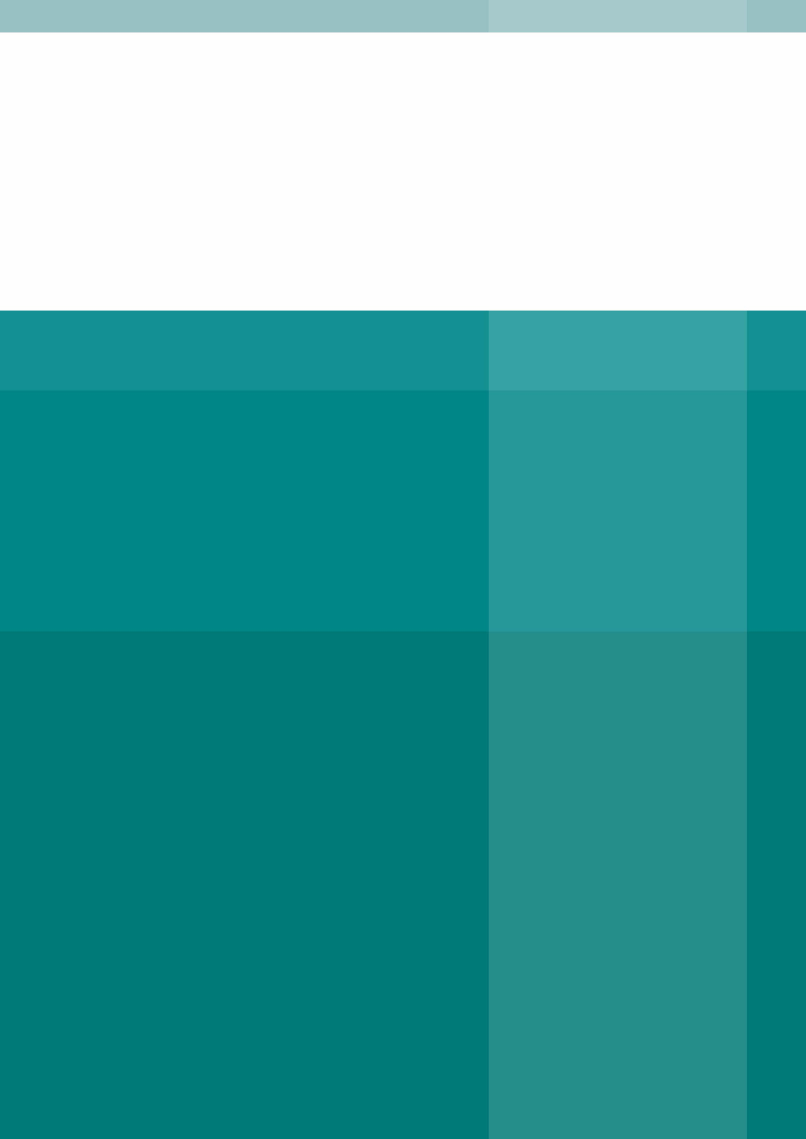
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**Presented by**

**CTBC Bank**

***(CTBC Bank Co., Ltd., Taiwan)***

**The Asset Triple A Digital Awards 2016: Asia-Pacific Region**

**Most Innovative Data Analytics Project**

**“Establishment of Data Driven Insight” Project**

***- A Beanstalk of Innovation, Evolution and Revolution-***

**Agenda**

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**Project Overview**

As rapid evolution of FinTech and fermentation of big data, in financial industry, the challenge of "Customer Management" and "Risk Management" has been much severer than before.

In Taiwan, the leading retail banking corporation, CTBC Bank, from decades of experience in business management, deeply realized how efficiency can be improved through technology and talent management. Last summer, with the cooperation with Teradata, CTBC introduced the enterprise solution of data analytic platform which allows exploration of data analytics in an innovative way. From laboratory to business, we successfully stride across the obstacle that traditional analytics have never made.

***Project Framework***

It has never been an easy task to carry out innovative data analytics in a business industry. In this project, CTBC, along with data warehouse industry solution, Teradata, cooperate in establishing a data exploring platform, Aster, which is responsible for the deployment of innovative algorithms.

* **Innovative Algorithms**

With establishment of the exploring platform, CTBC implemented many innovative algorithms in big data analytics, including Social Network Analysis, Path Analysis, Textmining, Collaborative Filtering Algorithm and lots more. We successfully applied those onto risk management, customer relationship management and retail campaigns in marketing, from which we gained tremendous business value and financial benefits.

* **Adoptable Customer Management Strategies**

The result of data exploring is merely a laboratory report if it cannot successfully resolve problems or provide suggestions in practical business. One of the highest values of this project is that, after months of investment, CTBC successfully implemented the innovative algorithms and extracted the potential value in practical business. Taking consideration on improving benefits and lowering down risks, we put data science into real practice so that the spirit of FinTech extends.

* **Communication with Data Warehouse**

Enterprise data warehouse is the basic foundation of portfolio management to all financial holding companies. Which means the facilities of innovations and existing data warehouse must be highly connected with each other. In the process of this project, CTBC ensures this connection stands all the time so that all scalabilities could be made in near future.

***Project Specification***

Consider the elaborateness and difficulties of the task, CTBC planned this project in two phases. The first thing is to verify the innovative methodologies do work well in real business. From here we raise a PoC, a short-term proof of concept, to capture and accommodate innovative ideas. Next, we officially set up infrastructure and invested business resources into what had kept in our mind. Some key features are listed as follows.

