization. In addition, how to transfer tacit knowledge into explicit knowledge is a tough question. Without knowledge management tools, KIBS enterprises may lose competitive advantages in the market. KMS can improve the communication and gain efficiency for the organization (Singh, 2013). A study done by Yu et al. (2006) has quantified the benefits of a knowledge management system. Their study showed that comparing to the companies without knowledge management system, the companies with KMS averagely achieve 73.8% for man-hour benefit (73.8% less man hour) and 86.6% for cost benefit (86.6% less cost invested). Alavi & Leidner (1999) also suggested that although interest in KMS across a variety of industries is very high, it still enables sustainable competitive advantage in hyper-competitive environments. In addition, a study from an engineering consulting firm, a typical KIBS, found that with the help of KMS, a 48.7% time reduction in data collection and 25.3% staff-hour saving can be achieved when preparing service proposal drafts (Yang et al., 2014). Moreover, a survey of KMS showed that a 42.22% time advantage could be gained compared with traditional problem solvers (Yu et al., 2012).

So what CMA do ?

A possible way to solve the above challenges is to implement a knowledge management system to maintain generated knowledge and refine them into explicit referable information. However, current knowledge management systems lack enough functions to support increasing complexity of KIBS knowledge. These systems could only retain structured knowledge like customer name, address, or email. In addition, all the information is stored in database without taxonomy. Users spend lots of time to search for wanted cases. Furthermore, there is no statistical analysis or reporting function embedded in current mainstream knowledge management systems. When management would like to review business condition, they still could not obtain valuable information from database. Although extant knowledge management system could help KIBS enterprise save time and resource for collecting information and knowledge, they are still not very mature. For instance, current KMS could store customer information and employee feedback automatically, but it requires further man-power to clean these data (sorting and clustering) and store them in corresponding database. Raw

data and information without statistical processing is also less valuable for management to review. That is why this project attempts to remedy this gap by developing an intelligent knowledge management system addressing the limitations mentioned above.

In order to overcome current challenges and problems on knowledge management, this project aims at designing an innovative knowledge management system to support local KIBS enterprises. Compared to traditional KMS in the market, this system leverages text-mining techniques to classify dynamic knowledge, and automatically learn from how users make use of the system – thereby information provided by this system is personalized and updated. This uniqueness of the proposed system could handle high variability of knowledge in KIBS. In addition, proposed system carries a statistics analysis module to generate on-time business review report for management. With the help of this smart system, dispersive knowledge shall be centralized in a single knowledge repository and produce valuable information through analytical module. Both dispersibility and innovativeness of knowledge can be addressed. In addition, it offers a centralized platform to facilitate tacit knowledge codifying into explicit knowledge. Using state-of-the-art technology, this KMS links up people and their knowledge for these KIBS. We believe that proposed intelligent system would not only complement limitations of extant KMS, but also further improve competitive advantages of local KIBS enterprises.

We choose to cooperate with the applicant company since it is a famous certification laboratory in Hong Kong. As a typical industry in KIBS, certification service in Hong Kong has the competitive edge in the world stage. Data from Hong Kong Statistic & Census Department (2013) showed that direct economic contribution of certification industry increased from $5.2 billion in 2010 to $6.0 billion in 2013 (0.3% of Hong Kong's GDP during the period). If we could successfully implement the proposed system in the applicant company, we will have a good foundation to extend this practice to the whole KIBS industry.

1.2. Details about the R&D work to be undertaken by the collaborating university in this project and its demonstrable manpower and/or other commitments for this work.

This project would like to establish a knowledge management system supported by novel text mining techniques and statistical analysis functions. The principal investigator and key team members, with support from the applicant company, will supervise the project to review previous literature, and employ appropriate techniques for the KM system design and establishment. Research would be done into the identification of critical factors for current problem of knowledge control existing in the applicant company. Architecture of proposed system will be evaluated on high performance computers in the university before its implementation.

1.3. Any previously related project(s) undertaken by your company, the collaborating university and/or key project team members in the past five years and supported by the ITF or any other funding sources in Hong Kong and around the world? If yes, please briefly describe the relevant/related project(s) and the source(s) of funding obtained for it (them).