* **Start Since:** July 2015
* **Investment:** 15 million TWD
* **Time of Completion:** March 2016
* **Resource Deployed:** 14 staffs in 780 man days

**The Incoming Challenge**

As the leading retail bank in Taiwan, CTBC has moved aggressively into digital banking and always looks forward to the consequence optimistically. Therefore, with being aware of the following challenges, CTBC is extremely confident of what might change ahead in our path.

* **Liberalized Regulation**

Meeting the trends of the times, consequently, the Financial Supervisory Commission (FSC) in Taiwan began to advance Digital Financial Environment. The aim is to promote financial innovation of the financial services industry, and create advantageous conditions for the development of a digitized financial environment. Banks were allowed to provide 12 online services in January 2015 including deposit, credit loan, credit card, wealth management and joint marketing services, including online credit loan application, car or home loan increases, credit card applications as well as opening of a trust account. Banks are now also allowed to begin engaging in low-risk electronic business transactions without being permitted in advance. In addition, the Bankers Association of Taiwan has been tasked to formulate accompanying measures for online opening of accounts.

* **Complex Customer Connections**

In present day, customer financial activities have entangled between numerous institutions. Thousands products are booming in market and more to come. However, from traditions to innovations, an institution has many difficulties to obtain the every fingerprint of customer activities.

In the meantime, in this project CTBC put lot efforts on extracting and re-organizing customer transaction data in order to fully capture the whole picture of its customers, which distributed in archives or data warehouse.

* **Personal Data Protection**

Personal Data Protection Law, addressed in Taiwan on October 2012, has gained a lot of legal attention and so does in financial environment. With nowadays business on going, CTBC has confidence to drive and implement a solution even in a more strict expectation by local regulators.

* **Computing Capability**

In new generation of data analytics, computing capability must be prepared far more than ever to discover clues in time and in quality. To achieve this, new investment of infrastructure is necessary and conflicts with existing operations or regulations must be eliminated. This is no easy task for a global banking corporate with dedication for more than half centuries.

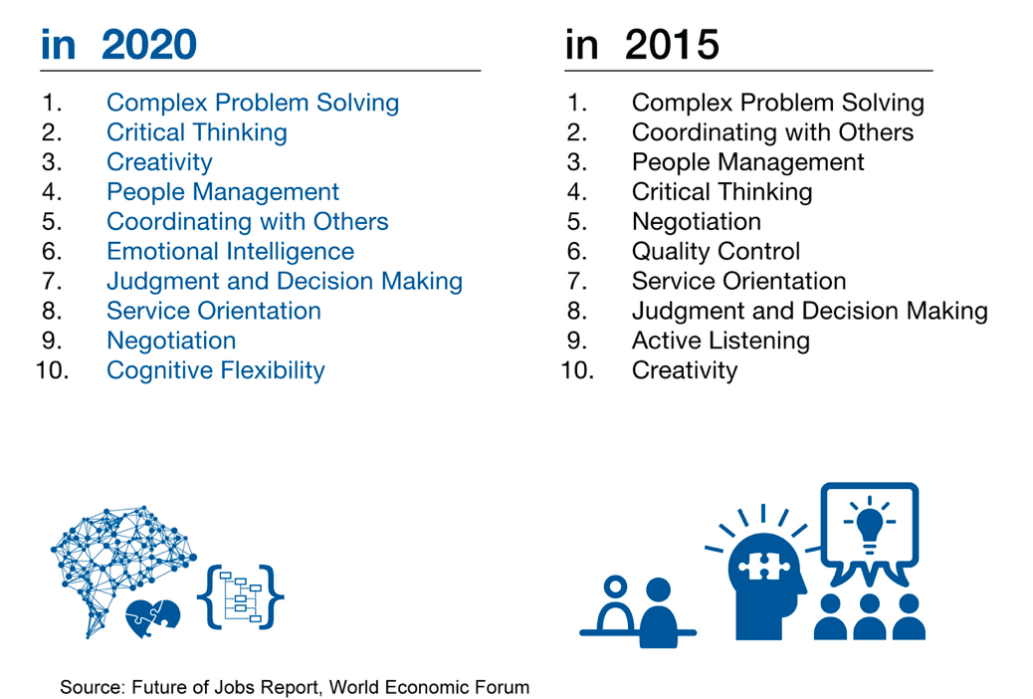
* **Global Launching Business**

CTBC continuously and enthusiastically expands territory in overseas market and would like to transform ourselves into the best regional financial institution in Asia. To achieve this, we must acquire a flexible, robust, and scalable platform that can easily deploy to overseas subsidiaries.

**Project Establishment**

***Project Development***

As The Forth Industrial Revolution rises, the World Economic Forum indicates the urged needs of developing new strategies. Personal training is definitely one of the top priorities. According to Future of Jobs Report in World Economic Forum, **Complex Problem Solving** is the most important personnel characteristic one employee should carry in 2020, following by **Critical Thinking**, and **Creativity.** (Detailed rank may be referred to Figure x) Furthermore, Data Scientist, the sexiest job of 21st centuries, also has these 3 typical characteristics. In order to pursue the evolution of economic trend, a sub-project aiming to train up data scientists was initiated to prepare and support CTBC becoming not only the Champion of Taiwan, but also the Leader and the Best Asian Financial Institute around the world.



***Figure 1: Summary table by Future of Jobs Report, World Economic Forum***

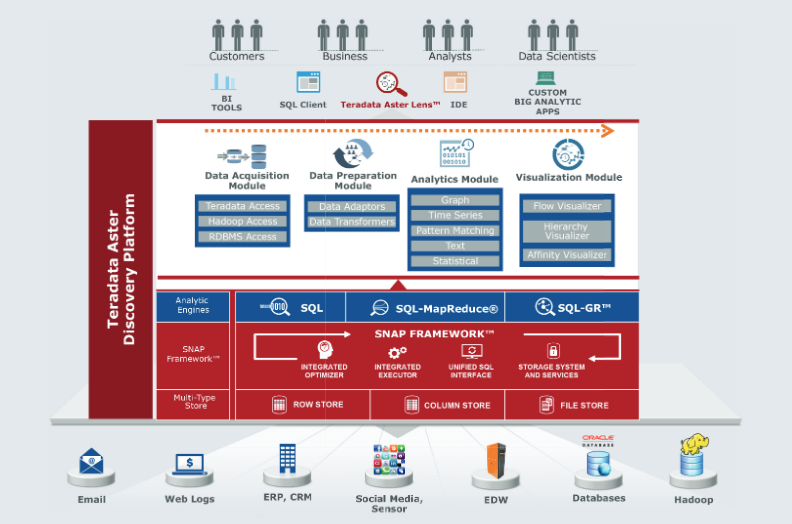
In order to achieve this vision, we start this investment to build a Big Bata Discovery Platform and cultivate many internal data analysts and data scientists in following dimensions:

* **Build Internal Big Data Discovery Platform**

For building the Big Data Discovery Platform, we developed three processes to implement and verify the performance of Big Data Platform. Finally, we chose Teradata Aster Discovery Platform to play the key role in Big Data Analysis in CTBC. Before talking about the process for building internal big data platform, here are the Teradata Aster brief introduction and architecture below.

Teradata Aster is an analytic platform that embeds MapReduce analytic processing with data stores. The main advantages are:

* Embedded MapReduce analytic processing and unique SQL-MapReduce® framework.
* Massively parallel data store for multi-structured data.
* Intuitive tools and SQL-MapReduce libraries for rapid analytic development



***Figure 2: Components illustration of data analytic platform by Teradata***

Above figure is the architecture of Aster Big Data Discovery Platform. From this illustration, we could clearly see that Aster Database accepts various types of structured data and unstructured data, including Email, Web Logs, ERP, CRM, Social Media, EDW, Databases and Hadoop platform. Stored data could be processed in 3 different ways: row store, column store and file store which is rarely seen in other analytic products. Moreover, a hybrid engine which includes SQL Engine, SQL-MapReduce Engine and SQL-GR Engine is embedded in Aster Discovery Platform. SQL-MapReduce, one of the major features for Aster, combines the advantages of MapReduce, which supports parallel processing in big data analysis, and ease of use in SQL-like format interface, which resolves the challenge of learning a new coding language for beginners. Every single packaged SQL-MapReduce function has already been developed by Teradata Research and Development engineers with embedded java script. Users then can easily analyze large datasets in a familiar way with many advanced and complicated statistical analytics methods without writing the MapReduce program. For the analytics layer, Aster provides Data Acquisition Module, Data Preparation Module, Analytics Module and Visualization Module. These four modules are based on the main big data analysis cycle: data preparation, data pre-processing, data analysis and visualization for discovering business insight. In terms of Analytics Module, there are more than 100 pre-built SQL-MapReduce functions, including Path Analysis, Text Analysis, Graph Analysis, Statistics Analysis, Clustering Analysis, Association Analysis, Data Transformation……etc. Each analytics module contains various sub-functions could be flexibly used together.

After the introduction of Teradata Aster Discovery Platform, now we further see the two processes of building internal big data platform as follows:

* **Proof of Concept (PoC)**

We invited Teradata Big Data Analysis Team members to implement the PoC through data analytic cycle on Teradata Aster Discovery Platform, including requirement collection, data preparation, data cleansing, data analysis, visualization and final presentation. Although we focused on rick management at the beginning, we founded using same analysis functions but used in marketing view will show different results. It was an interesting idea, letting us come out many analytic topics and benefit to different departments including CRM, Credit Card and Risk.

* **Projects**

After finishing the PoC, we started to integrate Big Data Platform with current operation databases, including SAS® Enterprise Guide™ and Teradata® Warehouse and come out a sub-project. Unlike general Big Data Analysis Project, we focused on letting many colleagues to be familiar with the new Big Data Platform and know how to use different algorithms to solve current business problems. For us, we emphasize to popularize the internal Big Data culture rather than only completing analysis topics which probably were done by vendors. The project execution process as follow:

* **Hardware and Software Installation and Setting.** Teradata project members helped to prepare and establish the Big Data Environment, including install software on four physical machines, install analytic function, and design encryption program for different data source connection to protect confidential information.
* **Big Data Platform Fundamental Training.** With Teradata team’s help, a Teradata Aster Discovery Platform training program was designed with the purpose of cultivating qualified and professional data analysts and data scientists within CTBC.
* **Big Data Scenario Implement Training.** Along with Teradata team’s consulting, during the training period, CTBC analysts and data scientists learned the principle elements of several algorithms specifically for big data analysis and methods to fully implement these academic theories into real world problems. It is also important for the trainees to understand the tips to discover business insights. Further details will be discussed later.
* **CTBC Internal Hackathon competition.** After completing the series of Big Data Analysis Training Courses, an internal Hackathon competition was hosted in CTBC, in order to make sure all trainees have fully understood the materials and been able to flexibly apply to business scenarios. Everyone who is engaged in this project and joined the training courses is required to attend this race. Attendees were divided into six groups. With limited time, attendees were required to come up with a relevant topic towards their department function and used Teradata Aster Discovery Platform to perform analysis. In this competition we has learned:
* Contagion Risk Path Analysis on Risky Customers
* Customer Social Cycle Graph Analysis on Merchants
* Relation Analysis between Balance Volatility and Potential Default
* Text Analysis Application
* **Build Data Analysis Teams from Risk and Marketing sides**
* **Six groups from different departments.**

To cultivate internal data analyst and data scientist, we divided about thirty people into six groups, two groups from risk department, two groups from credit card department and two groups from customer relationship management department(CRM). There are two roles in each group, one is project manager, the others are data analysts. Everyone should use personal talent to cooperate with each other.