A research project named "A statistical Model of Laboratory Productivity Prediction" undertaken by the applicant company and the collaborating university is supported by ITF's UICP scheme fund in 2014. The project uses a quantitative approach in building up a statistical model for predicting laboratory productivity and testing service quality. A three dimensional-model has been established using structural equation modeling techniques. These three big dimensions consist of capability of working, intention of working and environment of working. From the model established, management should realize that there are more potential and alternative ways to improve an individual's performance according to the result of this study. Proposed model could provide sufficient information for helping management to make final decision.

However, during the data collection, we found that most data and information in the applicant company is not readily available. One of the root causes is the data is unstructured. For example, customer enquiry data and corresponding solutions are recorded separately in different documents. Many previous cases are hard to find due to messy classification. Based on this finding, we believe that an intelligent knowledge management system involving the use of text mining tools to classify knowledge automatically and facilitating knowledge retrieval is very needed to solve above problems. This finding is one of the initiatives for our KMS establishment.

1.4. Any other R&D work or projects similar to this application have been done or are being carried out by other parties in Hong Kong and around the world? If yes, please set out the findings and explain how your approach is compared to others in terms of technological superiority, production costs, market acceptability, etc.

Considering our project aiming at designing an intelligent Knowledge Management System, similar R&D work is scarce. However, we could compare our proposed system to extant KMS in the market to see our superiorities.

Compared with current studies, our project has following superiorities:

1. Dynamic knowledge repository
2. Back-end without user intervention
3. Automatic knowledge classification with text-mining techniques
4. Powerful analytic module

Firstly, this intelligent knowledge repository is dynamic. The proposed smart KM system could generate and refine classification schemes on a continuous basis automatically, and learn from how users make use of the system, and thereby provide users with personalized and updated information at any time. For example, if an employee is a sales representative, the system could recognize his duty and show him the most relevant result about customer enquiry or sales guideline. If an employee is a managerial staff, what he will obtain from this system is something about summarized data of daily business or operational condition. This function is achieved by state of the art text mining algorithms. For example, assume that our system collected 100 customer enquiries, every enquiry consists of a mixture of topics, but we do not know the topic names now but each topic has probabilities of generating various words (like “sales”, “test”, “complain”) in these enquires. A text mining algorithm could identify how many topics in these enquires and also show most frequent words for each topic, each enquires will be automatically assigned to corresponding topic by counting the proportion of words assigned to each topic within that enquiry (Blei 2003).

Secondly, knowledge storage, disposition and extraction all are handled at the back-end without user intervention. This system contains four different modules, namely case archive module, enquiry handling module, management review module, and R&D reference module. Each module is responsible for respective affairs. Their function and responsibility will be elaborated step by step in Section 2.1 Data is clustered and stored in corresponding modules. When a user inputs enquires, this system will only show relevant and personalized results to suit user’s needs. Users do not need to spend long time on studying how to control this system.

Thirdly, in this project, we would like to use text-mining techniques to classify text-based knowledge automatically. No matter what industry of this firm, KMS could still assign proper labels to knowledge items accurately and achieve better classification of them. This innovative attempt could significantly save labor investment in daily operation.

Fourthly, this system could not only provide reliable answers for customer enquiries, but also generate statistical report for management review and R&D works. This function is achieved by implementing text-mining techniques embedded in the Case Archive Module so all the enquiries have been clustered into different types with specific labels. Management or R&D division could obtain designated information easily.

Last but not least, this project has a good chance to be successfully implemented. There are two reasons for our confidence. First, we have conducted two pilot studies in the applicant company to investigate feasibility and technical problems. The results of these two pilot studies showed that the applicant company is a proper context to establish our system. The project has the necessary support from the management of the applicant’s company and professionals of the PolyU. Secondly, based on the condition of the applicant company, we employ bottom-up approach to establish this system. Unlike traditional architecture of information system (top-down), we would like to set four databases firstly for enterprise to evaluate their reliability and accessibility. Once these four databases could perform well we could add designated functions on them one by one. If there is any problem happening, we could locate it immediately. Then in the next step, we would add interface and user instructions into this system to significantly increase its accessibility for all users. We

attempt to first focus on individual basic elements of the system in great details. These elements are then linked together to form larger subsystems (the functions tier). The whole system's complexity could then grow up step by step.

1.5. Any pilot work has already been done by your company, the collaborating university and/or the project team members in preparation for this project? If yes, please describe the work done.

Current proposal is supported by a baseline measurement project in the applicant company from Oct 2014 to March 2015. In this project, four challenges were identified including: 1) long feedback lead-time for enquiry handling, 2) no record system for case management, 3) management lacks for information to control current business condition, and 4) R&D division need a reliable database to collect customer information for test development and modification. Based on the challenges identified, the proposed system could solve them by embedding a case archive function and a statistical analysis function. Below is a more detailed description about this pilot project.

This pilot project has following objectives:

1. To assess the current enquiry management condition in the applicant company for revealing root cause of low efficiency of handling customer enquiries. For each enquiry, its response lead-time and customer satisfactory rate are recorded.

2. To evaluate current knowledge network in this company for better identifying key knowledge holder of business process

3. To study the relationship between customer satisfactory rate of response and successful rate of business

4. To provide a proposal for the applicant company to enhance enquiry management stage. Also, we would like to determine what kinds of databases are needed to achieve the necessary knowledge management purposes.

The main methodologies used in this project are time study and knowledge audit. Data collection period lasted for three months and 1097 samples of enquiry cases were collected. Through the implementation of this project, applicant company management and the project investigator found out some significant problems.

Firstly, same as previous scholars' observation, there is no systematic approach or tool for enquiry management. The lead-time of response is long due to insufficient technical support. Sales personnel do not have previous case to refer and it is hard for them to identify corresponding experts. In addition, there is not record system for enquiries.

Secondly, correlation analysis showed the significant relationship between customer satisfactory about response and successful rate of deals. The coefficient determination reached 0.74. This result confirms our assumption and motivates us to enhance enquiry management.

Thirdly, through that project, investigator and management realized that company lacks a standardized system to collect enquiry information automatically. Manual collection is not feasible due to big volume of enquires every day. They consider whether a computational system could be generated so that management could review enquiry information periodically to make future business plan.

The pilot project generated useful and supportive data and experience for this project. An intelligent knowledge management system is necessary since it could solve the above problems and obtain more potential possibility for customer satisfaction improvement.

1.6. Any request for funding support for this application previously rejected by ITF? If yes, please set out the project reference of the previous application.

N/A

1.7. If this application is a re-submission of a previously rejected application under any one of the ITF programmes, please highlight the main differences of this application the previous one and explain how the differences have addressed the concerns previously raised by the Innovation and Technology Commission.

N/A

2. Implementation Approach

2.1. Please elaborate on the technology to be developed and/or the innovative use of existing technologies. The brief information provided in Section A is relevant.

The knowledge management system developed in this project emphasizes on three innovative attempts. Firstly, all the functions embedded in this system are operating at the back-end without user intervention. Four databases support daily operation of knowledge collection and classification, namely enquiry database, customer database, capability database and capacity database. Reports for management review and R&D works are also based on statistical analysis of collected cases. Users do not need to control the operation of this system. Secondly, the knowledge repository embedded in proposed system is dynamic. It could generate and refine classification schemes on a continuous basis automatically via state of the art text mining. Thus, search and information retrieval will be efficient and effective. Thirdly, when generating response for customer, this system could consider current operation condition of the company through searching the capacity and capability databases.

A set of system modules will be developed to deal with the management of organizational knowledge. Developing a data-driven KMS requires sufficient preparation work. In the proposed system architecture showed in Figure 1, there are four main databases and four modules to construct the main part of this knowledge management system for sequentially carrying out the tasks of generating the response and provide further review function for management and R&D divisions. The four modules are case archive module, enquiry handling module, management review module, and R&D reference module. Together they can support a whole cycle of customer management.

The proposed KMS approach can help enhance the business processes of the marketing department and sales force. The decision-makers will be provided with various feasible solutions and valuable information, such as customer feedback and requirement, most valuable product, and current sales condition. Responses to customer enquiries, for example, will thus be more proper and effective. Currently, only the summary of recent business condition by analyzing cases received in the last month is available in the applicant company. This function could also provide reliable statistical report for management review and R&D works.