* **Benefits**

The benefits for three departments involved in are using big data analysis techniques to create three business values in different views: from Risk side, we could know the business focuses on Risk management, the objects are discovering more potential risk customers and knowing how to efficiently manage risk occurrences; from credit card side, we could know the business focuses on marketing of many kinds of credit cards, the objects are discovering more patterns of customer behavior to capture customer interests; from CRM side, we could know the business focuses creating excellent customer experience and discovering more potential VIP customers.

* **Attend Big Data Analysis Training Courses**

Teradata team tailored and designed specifically for CTBC a Big Data Analysis Program. This program comprises two levels of training courses: basic courses designed to guide CTBC colleagues to be familiar with Teradata Aster Big Data Platform and advanced courses designed to enhance trainees’ critical thinking and abilities of solving complex problems. Here is a brief introduction to each course.

* **Basic**

1. **Introduction to Teradata Aster.** This is the first class of series big data courses. The course is designed for Database Administrator, System Analyst (Data Owner), System Administrator and System developers. From this course, we could know the basic introduction of Teradata Aster big data platform. Besides, we could quickly understand some Aster use case from domestic and foreign experiences.
2. **Analytics and Data Mining Introduction.** This course is designed for Database Administrator, System Analyst (Data Owner), System Administrator and System developers. From this course, we could start to understand various Aster SQL/MapReduce Functions. The courses focus on four Analytics Function Modules, including Graph Analysis, Text Analysis, Association Analysis and Path Analysis. Apart from introduction of each Analytics Function Modules, we also could learn the real case application from these four function modules.
3. **Data Analysis & Aster System Management.** This course is designed for Database Administrator, System Analyst (Data Owner) and System Administrator. From this course, we could know the management skill of Aster, such as authentication design, database resource management.
4. **Teradata Aster AppCenter Introduction & Development.** This course is designed for Database Administrator, System Analyst (Data Owner) and System Administrator. From this course, we could understand the function of Aster App Center- a visualization tool which constructed on Aster platform. It could show many icons like app, every icon packages a set of Aster SQL Scripts which are designed from Data Analyst or Data Engineer. For managers or business users who need not to develop analysis program, they only have to click the packaged icons and set the schedule, the analytics report will automatically show up on the screen.
5. **Tableau Training.** This course is designed for System Analyst (Data Owner) and System Administrator. From this course, we could understand the function of Tableau- a famous visualization BI tool. Apart from the basic introduction of Tableau, we could further understand many scenarios by Tableau.

* **Advanced**

There are four advanced courses that are suitable for bank industry in Taiwan, the goal is to driving CTBC colleagues to learn the core analytic ideas and related algorithms. From completing these four implement topics, we could image everyone who join this project can have more creativity to figure out more big data analytic topic for themselves. Here is the brief introduction for each courses.

1. **Infection Path Analysis on Risk Customers.** This course is designed for each data analysis team member to deeply know how to implement Graph Analysis. “Graph Theory” is a methodology which could be used to identify social network. We use “Graph Analysis” methodology to build Cash Flow Communities by customer deposit data and figure out the observation period and the performance period, try to find someone who has cash flow relationship with high risk customer during observation period. For verifying the result, we further discover the target customers who are affected by the high risk customer and also transform to high risk during performance period. At last, we summarize the reason and pattern why deposit relationship may influence someone in the same community. These are the related Graph Analysis Functions below:

* Pagerank
* Betweenness
* Closeness
* Local Clustering Coefficient
* Modularity
* nTree

1. **Connection Analysis on Merchants.** This course is designed for each data analysis team member to deeply know how to implement Association Analysis. “Market Basket Analysis” is a method that figure out which items are often bought in the same order, and try to discover the best product sets to drive marketing value. We applicate “market basket analysis” in different way, analyze credit card statement data to discover which merchants are visited in the same credit card holder, try to figure out the merchant connection. At last, we summarize the potential merchant relationship sets which could be helped to come out marketing strategies.
2. **Relation Analysis between Balance Fluctuation and Default.** This course is designed for each data analysis team member to deeply know how to implement Path Analysis. “Path Analysis” is the method which often used in website analysis, try to figure out customer frequent path on website. We applicate Path Analysis in a new way. Our analysis target is the changed figure like deposit balance instead of a physical object like website’s clicked items, we try to figure out the balance fluctuation by path analysis method. At last, we summarize the frequent balance fluctuation path, also analyze the relation between the path and default. After finishing the analysis topic, we could come out strategies in advance before the customers who enter the same pattern in the future.
3. **Text Analysis on Customer Complaints for Lexicons.** This course is designed for each data analysis team member to deeply know how to implement Text Analysis. ”Text Analysis” or “Text Mining” is a famous method to analyze unstructured text information like blogs, forum from social media. The goal is to transform the unstructured data to structured data that can be easily understood by text segmentation, key word extraction, sentiment analysis, text classification. The Text Analysis training course is divided into two parts, one is new word discovery, the other is text classification by supervised machine learning method.

* **New Word Discovery.** New Word Discovery is an important concept in text mining. It is not easy for Chinese word identification by segment method because of new words invention incessantly like brand, 3c product. Also, Chinese sentences could not be recognized by blank space. For resolving these problems, we use nGram method to find the sequential frequent word sets, if the word has never shown in the dictionary we built before, it can be directly put in the dictionary.
* **Text Classification by Supervised Machine Learning Method.** Machine Learning is a popular skill in data mining, it is divided into supervised and unsupervised method. Supervised machine learning means we have history data set that has already tagged classification results, system can learn the history data and predict the future data which do not have answer. Unsupervised machine learning means we do not have any tagged answers and directly do classification by math algorithm. For Supervised Machine Learning method in text mining, we use Naïve Bayes to predict the classification result on social media articles. These are the related Text Analysis Functions below:
* TextTokenizer
* TF-IDF
* nGram
* Sentiment Extractor
* Naïve Bayes
* **Internal Hackathon Competition**

After completing the two levels of Aster Big Data Training courses, each team must use the algorithms they have learned to achieve their topics in limited time and present the final results on the final day. Further detail will be discussed in nextparagraph.

***Project Achievement***

1. **Internal Hackathon Competition**

There are total of six big data analysis topics in this internal hackathon competition. Each team member has done his/her best to finish the competition. Here are the results:

1. **The Butterfly Effect of Risk** (Department: Risk Management)

* **Analytics background and Target:**

CDIA is a contract that help customer to solve the debt issue in a different way. The figure of applicants has grown annually; we also find someone who break their promise. For resolving the growth of break rate, we try to use big data analysis method to discovery the break path of customers and expect to find someone who has cash flow relationship with them also has the probability of promise breaking. In Addition, we further observe the payment channel path, trying to decrease the human resource effort.

* **Data Includes:**

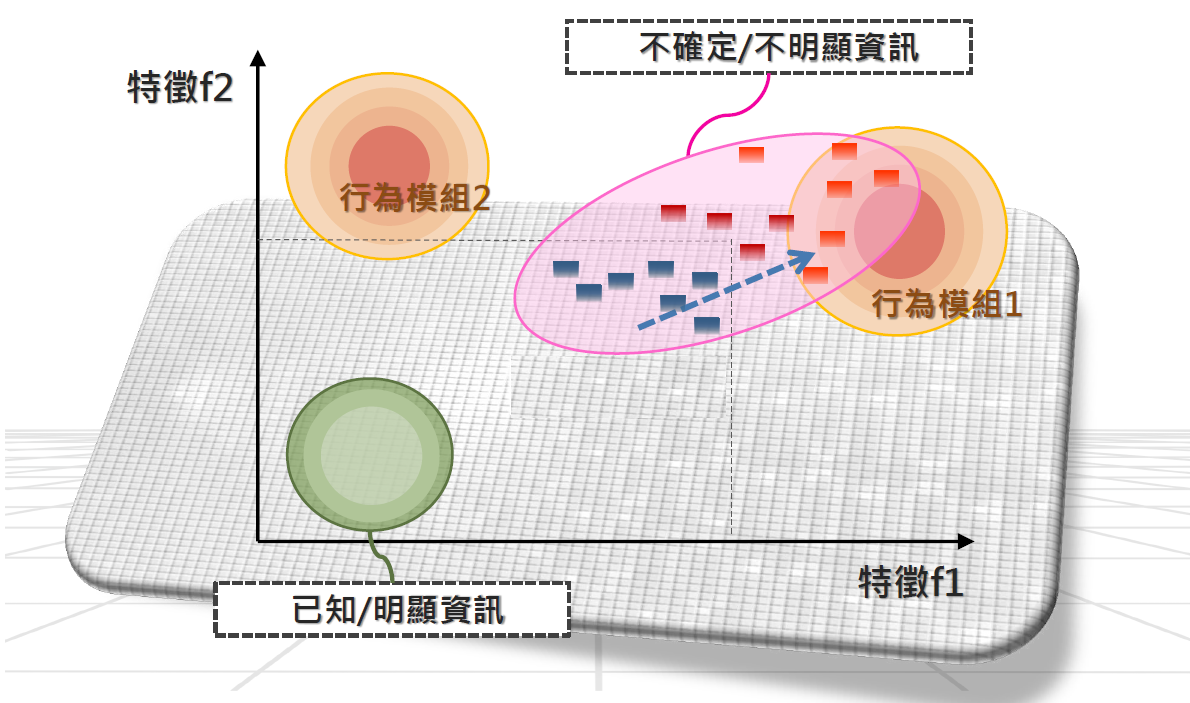
Monthly Customer Delinquency Bucket Records, CDIA Customer Historical Records, Deposit Account Transaction.

* **Aster Algorithm:**

Path Analysis Module, Graph Analysis Module

* **Analytics Result:**

The golden path of default behavior has been identified. With this information, before CDIA contract we can conduct price differentiation for different level of risky customers to lower the default rate of CDIA. Furthermore, in this topic, we have also proved that risk is contagious among money transaction accounts.



***Figure 3: Illustration of business concepts of internal competition***

1. **The Consumer Decision Analysis of Car Buyer** (Department: Credit Card Marketing)

* **Analytics background and Target:**

Considering vehicle is a high-priced product along with many subsequent needs. For example: car loan, car insurance, maintenance…etc. The hypothesis is that if we can fully plan out the consumer’s behavior, we will be able to capture business opportunities at the perfect timing.