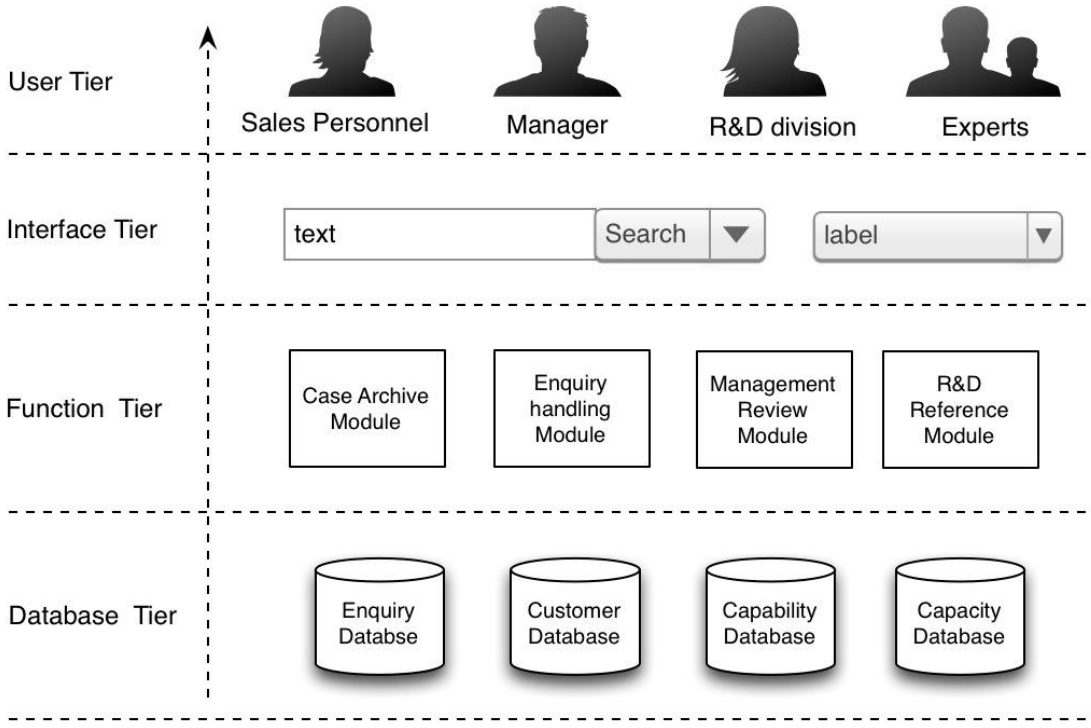

Figure 1. Architecture of Proposed Knowledge Management System

We would employ a bottom-up approach to construct this proposed system. Four databases will be established for evaluation of their reliability and accessibility. These four databases consist of the enquiry database, the customer database, the capability database, and the capacity database. Enquiry database purely focuses on collecting all the relevant information about incoming requests from customer. In this company, relevant information contains content of enquiry, final response from expert, customer's feedback on response and support document of response. Customer database, as the name suggests, allows company to store customer information. We would like to assign value score on each customer based on its business volume. The capability and capacity databases link previous cases with current operational condition. One could understand when a sale personnel makes a response, he or she must control current capacity and capability to see if company could accept this deal. These two databases are necessary to support decision-making. As for capacity database, the information related to company capacity, such as availability of resources, time availability, will be stored; while capability database stores company capability information, such as business area, previous successful business cases, and yellow pages of internal experts, which highly depended on the business characteristics of the company. Once these four databases could perform well we could add designated functions on them one by one. There are mainly four modules for this knowledge management system. They are the case archive module, the enquiry handling module, the management review module, and the R&D reference module. Each module corresponds to different requirements of the company. For the case archive module, text mining techniques will be employed to classify enquiries automatically. The enquiry module contains search engine and filter function. Users could locate most relevant cases from enquiry database. The management review and the R&D reference modules aim at providing statistic report to managerial users, to provide them with information about current business conditions. Then in the next step, we would add interface and user instructions into this system to significantly increase its accessibility for all users. When this system is implemented, we propose a new workflow for sales personnel to handle incoming enquiry. The proposed workflow is shown as below:

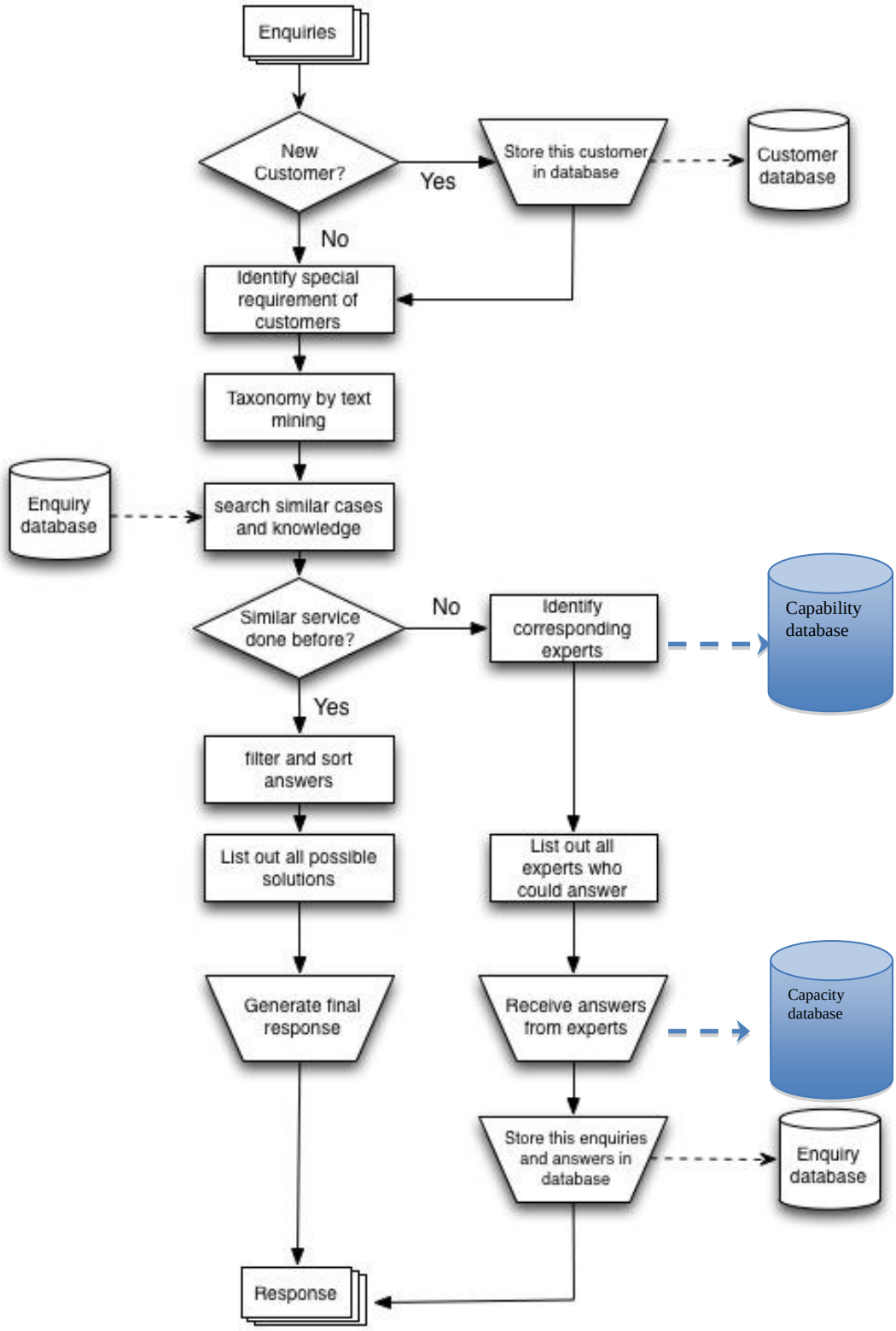

Figure 2. Workflow of using proposed Knowledge Management System

2.2. Please elaborate with technical details on each project milestone. The brief information provided in Section B is relevant.