* **Data Incudes:**

Internal Data- Customer Card Statement, Merchant Information, The Event That Car Buyers focus on, Car Buyer’s Profile.

External Data- Taiwan PTT Online Billboard, Taiwan Mobil01 Forum.

* **Aster Algorithm:**

Path Analysis Module, Graph Analysis Module, Text Analysis Module, Association Analysis Module.

* **Analytics Result:**

With the help of new analytic modules, we have discovered vehicle consumers’ behavior patterns which provide a clearer picture of the customers and their needs. We further discover that for vehicle consumers there are great demands in car insurance, maintenance, and traveling. Based on the result, an enhancement of related types of merchant relation should be performed.

1. **Customer Churn Path Analysis** (Department: Credit Card Marketing)

* **Analytics background and Target:**

Prior to this project, when it comes to credit card cancellation, bank is usually the last to know. There is no reliable sign to alert us. Now with the new analysis module, Path Analysis, a golden path of customer behavior before credit card cancellation could be identified. When any customer’s behavior starts to follow the golden path, we should be alerted and take appropriate actions to redeem the trust of customers.

* **Data Includes:**

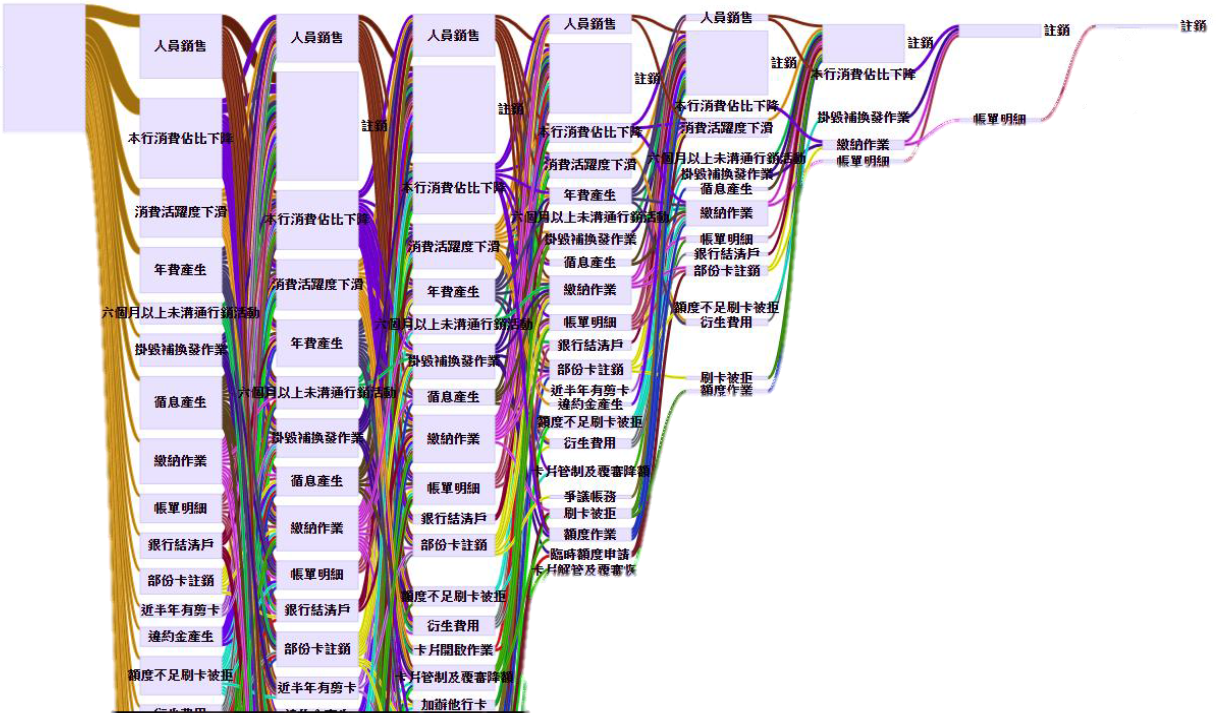
Customer Card Statement, Merchant Information, The Events That Credit Card focus on (customer adhesion degree, costs incurrence, marketing contact……), Credit Card Holder Profiles.

* **Aster Algorithm:**

Path Analysis Module.

* **Analytics Result:**

Approximately four thousands of credit card cancellation paths were identified. Other than the golden path, other representable paths could also be used as references when it comes to customer management.



***Figure 4: Sankey diagram in path analysis of real transactions in early 2016***

1. **Customer Life Circle Discovery Analysis** (Department: CRM Marketing)

* **Analytics background and Target:**

From observation, we noticed many customers’ life circles are apart from the branch where they initially started business with CTBC. It has caused not only the loss of customers due to inconvenience but also the difficulty of customer management for account specialists. In order to solve the issues, we use purchase records to distinguish customers’ work and life circles.

* **Data Includes:**

Customer Card Statement, Merchant Information, ATM Transaction Detail, Credit Card Holder Profile.

* **Aster Algorithm:**

Graph Analysis Module.

* **Analytics Result:**

After successfully identified customers’ work and life circles, we could then assign nearby account specialists to provide a better customer service.

1. **Graph Analysis of Group Leader** (Department: CRM Marketing)

* **Analytics background and Target:**

The original idea of this topic came from “group purchasing”, meaning a large amount of purchases to lower the cost (like retail). The assumption here is that people tends to believe their family and friends more than an unknown sales person. Therefore, the goal is to find the key man, who is active and interested in group purchasing within a group. We target our marketing campaigns on these key men and use their influence within their groups to spread the words. Here we use graph analysis based on deposit transactions of existing payroll accounts to build the social network.

* **Data Includes:**

Customer Deposit Transaction Data, The Profile of Customers who has Payroll Transfer Account.

* **Aster Algorithm:**

Graph Analysis Module.

* **Analytics Result:**

In term of the results, we were able to identify these key men within their groups and discover most of them have similar characteristics, such as wealthy and active with banks. By knowing these key men, we can run marketing strategy, MGM (Member Get Member) to increase our profit and reputation and lower the cost without blindly marketing.

1. **Potential Risk Customer Behavior Analysis** (Department: Risk Management)

* **Analytics background and Target:**

From previous experiences, lack of analytic models has always been a problem. By using only one single model on all types of customers often results in poor prediction in certain groups of customers. Thus, this topic aims to create a different prediction model with the help of newly introduced analytic functions in Aster. Our target customers are focused on those low prediction segments: 1. Customers with risk scaled in the grey area. 2. Customers in thin file profile. 3. Customers with loans.

* **Data Includes:**

Internal Data- Customer Card Statement, Customer Deposit Transaction.

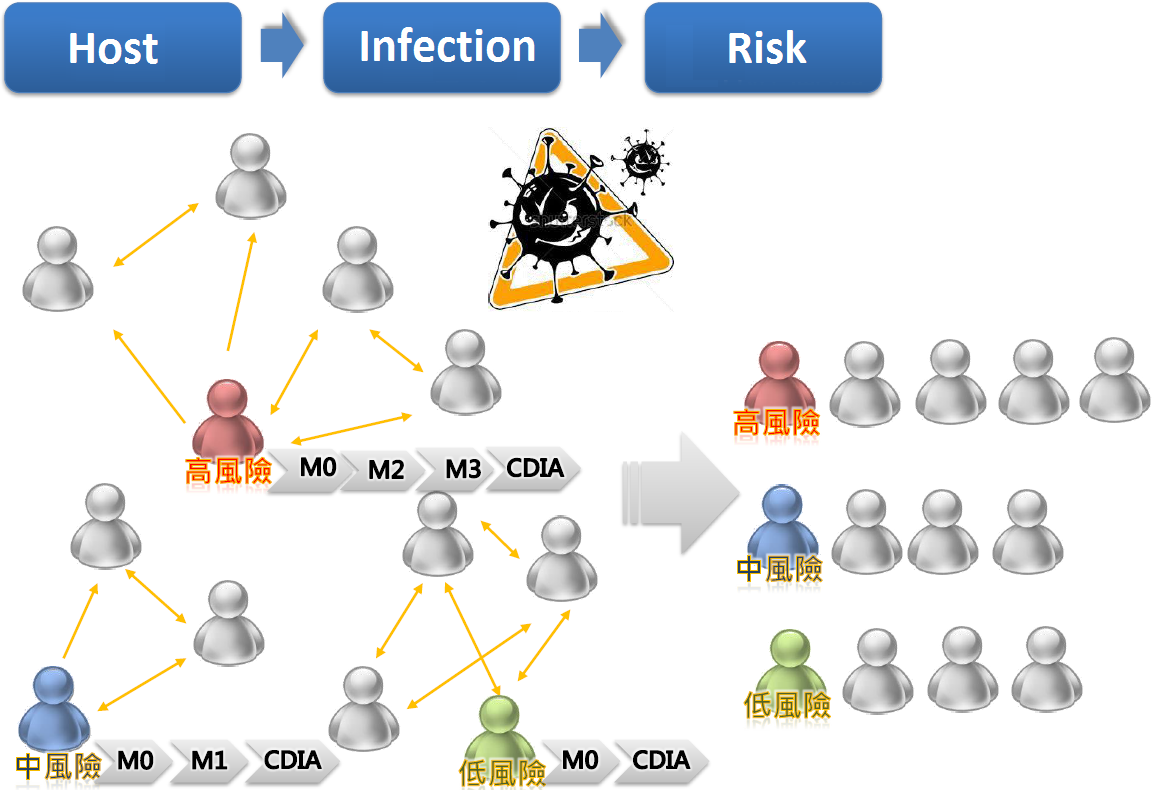
External Data- Taiwan Mobil01 Forum.

* **Aster Algorithm:**

Path Analysis Module, Graph Analysis Module, Text Analysis Module, Association Analysis Module.

* **Analytics Result:**

For customers with risk scaled in the grey area, based on the result of analysis on delinquency of credit card holders, customer management policies have been modified to better capture the loopholes. For customers with thin file profile, a new method was developed by using graph analysis to find existing customers related to our target customers and observing the behavior and interaction of the two to foresee potential risk. For customers with loans, unusual behavior was detected as an alert to prevent potential risk in advance.



***Figure 5: Illustration of risk contagion in internal competition***

**Significant Benefits**

1. **Business Dimension**

After investment of this project, CTBC has gained lots of significant benefits from different ways of business. First, in Section of Retail Risk, we obtained more clear pictures of our customer profiles. We put these benefits onto quantitative models in production and gained more predictive power. That means we have much more durable models in risk management and hence reduce the operating costs.

On the second hand, in customer relationship management, we have improved the predicting power in prediction of potential customers via innovative algorithms. Hence we get more opportunities to contact customers outside the existing portfolio, spread out the enterprise image in positive ways more efficiently, and bring the essential profit back.