1. 1st Milestone (6 months after project start) Project Setup and data collection, and knowledge repository construction

There are three main tasks before repository construction. Firstly, we would like to spend one month

collecting enquiry cases. The objective of this task is to identify valuable information in each case and filter useless noise in data. This step is necessary for stemming enquiry information before inputting them into databases. Also, we would like to cooperate with management to understand what kind of information is most critical and valuable for them to review. Secondly, enquiry database and customer database will be established. Initial thought is to create two SQL server databases and link them with a primary key, such as enquiry number. With a free graphical user interface (GUI) program such as SQL Server Management, this project does not need to worry about fumbling around with the command line. Thirdly, more effort will be invested in setting up properly the capability and capacity databases. Establishment of these two databases is much more complicated since we need them to track current capacity conditions. These two databases must link to routine operation and need high accessibility for users. For instance, when a production facility will be occupied in future three days, users must let this database know this condition through inputting proper command. What we will do in this process is to simplify the way of command. After above three tasks are finished, the knowledge repository could be well constructed.

2. 2nd Milestone (12 months after project start) Development of the system core functions: case archive, enquiry handling, management review, and R&D reference.

In step 1, four databases are combined to become a knowledge repository. So in step 2, we would like to add four modules to make use of the information stored in the databases. Case archive module will be set firstly for better filtering and clustering incoming enquiry cases. State of the art text mining techniques such as Latent Dirichlet Allocation (Blei 2003) will be added in this module to achieve automatic classification. This is a proven technique that could detect and perceive content of each case and assign corresponding tags to them automatically. This is an innovative attempt since traditional KMS still requires manual work to conduct knowledge classification. Leveraging this technique, our system could finish this task without any user intervention. Additionally, this function could perform better and better when it receives more incoming cases. In other word, this system could "learn" how to do classification through machine learning mechanism. Also, if users could provide it with instructions about desired output, this KMS could conduct taxonomy more accurately through supervised learning processes. Then, we could start to setup the enquiry handling module. In this step, we mainly focus on search engine construction. There are two choices for us to build a reliable search mechanism. First choice is to employ outsourced support to provide this module with a reliable and efficient search engine. This choice could make the whole system perform better but require higher investment. Second choice is to employ open sourced full-text search engine. This kind of search engine could be embedded into any kind of databases. We would discuss these two choices with management in depth. Their requirements and complexity of cases are two determinants of our choice. Then, we could start to setup the management review and the R&D modules. These two modules required statistical tools to provide users with visual information. We could achieve this target by employing R programming to install designated analysis packages in this system. What we need to identify in this step is the valuable information covered by the data.

3. 3rd Milestone (18 months after project start) Development of the visualization module and user interface

User interface design is a vital part in system construction. The goal of user interface design is to make the user's interaction as simple and efficient as possible, in terms of accomplishing user goals. When designing this system's interface, we need to clarify two questions. First question is how to make this system align with user's routine operation and daily activity. Second question is how technically savvy is the user and what similar systems does the user already use. We thought that this system's interface should be based on user-oriented terms and concepts rather than computer concepts. So the target is that users without any technical background could still operate this system smoothly. In addition, we also would like to add more information visualization module in the interface to help user catch messages easier. Cooperation is necessary in this step to ensure high accessibility of this system.

4th Milestone (24 months after project start) Integration and final refinement of the system, and user training

Once the whole system is established, we could conduct a pilot trial to evaluate the performance of this system. The main purpose of this step is to identify possible problems happened in using the system and potential bugs. Also, users' feedback is necessary to refine functions and modules. Trial and error will

last for 6 months to ensure all above problems are solved. Finally, user training could be conducted to generalize this system.

3. Target Results and Benefits

3.1. The proposal's contribution to the innovation and technology upgrading of the Hong Kong economy.

Hong Kong's knowledge intensive business has grown substantially since the 1980s. Hong Kong fact sheets state that in 2013, manufacturing only accounted for 1.5 percent of the GDP of Hong Kong but service industry constituted a share of 92.9 percent. One of the key services sub-sectors in Hong Kong is professional and business service, which accounts for 27.4% of the total GDP. It is obvious that knowledge intensive service business is a major brace of economics of Hong Kong. However, with the rapid development of Mainland China and the open of free trade zone in Shanghai, Hong Kong's advantages may be relatively alleviated.
So in order to face fierce competition in the future, service enterprise must know how to maintain intensive knowledge in the entire organization. We believe that our proposed KMS could contribute to the innovation and technology upgrading of the Hong Kong economy through the following perspectives:

1. The knowledge management system proposed by this project could make knowledge visible and accessible throughout the entire organization. Previous solutions and experience could be retained and recycled. Thus, the whole enterprise's efficiency could be greatly improved.