Last but not least, by the means of data science, CTBC obtained brand new eyesight to penetrate our customer behaviors in retail business. We gained higher response rate in business campaigns. From that we earned much more physical feedbacks. Through Consumer Path Analysis, Volatility Analysis and so on, we strengthened models in retail business significantly. We expect lots more benefits would be earned in the very near future.

1. **Qualitative Dimension**

CTBC has benefited a lot from data scientist sub-project through many dimensions. Below is a summary of what we have accomplished and received:

* 1. **Big Data Environment Establishment.** In this project, Teradata Aster Big Data Discovery Platform was built and implement at CTBC. With the strong architecture of parallel processing feature and various data analytic modules, we picture there will be more Big Data Analytic Topics in CTBC in the future.
  2. **Data Scientists cultivation.** At the beginning of this project, not many CTBC analysts understand the needs and purposes of Aster Big Data Discovery Platform. During four months of training courses and experience sharing with Teradata team, many colleagues started to have a sense of the importance of big data analysis, feel interests in different statistical methodologies, and even have new idea towards business scenarios. Every project member who has successfully completed the series of data scientist training program and hackathon competition has become a real data scientist with the characteristics of complex problem solving, critical thinking, and creativity. From their experiences, we could say that CTBC has achieved the goal of personnel cultivation.
  3. **Six hackathon big data analytics topics.** With the accomplishment of the hackathon competition, we have built total of six big data analysis prototypes. These prototypes are mature and ready to be implemented on production to enhance and enrich CTBC prospects.
  4. **The Cooperation of Risk Management, CRM Marketing and Credit Card Marketing Departments.** One of the lessons learned from this project is the importance of cooperation. In the near future, our goal is to integrate not only data from different departments but also the wisdom of people to create a customer single view. With great precision of customer single view, CTBC will better serve and deliver excellent customer experience to all our valued customers.

**Risk Control**

Although big data analytics proves to be innovative and necessary, there are still some risks should be considered before implementation.

* **Personal Privacy Protection:**For Personal Privacy Protection, all customer data in the analytical data mart is always encrypted and all personal information related to the customer’s identity, would be replaced by a unique random code. The raw data could be processed only in restricted areas which need authorization to access. Decryption prevents customer information leaks which are aligned with our core belief in customer centricity.
* **Operation Risk:** Building a new systematic environment along with existing ones, especially transaction systems in banking business, any slight sign of operation risk should be treated seriously. To eliminate such risks, in this project, CTBC does not evaluate and implement an analytic system by merely one department. On the contrary, we invited multiple departments in different sections to participate every detail from the very beginning. Allowing users to take participation in evaluation and verification is much more reliable and trustworthy to reduce operation risk.

**Future Plan**

After this project, every member has earned a lot from it technically and professionally. In order to extend the fashion of data analytics and regain the benefits in the short future, CTBC planned to drive a series of conferences and training courses in some specific subjects. Also, we encourage our colleagues to learn new technologies and methodologies in any specifications related to our business, and inspire them to propose any solutions afterwards. We deeply believe that only through following the spirit of FinTech in the generation of Big Data 3.0 is the key for us to maintain in the leading position of data analytics in financial banking industry.

**A Leap to Digital Banking: Why CTBC Should Win?**

Following its core belief of innovation, CTBC always endeavors in pursuing new ideas to boost business development. The “A New Era of Analytics Project” is established for big data development; keeping our dominance and lead in analytic technique. Combined with the previous infrastructure with innovative data techniques, the project creates an unprecedented information flow, which could be regarded as milestone for data analytics of the bank with the following features:

* **Best Analytics Team:** Starting with enrichment data, CTBC has the best analytics team to seize the value of new form data, to create new variables based on business insights and also to add them into the model, the results suggest that the model will be enhanced and helpful for every business process.
* **Unified Strategy Platform:** CTBC is the first bank to leverage a unified platform for data analytics in Taiwan. Teradata® Aster™ helps CTBC not only discover its portfolio deeply and thoroughly, but put customers into a pioneer position in related industry.
* **Innovation Inside:** With introduction of this project, CTBC successfully loaded the innovative gene into our business operations and portfolio management. In the meantime, we enhanced the talent education and trained data scientists to contribute more with the transformation of financial environment.

***<Appendix>***

* 1. ***Please give a description and provide the background of the project?***

Please refer to Chapter 1.

* 1. ***Before the project was implemented, what kind of business and technical challenges was the bank/institution facing?***

In the recent years, technology has dramatically raised a revolution in all aspects in everyday life, including customer financial behaviors and how we extract and analyze data. Before this project was implemented, the first thing impacted us seriously was that lots of talented resources in analytic field are required to resolve questions we have never met. Not only on how to interpret them, but how to prepare for those coming next. However, this leap is wide hence technical support is essential. Banking industry is a well-developed and highly sensitive business. There are lots existing systems operating day after day need to verify and collaborate if we would like to understand ourselves better in an innovative way, for now, and on.

* 1. ***Did you collaborate with a third party for your project? If not please explain why you decided to develop the project in-house?***

This project is addressed along with Teradata, a data analytic giant which has cultivated in this field for decades, and become one of the most successful examples in related industry.

* 1. ***How long did it take to implement your project?***

Please refer to Chapter 1.

* 1. ***What were some of the risk your institution saw when implementing this technology, and how did your team mitigate the risk?***

Please refer to Chapter 5.

* 1. ***What were the benefits the bank/institution saw after implementing your project?***

Please refer to Chapter 4.

* 1. ***How would you consider your product innovation compared with the competition?***

Please refer to Chapter 3 and 4.

* 1. ***Are you considering any new upgrades to the project in the near future?***

Please refer to Chapter 6.