2. Powerful analytic module carried by the proposed KMS can generate valuable report for managerial review or R&D. Reports generated could help show future trends of the market, current operational conditions, and the internal knowledge sources of the whole company, which will enable better and faster decision making. With the support of text-mining techniques, this function could be achieved without user intervention.

3. This system could reduce the loss of intellectual capital from people leaving the company. As the most precious asset of KIBS, experts play the most important role in this kind of company. The proposed KMS could record every case and solutions given by employee to retain the knowledge involved in them. Cost of training and manpower investment could be saved.
In summary, we expect that this system could increase competitiveness through integrating valuable knowledge of service companies, especially for KIBS. Use of this system could certainly contribute to the development of Hong Kong's service industry.

3.2. The proposal's contribution to the innovation and technology capabilities of the company.

This proposal mainly aims at developing an intelligent KMS to manage information automatically and dynamically. What we focus on this system is that it could integrate all the relevant knowledge from different divisions, different periods of time and different individuals and refine them into valuable solutions. This target could be achieved by first tier's databases. Power of these four databases will be performed by modules to achieve expected functions.

As discussed in previous sections, this KMS will not only solve enquiry management problem, but also become a knowledge repository and collector for the whole company. Management and R&D division could obtain valuable information from it at any time they want. Company could even add more modules in the second system tier to achieve multiple functions at the same time. For example, company could assess customer's value according to business volume information stored in customer database. Price discrimination strategy or "80-20" customer service rule could be implemented according to information obtained. It is considered that the company's innovation capability could be significantly improved from sufficient information support and data mining. So once the architecture of this KMS has established, the company could customize this system according to specific requirements or needs. Not only could this system improve service efficiency, but it could also provide more innovative functions through further developments and refinements.

3.3. The benefits of this proposal to the collaborating university, its faculty members and/or graduate students.

The benefits of this proposal to the collaborating university mainly focus on its theoretical contribution. The project advances our knowledge in applying text mining techniques and algorithms for managing dynamic streams of unstructured information in the context of providing professional business service. The work leverages on the expertise of the faculty members of the collaborating university, Dr. Eric See-To (the project coordinator) who is an expert in text mining, Prof. Winco Yung who is an expert in the application domain, and Prof. Eric Tsui who is the expert in knowledge management. Graduate students can participate in this project in researching the relevant text mining techniques and algorithms, thus gaining precious experience in applying highly specialized knowledge into the real world.

4. Collaborations with Other Organisations

4.1. Any collaboration with other organizations? If so, please elaborate on the form of such collaborations.

N/A

4.2. Any special arrangements arising from such collaboration, e.g. licensing of intellectual property rights? If so, please elaborate.

N/A

5. Intellectual Property Rights of the Project Results/Deliverables

5.1. Any intellectual property rights from your company or the collaborating university that would be used for the generation of the project results/deliverables? If so, please provide details about such arrangements.

N/A

5.2. Any intention to patent any of the project results/deliverables to be developed under the project and if so, the name of the patentable item(s) and the country/countries where such registration will be filed?

N/A

5.3. Any agreement between your company and the collaborating university on the sharing of the royalties or any other sorts of income to be generated from the project results/deliverables and if so, brief description of such arrangement? (Please attach a copy of the relevant agreement to this application.)

N/A

6. Company Details

6.1. General Information

[Such information has been provided in Section D.]

CMA Industrial Development Foundation Limited (CMA Testing) is a leading independent quality assurance organization in Hong Kong. CMA Testing was established in 1979 by The Chinese Manufacturers Association of Hong Kong, which is one of the largest and oldest Chamber of Commerce and Industry organizations of Hong Kong.

CMA Testing is a Dynamic Quality Team comprised of experts in various technical and professional fields. Company offer accredited third-party quality assurance services, including testing, inspection and certification services, based on internationally recognized standards. With continuous investment in advanced facilities, CMA Testing conducts testing

for toys, children's articles, electrical and electronic products, textile garment, food, cosmetic, traditional Chinese medicine, chemicals, wastewater, and more.

6.2. Business Information

No. of Employees in HK	:	270
Year of Establishment	:	1979
Nature of Business	:	Testing, inspect and certification
Line of Products	:	Toys, Textile, Environmental, Electronics, Food, Pharmaceutical

6.3. Shareholding Information

No.	Shareholder's Name	% held
	N/A	

6.4. Management Team Information

No.	Name	Position	Date of 1st Appointment (DD/MM/YYYY)
1	Lam Chun-Hong Dominic	Acting CEO	7 Apr 1990
2	Chan Yu Kong, Alfred	General Manager of Finance, Human Resources & Admin	30 Sep 2010
3	Lam Sing Yum, Arthur	General Manager of Business Development	1 Aug 2012

6.5. Relationship between the Company, the Collaborating University and their Staff Members Participating in the Project

(Please provide details about any other kind of affiliation if they have not been provided in 6.4 above)

N/A

7. Other Information in Support of the Application

Support letter from the applicant company. Please see attachment in section H.

Section D – Applicant Organization and Collaborating Parties

(When an application is approved, the information in this section will be published at the ITF website (denoted with #) and/or carried forward as pre-filled data in the related progress/final reports.)

1. Information on the Applicant Company#

(Please provide business, shareholding and management team information in Section C.)

Name in English	:	CMA Industrial Development Foundation Limited
Name in Chinese	:	香港中華廠商聯合會工業發展基金有限公司
Registered Address	:	Room 1302, Yan Hing Centre, 9-13 Wong Chuk Yeung Street, Fo Tan, Shatin, New Territories, Hong Kong
Telephone Number	:	852-26988198
Fax Number	:	852-26954177
Email Address	:	dominiclam@cmatcl.com
Webpage	:	www.cmatcl.com
Contact Person - Name	:	Mr Dominic LAM
Contact Person - Position	:	Acting CEO

2. Information on the Collaborating University#

Name in English	:	The Hong Kong Polytechnic University
Name in Chinese	:	香港理工大學
Year of Establishment	:	
Nature of Business	:	Higher Education Institution
Registered Address	:	The Hong Kong Polytechnic University, Kowloon
Telephone Number	:	852-27665023
Fax Number	:	852-23557651
Email Address	:	virginia.cheng@polyu.edu.hk
Webpage	:	
Contact Person - Name	:	Dr Virginia CHENG
Contact Person - Position	:	Head, Research Office

3. Other Collaborating Parties#

No	English Name (Chinese Name)	Role in the Project	Address / Webpage (if any)	Contact Person	Tel No / Fax No / Email

Section E – Project Team

(When an application is approved, the information in this section will be published at the ITF website (denoted with #) and/or carried forward as pre-filled data in the related progress/final reports.)

1. Project Coordinator#

Project Role	:	Project Coordinator + Principal Investigator
☒**Key member** ☒**CV included** ☐**To be Paid by the Project**		
Name in English	:	Dr Wing Kuen SEE-TO
Name in Chinese	:	司徒穎權博士
Position	:	Assistant Professor
Department (if any)	:	Industrial and Systems Engineering
Organization Name	:	The Hong Kong Polytechnic University
Telephone Number	:	852-34003002
Fax Number	:	852-23625267
Email Address	:	eric.see-to@polyu.edu.hk
Main Task	:	Project management and coordination
Organization Webpage	:	

2. Other Team Members#

No	Key Member?	Name (Chinese name) Role in the Project [PSC Member@]	Main Task	Position or Project Post/Rank Department Organisation	With CV?
1	*	Dr Kam Chuen Yung (容錦泉) Deputy Project Coordinator [PSC Member]	Coordination and Investigation	Associate Professor - The Hong Kong Polytechnic University	Yes
2	*	Prof Eric Yue Hong Tsui (徐汝康) Investigator [PSC Member]	Coordination and Investigation	Professor Department of Industrial and Systems Engineering The Hong Kong Polytechnic University	Yes
3		Mr Dominic Lam (林俊康) Investigator [PSC Member]	Coordination and Investigation	Acting CEO - CMA Industrial Development Foundation Limited	No

@ PSC Member = Project Steering Committee Member.